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A structured literature review to identify cost-effective interventions to prevent falls in older people living in the community

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Contents

Abbreviations

AMED	Allied and Complementary Medicine Database
CCAC	Community Care Access Centres
CDSR	Cochrane Database of Systematic Reviews
CEA	Cost Effectiveness Analysis
CENTRAL	Cochrane Central Register of Controlled Trials
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CRD	Centre for Reviews and Dissemination
CUA	Cost utility analyses
DALY	Disability adjusted life years
DSA	Deterministic sensitivity analyses
EED	Economic Evaluation Database
FaME	Falls Management Exercise
FRID	Fall-risk-increasing drugs
FRP	Falls Rehabilitation Program
HFJM	Home safety assessment and modification
HSAM	Healthy Steps for Older Adults
HSOA	Healthy Steps for Older Adults
HTA	Health Technology Assessment
ICER	Incremental cost-effectiveness ratio
MMSE	Mini-Mental State Examination
NBRF	Net benefit regression framework
NHS	National Health Service
NHSEED	NHS Economic Evaluation Database
NICE	National Institute of Health and Care Excellence
OECD	The Organization for Economic Cooperation and Development
OEP	Otago Exercise Programme
OT	Occupational Therapy
PD	Parkinson's disease
PHE	Public Health England
PSA	Probabilistic sensitivity analyses
PSS	Personal social services
P & S	Primary and secondary prevention
QALY	Quality-adjusted life-year
RCT	Randomised controlled trials
ROI	Return of Investment
SAFER	Support and Assessment for Fall Emergency Referrals
SOYF	Stay on Your Feet
UK	United Kingdom
YHEC	York Health Economics Consortium

Executive summary

Objectives

The objective of this literature review is to identify which interventions are cost-effective in preventing falls in older people living in the community. Its findings will inform an economic model to estimate the return on investment of the cost-effective interventions across communities in England.

Methods

The methods used to conduct this literature review are consistent with those set out in the NICE Processes and Methods manual [1]. These are based on internationally recognised guideline development methodology and the experience and expertise of NICE staff and stakeholders.

Results

A literature search identified 26 studies that met the inclusion criteria, with some studies addressing multiple interventions. The review identified 6 types of interventions: exercise (13), home assessment and modifications (4), multifactorial programmes (12), medicines review and modification to drugs (5), cardiac pacing (2) and expedited cataract surgery (2). These 26 studies provided cost-effectiveness results for 38 different interventions. The interventions were compared to a range of comparators including no intervention, usual care and other interventions. Twenty studies recruited a combination of people who had fallen in the past and those at risk of falling. Six studies recruited only people with a history of falls. No study was solely for primary prevention in people who had never fallen.

Of the 26 studies, 12 were judged to be directly applicable and 14 did not meet one or 2 of the criteria but were included because the weaknesses were assessed as unlikely to change the study results. Study quality was good, as most studies (22 out of 26) presented minor methodological limitations, often related to the relatively short time horizon or the partially limited perspective of the cost analysis. Four studies were set in England.

Evidence on studies falling under the broad term exercise was synthesised for different groups from 13 studies. Results from 6 group-based exercise studies were not able to demonstrate this intervention was cost-effective using a cost per quality adjusted life year form of analysis in the general population of older

people. However, one which included participants with Parkinson's disease, found a high probability that delivering exercises from the Falls Management Exercise (FaME) programme was a cost-effective strategy relative to no intervention. One study did find group exercise was cost-effective in a subgroup of women over 70 years old. A second compared FaME, a group based programme, to a home-based programme (Otago) and usual care. The primary outcome was the proportion of participants undertaking moderate-to-vigorous physical activity per week and on this measure participants randomised to the FaME arm achieved a statistically significant improvement which was not achieved in the other arms. The results from a cost-utility analysis showed the Otago programme was very similar in terms of quality of life changes but slightly cheaper than FaME but the latter was more effective in reducing injuries and all falls. All the studies appraising Tai Chi and Tai Ji Quan interventions found these cost-effective in more mobile older groups.

Eight of the 12 studies assessing the cost-effectiveness of a multifactorial risk assessment and management programme reported negative results. The remaining 4 studies accompanied clinical studies and these analyses concluded this intervention was cost-effective.

The results from 3 of the 4 studies of home assessment and modification programmes suggested this intervention was cost-effective. The fourth study (Church 2012) [2] included a population who had previously fallen and incurred an injury and reported an incremental cost per QALY of AUS$57,856, slightly higher than the willingness to pay threshold of AUS$50,000.

Of the 5 studies of withdrawal of fall-risk-increasing drugs in older age groups, 2 reported the intervention reduced costs and improved benefits so was dominant, one found it had little impact on costs and benefit and the other 2 reported an incremental cost-effectiveness ratio that was somewhat below the generally accepted threshold and so demonstrated value for money.

Expedited cataract surgery was reported to be cost-effective in 2 studies, whilst neither study of cardiac pacing demonstrated this intervention was cost-effective.

Discussion

Minor limitations were identified with the conduct of the literature search but these are not judged to have introduced bias into the results. There are also challenges in interpreting the evidence particularly where the outcome was cost per fall. Moreover, this has only been a narrative synthesis. No meta-analysis has been conducted whereby the quantitative results of separate, but similar studies, are combined. Hence it has not been possible to provide measure of uncertainty

around the results. We have also not assessed the validity or the quality of clinical studies that informed the efficacy data used in the economic evaluation. However, such limitations are common to most reviews of economic studies and none seriously challenge the validity of the findings.

By focusing on economic evaluations, previous clinical studies informing the clinical evidence base have not been reviewed. This is particularly relevant for the FaME intervention as the initial RCT was conducted in a different population[1] which did not have an accompanying economic evaluation. The pivotal study included women aged 65 years or over, living in their own home and with a history of 3 or more falls in the previous year. Hence by including only economic evaluations we may be failing to capture all the populations that would benefit clinically and where the intervention would be cost-effective due to the absence of evidence.

Some of these limitations can be addressed at the next stage of the process whereby, for the cost-effective interventions agreed with the Steering Group, we will go back to the clinical studies to extract the key components of the intervention to inform the resource use in the model.

Conclusions

The conclusions of the assessment are informed by 26 methodologically robust studies judged applicable to the English setting and for community-dwelling older people. There was consistency in the direction and magnitude of results for some interventions but for others the results across studies were inconsistent, or adopted a cost per fall measure and thus difficult to interpret.

Based on the evidence we recommend that the economic model includes the following interventions and groups. Groups are described using the characteristics of people included in the relevant clinical studies.

- Otago strength and balance programme for people aged over 80 years (mean age 82 years) who have a similar falls risk to those in the clinical studies, being 43% had a fall(s) in previous 12 months
- group exercise for women aged 70 years or over (mean age 76 years) with a falls risk equivalent to approximately 6% a month
- group exercise using the FaME programme in people aged 65 and over (mean age 71 years) with a falls risk equivalent to 16% having a fall(s) in the 12 months before the intervention

[1] Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (Falls Management Exercise — FaME) reduces falls in community-dwelling older frequent fallers (an RCT). Age Ageing 2005; 34(6): 636–63

- Tai Chi or Tai Ji Quan in people with mean age of 75 years and 35% having 2 or more falls in the previous 6 months
- common aspects of the 4 multifactorial risk assessment and management studies that were cost-effective, with a focus on that delivered by Sach and colleagues in the East Midlands in a high-risk population group in people aged over 60 years (median 82 years) and 81% having 2 or more falls in past 3 months
- home assessment and modification
- medication reviews; these will be delivered as an intervention within the multifactorial risk assessment and management programme so the same age and falls risk characteristics apply.

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1. Introduction

Public Health England (PHE) commissioned York Health Economics Consortium (YHEC) to carry out a literature review to identify cost-effective interventions to prevent falls in older people living in the community and to develop an economic model to report the return on investment (RoI) for each cost-effective intervention.

This document currently presents the literature review. Following discussion of these findings with the Steering Group, the interventions evidenced as cost-effective will be modelled. This report will be updated with the results from the modelling later in the year.

1.1 Background

Falls are common in people aged 65 years and over, with 30% of people in that age group suffering a fall every year, rising to 50% of people aged 80 years [3]. The consequences can be serious, including fracture, other injury, pain, impaired function, loss of confidence in carrying out everyday activities, loss of independence and autonomy, and even death [4]. For example, some people who fall will experience a hip fracture, which has a high mortality risk of 9.4% at 30 days and 31.2% at 1 year and a mean length of hospital stay within one year of fracture of 20.5 days [14].

Managing morbidity requires resources from many stakeholders, including families and carers, the NHS and social care providers (principally local authorities). Incident hip fractures were estimated to cost the NHS £1.1 billion per year from 2003 to 2013 [5]. Furthermore, the total cost of falls to the NHS is estimated to be £2.3 billion per year [3]. The largest component of this cost arises because some people who fall will not be able to return to live at home independently but will require social care support or to be discharged to a nursing or care home.

Without action, the impact of falls on the NHS and social work will grow substantially in the near future due to the increased proportion of older people in the population. The number of people aged 65 years and over is projected to increase by an average of 20% between mid-2014 and mid-2024 [6]. Moreover, a higher proportion of this population will have multimorbidity (the presence of 2 or more disorders), have poorer functional status and quality of life and more will take multiple medications, all significant risk factors for falls [7].

There is evidence that several different types of interventions may be effective in preventing falls among older people and that health and social care costs could be reduced [8].

1.2 Current recommended interventions in England

In 2013 NICE produced guidance [3] recommending approaches to risk assess older people in the community and to deliver effective interventions to prevent falls in older people. Recommendations included:

1. Case/risk identification whereby older people in contact with healthcare professionals are asked routinely whether they have fallen in the past year and, if so, the frequency and nature of the fall;

2. Multifactorial falls risk assessment are offered to older people who have fallen or have abnormalities of gait and/or balance;

3. Older people with recurrent falls or assessed as being at increased risk of falling should be offered an individualised multifactorial intervention. Specific components commonly include:

I. strength and balance training
II. home hazard and safety assessment and intervention/modification/follow-up
III. vision assessment and referral
IV. medication review with modification/withdrawal

4. Cardiac pacing should be considered for older people with cardioinhibitory carotid sinus hypersensitivity who have experienced unexplained falls;

5. To promote the participation of older people in falls prevention programmes the following should be considered:

I. Healthcare professionals involved in the assessment and prevention of falls should discuss what changes a person is willing to make to prevent falls.
II. Individuals at risk of falling, and their carers, should be offered relevant information orally, and in writing, in languages other than English about:

    - 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 fall

III. Falls prevention programmes should address potential barriers such as low self-efficacy and fear of falling, and encourage activity change as negotiated with the participant.

6. All healthcare professionals dealing with patients at risk of falling should develop and maintain basic professional competence in falls assessment and prevention.

These recommendations were used to develop the literature search strategy (see Section 3:Search strategy).

1.3 Objectives

The objective of the cost-effectiveness review, as requested by PHE, is to answer the following research question:

- which interventions are cost-effective in preventing falls and fragility fractures in older people living in the community?

1.4 Operational definitions

This report adopts the taxonomy developed by Lamb and colleagues [9] to describe interventions used to prevent falls in older people. This taxonomy has been adopted successfully in the relevant Cochrane systematic review [8]. However, some limitations have been identified when seeking to apply it to economic evaluations, particularly those comparing several interventions. These seldom describe the important aspects of service configuration and intervention delivery which the taxonomy requires to ensure interventions are fully described. At the next stage of this project we shall be extracting information on these aspects for interventions evidenced as cost-effective. This is to ensure we have a full description of the intervention for modelling purposes. Hence the taxonomy will be helpful for the data extraction stage.

1.5 Identification of equality and equity issues

Key equality and equity issues include:

- is there a difference in the number and rate of falls in sex and age adjusted populations, arising from socioeconomic factors or ethnicity?
- do some standardised interventions benefit certain socioeconomic groups more than other groups?
- does the uptake of risk assessment for modifiable risk factors vary by socioeconomic group?
- does the referral rate to individual interventions vary by socioeconomic group?
- does the uptake of individual interventions vary by socioeconomic group?
- do outcomes for standardised interventions vary by socioeconomic group?

All outcomes relevant to answering these questions were extracted to inform the evidence tables.

2. Methods

Unless otherwise stated, the approach outlined in this protocol has been written in accordance with the relevant sections from the NICE 'Developing NICE guidelines manual' [1].

2.1 Inclusion / exclusion criteria

Studies eligible for inclusion in this review met the inclusion criteria described in Table 1 to Table 4. Studies were excluded if they met the exclusion criteria in the same Tables. These criteria were derived from the PHE invitation to tender specification, the Cochrane protocol to update the existing 2012 systematic review [10] and following discussions with Steering Group members and PHE staff.

2.2 Population

The populations included in the eligible and ineligible studies for this review are presented in Table 1.

Table 1: Population eligibility criteria for the review

Eligible studies	Ineligible studies
Participants aged 65 years or over.	Studies which incorporated no older participants. Studies where the majority of participants resided in residential, or nursing care facilities, sheltered housing or were patients in hospital or in rehabilitation services.
Or if participants were inpatients aged 50 to 64 years who were judged by a clinician to be at higher risk of falling because of an underlying condition. (As defined by the NICE guidance [11])	
The majority of participants lived in the community, either at home or in places of residence that, on the whole, did not provide residential health or social-related care or rehabilitative services.	
Trials with mixed populations (community and higher dependency places of residence) if data were provided for subgroups based on setting.	
Trials which recruited participants in hospital if the majority were discharged to the community and the falls interventions were administered in the community setting only.	

2.3 Interventions

The interventions eligible and ineligible for inclusion in this review are presented in Table 2. These capture all the recommended activities in the NICE Guidance [3] and the interventions for inclusion in an update to the 2012 Cochrane review [10]. No studies for interventions which failed to demonstrate they were cost-effective at the time of the NICE guidance were included. Thus studies of the

use of vitamin D, hip protectors and cognitive/behavioural interventions were excluded. This was a pragmatic decision reflecting the need to prioritise interventions to include in the modelling tool.

Table 2: Interventions eligibility criteria for the review

Eligible studies:	Ineligible studies
All eligible studies were delivered in a community setting.	
From NICE guidance [3]:	
Case/risk identification of people in the community at higher risk of falling.	Interventions not shown to be cost-effective by NICE including vitamin D, hip protectors and cognitive/behavioural interventions. Studies incorporating multiple interventions some of which were unrelated to falls prevention where the data for fall prevention assessments and interventions were not reported separately.
Multifactorial falls risk assessment in a community setting.	
Strength and balance training.	
Home hazard and safety assessment and referral.	
Vision assessment and referral.	
Medication review.	
Cardiac pacing.	
Provision of information.	
Communications with healthcare professionals.	
Training for healthcare professionals in falls assessment and prevention.	
From Cochrane review [10]	
Any multifactorial intervention designed to reduce falls in older people in which interventions from 2 or more main categories of intervention are given to participants, with the choice of intervention informed by a risk assessment and the combination of interventions differs across the group.	Interventions delivered in settings which were inaccessible to the eligible population in England eg in residential care homes or outpatients.
Any multiple component intervention designed to reduce falls in older people whereby interventions from 2 or more main categories of intervention are given to all participants in a study.	

2.4 Comparators

To be included in the review, studies were required to feature an eligible comparator as presented in Table 3.

Table 3: Comparators eligibility criteria for the review

Eligible studies:	Ineligible studies
Usual care/current practice An attention placebo control intervention (ie an intervention that is not thought to reduce falls; eg general health education or social visits)	Studies comparing different single or multifactorial interventions or multiple component interventions, comparisons which are different from usual care in England. For this purpose exercise will be construed as usual care.

2.5 Outcomes

To be eligible for inclusion in the review, studies had to report one or more of the economic or equality outcomes shown in Table 4.

Table 4: Outcomes relevant to the review

Eligible studies:	Ineligible studies
Cost-effectiveness outcomes eg cost per fall prevented, cost per quality-adjusted life year, cost per life year gained. Incremental costs and benefits for 2 or more interventions presented using cost-consequences or cost-minimisation or cost-benefit analyses. Return on investment. Any outcomes related to health inequalities and equity.	Cost-effectiveness studies reporting partial results, eg including results for the intervention arm only or only including costs or only a measure of effect such as change in rate of falls.

2.6 Study design

Only the following study types were eligible:

- cost-utility analyses
- cost-effectiveness analyses
- cost-benefit analyses
- cost-minimisation analyses
- cost-consequences analyses
- randomised controlled trials (RCT) that included economic data in the study designs

2.7 Study features

To be eligible for inclusion in the review studies had to be:

- published in January 2003 or later;
- published in English (as per NICE process and methods manual [1]);
- conducted within an OECD (Organization for Economic Cooperation and Development) country.

The publication date of 2003 was selected since the searches undertaken as part of the cost-effectiveness review and modelling to inform NICE Guidance CG161 [12] were conducted in April 2003 [11]. Our searches therefore updated this work. The countries were limited to those in the OECD in an attempt to improve generalisability to the English setting.

3. Literature Searches

3.1 Search strategy

The literature search was designed to identify studies reporting on the cost-effectiveness of interventions preventing falls in older people. The strategy was developed for Ovid MEDLINE (Figure 1) and comprised the following concepts:

- falls (search lines 1-4)

AND

- older people (search lines 5-7)

AND

- cost effectiveness (search lines 8-28)

The search terms used for the cost-effectiveness concept comprised the Centre for Reviews and Dissemination (CRD) search filter developed to identify economic evaluations for inclusion in the NHS Economic Evaluations Database (NHS EED) [13]. This search filter was supplemented by a search line to identify evidence related to ROI as this outcome is not specifically covered by CRD (search lines 25 and 26).

The strategy did not search specifically for the interventions described in the eligibility criteria. Our generic approach aimed to identify all fall prevention studies which report cost-effectiveness outcomes in older people, and therefore it was not necessary to search for interventions individually. Searching for all falls prevention interventions was preferred for efficiency and because many of the eligible interventions were complex and could not be easily retrieved with database searches due to the variance in language used to describe them.

The strategy also searched only for studies which made the older population explicit in the database record. Whilst this had the potential to miss studies reporting on falls interventions in participants with conditions such as stroke, Parkinson’s disease (PD), or Alzheimer's disease, which are more common in older populations, including these terms would have retrieved an unacceptably high volume of irrelevant results.

Animal studies were removed from the MEDLINE strategy using a standard algorithm. The strategy also excluded publication types that were unlikely to yield relevant information; comments, editorial, news, letters and case reports.

The MEDLINE strategy was translated appropriately for other databases. Full strategies (including search dates) for all sources searched are included in Appendix A: Full Search Strategies.

Figure 1: Epub Ahead of Print, In-Process and Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present

Database: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:

1	Accidental Falls/ (19978)
2	(fall or falls or falling or faller$1 or fallen or fell).ti,ab,kf. (212820)
3	(trip or trips or tripped or tripping or stumbl$ or slip or slips or slipped or slipping).ti,ab,kf. (22831)
4	or/1-3 (239886)
5	exp Aged/ (2803738)
6	(elder$ or older or old people$ or old person$ or old wom#n$1 or old m#n$1 or old male$1 or old female$1 or old adult$1 or old age$ or aging or geriatric$ or senior citizen$ or seniors or pensioner$ or veteran$ or sexagenarian$ or septuagenarian$ or octogenarian$ or nonagenarian$ or centenarian$).ti,ab,kf. (1076676)
7	5 or 6 (3441155)
8	economics/ (28596)
9	exp "costs and cost analysis"/ (217016)
10	economics, dental/ (1917)
11	exp "economics, hospital"/ (23030)
12	economics, medical/ (9389)
13	economics, nursing/ (4000)
14	economics, pharmaceutical/ (2804)
15	(economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (635524)
16	(expenditure$ not energy).ti,ab. (24924)
17	(value adj2 money).ti,ab. (1402)
18	budget$.ti,ab. (24600)
19	or/8-18 (781501)
20	((energy or oxygen) adj cost).ti,ab. (3631)
21	(metabolic adj cost).ti,ab. (1199)
22	((energy or oxygen) adj expenditure).ti,ab. (22816)
23	or/20-22 (26731)
24	19 not 23 (775581)
25	((return$ or gain$1) adj3 investment$1).ti,ab,kf. (2060)
26	(ROI or ROIs).ti,ab,kf. (11326)
27	24 or 25 or 26 (786968)
28	4 and 7 and 27 (3556)
29	exp animals/ not humans/ (4669486)
30	(news or comment or editorial or letter or case reports).pt. or case report.ti. (3520225)
31	28 not (29 or 30) (3470)
32	limit 31 to yr="2003 -Current" (2526)
33	limit 32 to english language (2381)
34	remove duplicates from 33 (2108)

The literature search was conducted in a range of relevant bibliographic databases and other information sources containing both published and unpublished literature.

3.2 Resources searched

The databases and information sources searched are shown in Table 5.

Table 5: Databases and information sources searched

Database / information source	Interface / URL
MEDLINE, MEDLINE In-Process, MEDLINE Daily and Epub Ahead of Print	Ovid SP
PubMed	http://www.ncbi.nlm.nih.gov/pubmed
Embase	Ovid SP
Cochrane Database of Systematic Reviews (CDSR)	Cochrane Library / Wiley
Health Technology Assessment Database (HTA Database)	Cochrane Library / Wiley
NHS Economic Evaluation Database (NHS EED)	Cochrane Library / Wiley
EconLit	OvidSP
Cost Effectiveness Analysis Registry (CEA Registry)	https://research.tufts-nemc.org/cear4/
Allied and Complementary Medicine Database (AMED)	EBSCO
Cumulative Index to Nursing and Allied Health Literature (CINAHL)	EBSCO
Physiotherapy Evidence Database (PEDro)	http://www.pedro.org.au/
Social Policy and Practice	OvidSP

In addition to the database searches we also searched the webpages of the following relevant organisations in order to identify unpublished or grey literature, including ROI tools:

- Chartered Society of Physiotherapy
- College of Occupational Therapists
- British Geriatrics Society
- British Orthopaedic Association
- Age UK
- National Osteoporosis Society
- Royal College of Nursing

We also asked Steering Group members to identify any relevant publications, particularly unpublished publications which they had access to.

3.3 Running the search strategies and downloading results

Searching a number of databases produced a degree of duplication in the results. To manage this issue, the titles and abstracts of bibliographic records were downloaded and imported into EndNote bibliographic management software and duplicate records were removed using several algorithms. Where result format did not facilitate loading into EndNote, Word documents or Excel spreadsheets were used as appropriate.

3.4 Assessing the relevance of studies to the review

The search results were assessed and categorised according to the eligibility criteria set out in Section 0 2.1 Inclusion / exclusion criteria. We recorded the number of records included and removed at each selection stage according to the PRISMA template.

A first pass was undertaken of the retrieved records to remove any obviously irrelevant studies, such as, animal studies and other ineligible study types.

Two reviewers then selected records using a 2 stage process:

1. Title/abstract screening;
2. Full paper screening.

A third reviewer was available to discuss any papers that the initial reviewer queried with regards to categorisation.

We obtained electronic or paper copies of potentially relevant full papers which met the review's inclusion criteria.

Once we obtained the full text of studies, we assessed them in detail for relevance to the review's eligibility criteria and made the final selection of studies to inform the review.

Studies excluded after assessment of the full document are described in an excluded studies table with the reasons for exclusion [1].

3.5 Assessing the quality of studies

Two reviewers assessed the quality of the eligible studies using the appropriate appraisal checklist [1]. The checklist comprises 2 sections. The first informs a

judgment on the applicability of the evidence to the review question. Each study was given one of the following ratings:

1. Directly applicable – the study met all applicability criteria, or failed to meet 1 or more applicability criteria but this was unlikely to change the conclusions about cost effectiveness;
2. Partially applicable – the study failed to meet one or more of the applicability criteria, and this could have changed the conclusions about cost effectiveness;
3. Not applicable – the study failed to meet one or more of the applicability criteria, and this was likely to change the conclusions about cost effectiveness. Such studies were excluded from further consideration and there was no need to continue with the rest of the checklist.

The second part of the checklist addresses study limitations. Each study was assessed to have minor limitations/potentially serious limitations/very serious limitations. The quality assessment of each included study is presented as a table in AAppendix G: Completed checklists.

3.6 Data extraction

Data extraction was conducted by 2 researchers and 10% were checked by a third. This check indicated the quality of data extraction was high and no further checks were conducted. The evidence table used was that set out in Appendix H of the NICE Process and Methods manual [1]. Hence for each included study the following data were extracted:

- bibliographic details
- study type
- study quality assessment
- setting
- intervention and comparator in detail
- number of participants in each arm, with inclusion and exclusion criteria and relevant participant characteristics
- methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
- results for each outcome including outcomes related to health inequalities impact
- limitations identified by authors and by reviewers
- additional comments eg source of funding, evidence gaps, further research identified

Full data extraction evidence tables for each included study are reported in the Appendix E: Evidence tables.

3.7 Data synthesis and evidence profiles

For each study an evidence profile is presented as defined in Appendix H of the NICE manual [1]. The profile summarises intervention, limitations with the study, its applicability to the English setting, and provides measures of incremental costs, effects, cost-effectiveness and uncertainty. Completed economic evidence profiles are provided at Appendix F: Evidence profiles.

These were used to develop evidence statements for each intervention.

4. Results

4.1 Results of the literature search

Searches identified a total of 7,250 records. The database searches identified 7,178 records, with a further 72 records identified by hand-searches of webpages and the CEA Registry (Table 6: Literature search results).

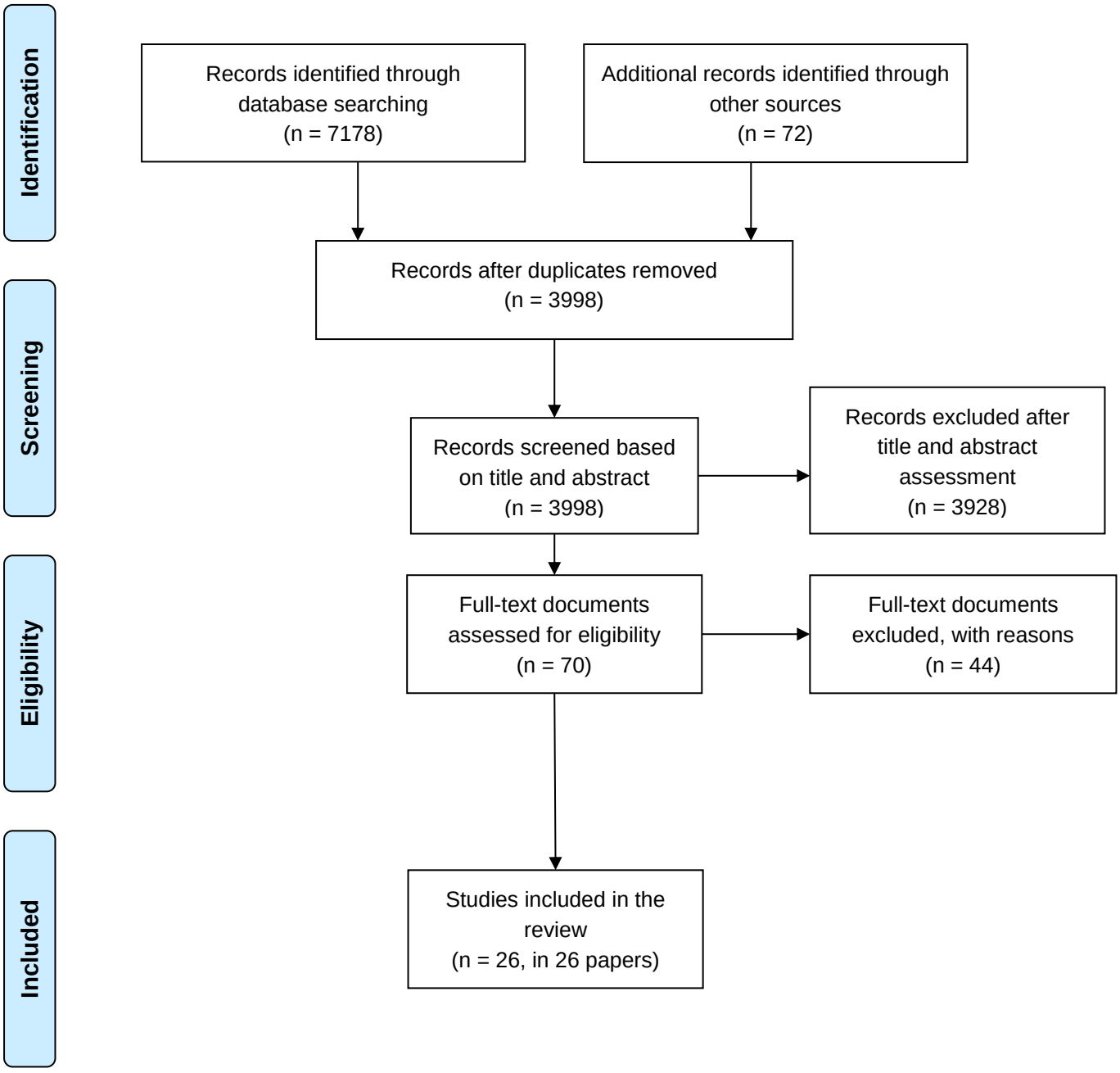
Following deduplication 3,998 records were assessed for relevance of which full papers were obtained for 70. On review of the full papers against the inclusion and exclusion criteria, 26 were selected for inclusion. A full list of excluded studies, together with reason for exclusion is provided at Appendix H: Excluded studies table.

Table 6: Literature search results

Resource	Records identified
MEDLINE, MEDLINE In-Process, MEDLINE Daily and Epub Ahead of Print	2,108
PubMed	259
Embase	2,955
Cochrane Database of Systematic Reviews (CDSR)	13
Health Technology Assessment Database (HTA Database)	27
NHS Economic Evaluation Database (NHS EED)	102
Cochrane Central Register of Controlled Trials (CENTRAL)	278
EconLit	76
Cost Effectiveness Analysis Registry (CEA Registry)	65
Allied and Complementary Medicine Database (AMED)	53
Cumulative Index to Nursing and Allied Health Literature (CINAHL)	1,022
Physiotherapy Evidence Database (PEDro)	85
Social Policy and Practice	200
Web page searches	7
TOTAL	**7,250**
TOTAL after deduplication	**3,998**

A PRISMA flow diagram of the record selection process is shown in Appendix B: PRISMA Table.

Figure 2: PRISMA Flow Diagram



Overview of the studies

The 26 studies undertook all forms of economic analyses: cost-utility analyses (CUAs), cost-effectiveness analyses (CEAs), cost-benefit analyses (CBAs), cost-minimisation analyses (CMAs), cost-consequences analyses (CCAs) as well as RCTs reporting economic data, with some combining CEA and CUA. Seven were directly based on a modelling approach (mainly Markov models), one study was based on a CCA design, and 2 studies were CBAs which evaluated the economic benefits of the interventions valued in monetary units only. The majority of the studies were CEAs (18), with 13 also providing a CUA.

A total of 17 economic evaluations used primary data: 13 were carried out alongside a RCT, while 4 were based on longitudinal and/or prospective studies. In these 17 studies, the sample size varied widely, with study participants ranging from 100-130 participants to beneficiaries of state-wide programmes such as more than 5 million Medicare beneficiaries. Similarly, studies varied substantially in the choice of the time horizon, which ranged from a few weeks to lifetime, although the bulk of the studies (11) adopted a one-year perspective (either when using modelling or primary data from a RCT). Only 4 studies used a lifetime horizon. Almost all studies investigated the issue of uncertainty performing various types of statistical tests and sensitivity analyses.

Some of the 26 studies provided results for multiple interventions, with results available for a total of 38 interventions.

Included interventions and comparators

The review identified 6 types of interventions: exercise, including strength and balance (13), home assessment and modifications (4), multifactorial programmes (12), medicines review and modification to drugs (5), cardiac pacing (2) and expedited cataract surgery (2) (see Table 7).

Table 7: Included Studies by Intervention

Formatted record	Strength and balance	Home assessment and modifications	Multifactorial programme	Cardiac pacing	Expedited cataract surgery	Medicines review and modification
Albert SM, Raviotta J, Lin CJ, Edelstein O, Smith KJ. Cost-effectiveness of a statewide falls prevention programme in Pennsylvania: Healthy Steps for Older Adults. Am J Manag Care. 2016; 22(10):638-44.			x			
Beard J, Rowell D, Scott D, van Beurden E, Barnett L, Hughes K, et al. Economic analysis of a community-based falls prevention programme. Public Health. 2006; 120(8):742-51.			x			
Campbell AJ, Robertson MC, La Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ, et al. Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial. BMJ. 2005;331(7520):817.	x	x				
Carande-Kulis V, Stevens JA, Florence CS, Beattie BL, Arias I. A cost-benefit analysis of 3 older adult fall prevention interventions. J Safety Res. 2015;52:65-70.	x					
Church J, Goodall S, Norman R, Haas M. The cost-effectiveness of falls prevention interventions for older community-dwelling Australians. Aust N Z J Public Health. 2012;36(3):241-8.	x	x	x	x	x	x
Church J, Goodall S, Norman R, Haas M. An economic evaluation of community and residential aged care falls prevention strategies in NSW. N S W Public Health. 2011;22(3-4):60-8.	x		x	x	x	x
Farag I, Howard K, Ferreira ML, Sherrington C. Economic modelling of a public health programme for fall prevention. Age Ageing. 2015;44(3):409-14.	x					
Farag I, Sherrington C, Hayes A, Canning CG, Lord SR, Close JCT, et al. Economic evaluation of a falls prevention exercise programme among people with Parkinson's disease. Mov Disord. 2016;31(1):53-61.	x					
Fletcher E, Goodwin VA, Richards SH, Campbell JL, Taylor RS. An exercise intervention to prevent falls in Parkinson's: an economic evaluation. BMC Health Serv Res. 2012;12:426.	x					
Frick KD, Kung JY, Parrish JM, Narrett MJ. Evaluating the cost-effectiveness of fall prevention programmes that reduce fall-related hip fractures in older adults. J Am Geriatr Soc. 2010;58(1):136-41.		x	x			x
Hektoen LF, Aas E, Luras H. Cost-effectiveness in fall prevention for older women. Scand J Public Health. 2009;37(6):584-9.	x					

Formatted record	Strength and balance	Home assessment and modifications	Multifactorial programme	Cardiac pacing	Expedited cataract surgery	Medicines review and modification
Hendriks MRC, Evers SMAA, Bleijlevens MHC, van Haastregt JCM, Crebolder HFJM, van Eijk JTM. Cost-effectiveness of a multidisciplinary fall prevention programme in community-dwelling elderly people: a randomized controlled trial (ISRCTN 64716113). Int J Technol Assess Health Care. 2008;24(2):193-202.			x			
Iliffe S, Kendrick D, Morris R, Masud T, Gage H, Skelton D, et al. Multicentre cluster randomised trial comparing a community group exercise programme and home-based exercise with usual care for people aged 65 years and over in primary care. Health Technol Assess. 2014;18(8):1-106.	x					
Irvine L, Conroy SP, Sach T, Gladman JRF, Harwood RH, Kendrick D, et al. Cost-effectiveness of a day hospital falls prevention programme for screened community-dwelling older people at high risk of falls. Age Ageing. 2010;39(6):710-6.			x			
Jenkyn KB, Hoch JS, Speechley M. How much are we willing to pay to prevent a fall? Cost-effectiveness of a multifactorial falls prevention programme for community-dwelling older adults. Can J Aging. 2012;31(2):121-37.			x			
Li F, Harmer P. Economic Evaluation of a Tai Ji Quan Intervention to Reduce Falls in People With Parkinson Disease, Oregon, 2008-2011. Prev Chronic Dis. 2015;12:E120.	x					
Li F, Harmer P, Fitzgerald K. Implementing an Evidence-Based Fall Prevention Intervention in Community Senior Centers. Am J Public Health. 2016;106(11):2026-31.	x					
Markle-Reid M, Browne G, Gafni A, Roberts J, Weir R, Thabane L, et al. The effects and costs of a multifactorial and interdisciplinary team approach to falls prevention for older home care clients 'at risk' for falling: a randomized controlled trial. Can J Aging. 2010;29(1):139-61.			x			
McLean K, Day L, Dalton A. Economic evaluation of a group-based exercise programme for falls prevention among the older community-dwelling population. BMC Geriatrics. 2015;15:33.	x					
Patil R, Kolu P, Raitanen J, Valvanne J, Kannus P, Karinkanta S, et al. Cost-effectiveness of vitamin D supplementation and exercise in preventing injurious falls among older home-dwelling women: findings from an RCT. Osteoporos Int. 2016;27(1):193-201.	x					
Peeters GMEE, Heymans MW, de Vries OJ, Bouter LM, Lips P, van Tulder MW. Multifactorial evaluation and treatment of persons with a high risk of recurrent falling was not cost-effective. Osteoporos Int. 2011;22(7):2187-96.			x			

Formatted record	Strength and balance	Home assessment and modifications	Multifactorial programme	Cardiac pacing	Expedited cataract surgery	Medicines review and modification
Pega F, Kvizhinadze G, Blakely T, Atkinson J, Wilson N. Home safety assessment and modification to reduce injurious falls in community-dwelling older adults: cost-utility and equity analysis. Inj Prev. 2016;22(6):420-26.		x				
Polinder S, Boye NDA, Mattace-Raso FUS, Van der Velde N, Hartholt KA, De Vries OJ, et al. Cost-utility of medication withdrawal in older fallers: results from the improving medication prescribing to reduce risk of FALLs (IMPROveFALL) trial. BMC Geriatrics. 2016;16(1):179.						x
Sach TH, Logan PA, Coupland CAC, Gladman JRF, Sahota O, Stoner-Hobbs V, et al. Community falls prevention for people who call an emergency ambulance after a fall: an economic evaluation alongside a randomised controlled trial. Age Ageing. 2012;41(5):635-41.			x			
van der Velde N, Meerding WJ, Looman CW, Pols HAP, van der Cammen TJM. Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients. Drugs Aging. 2008;25(6):521-9.						x
Wu S, Keeler EB, Rubenstein LZ, Maglione MA, Shekelle PG. A cost-effectiveness analysis of a proposed national falls prevention programme. Clin Geriatr Med. 2010;26(4):751-66.			x			
Total	**13**	**4**	**12**	**2**	**2**	**5**

The interventions were compared either to no intervention/usual care or to other interventions, depending on the study. For example, the cost-effectiveness of strength and balance interventions were compared to no intervention, other types of exercise such as Tai Chi or other types of interventions (ie multifactorial programme or education support). The correct classification of the interventions and the relevant comparators is crucial to draw meaningful conclusions about the cost-effectiveness of the strategies under examination. In addition, some studies compared multiple interventions, which were judged relevant and appropriate for the study population of community-dwelling older people.

4.2 Country setting for the intervention

Seven studies reported economic evaluations for a range of interventions hosted in multiple countries. Of the 19 single country studies, 4 were set in each of England and Netherlands, 3 in each of Australia and the USA, 2 studies in each of Canada and New Zealand, with one in Finland. This is somewhat misleading as many of the multiple-study interventions included the Otago exercise programme which was conducted in New Zealand, please see Appendix C: Summary of county of origin.

4.3 Analysis of primary and secondary prevention studies

Twenty studies recruited a combination of people who had fallen in the past and those at risk of falling. Six studies recruited only people with a history of falls, whilst none included only those who had never fallen. Please see Appendix D: Taxonomy Table.

Publication date

Of the 26 studies, over 60% have been published in the last 4 years, with 7 (27%) published in 2016 (see Table 6).

Table 8: Publication date

Publication date	Number of studies	Publication date	Number of studies
2005	1	2012	4
2008	2	2014	1
2009	1	2015	4
2010	4	2016	7
2011	2	Total	26

4.4 Components used in the taxonomy

Appendix D: Taxonomy Table uses the Lamb taxonomy to describe the studies. Some of the salient aspects, particularly the intervention, have already been discussed. This section provides an overview of the other components within the taxonomy.

4.5 Age and sex

Many studies did not report participant characteristics, rather noting such information was contained in the related clinical evidence or adopted a hypothetical population. Both features are not uncommon in economic evaluation and can be a weakness in their interpretation. An analysis by mean age is provided in Table 9. Over a quarter (7) did not report these, usually because they were modelling multiple interventions and assumed populations across studies were homogenous, with no formal testing of that hypothesis. Thus the model was populated with data from a range of studies often with heterogeneous populations.

Two studies, Farag 2016 [14] and Li 2015 [15] included participants from the age of 40, all of whom had Parkinson's disease. Farag 2016 [14] reported a mean age of over 70 years and thus met entry criteria. Li did not disclose the mean age. Hence technically it failed to meet the criteria but we included it to be consistent with including Farag 2016.

One study, Albert 2016 [16], included people from aged 50 years but mean age was 75.5 years and hence included. Beard 2006 [30] included people aged 60 years in some settings but over 65 years from others. Separate analyses were provided for the 2 groups. Sach 2012 [17] also included people aged 60 years and over. No mean age of the included group was provided. We have assumed the mean age was over 65 years given recruitment used ambulance service records to identify people who had fallen.

Table 9: Age at entry

Age at entry (years)	Number of studies	Age at entry (years)	Number of studies
≥ 40 years	2	≥ 75	3
≥50	1	≥ 80	1
≥ 60	2	Not disclosed	7
≥ 65	6	Total	26
≥ 70	4		

Two studies included only women ([18] and [19]) and 3 focussed on specific disorder being Parkinson's disease ([14] and [15]) and those with an eye disorder ([20]).

4.6 Recruitment

Recruitment strategy was not described in 9 studies. The most common setting was following attendance at an acute setting (7), with another study using ambulance records for those calling an ambulance but not taken to hospital. Recruitment was from primary care in 2 studies and community clinics were used in 3. Other sources used included the electoral roll, referrals for home support and a veterans' register.

4.7 Delivery setting

Most interventions were delivered in the main in the community (11/26; 42%), with 6 (23%) delivered in a day hospital setting, 3 (12%) at home, 2 (8%) in a mix of locations, with 4 (15%) unspecified. However, this picture may be somewhat misleading as some authors used the generic term 'community' but did not provide a sufficiently full description to enable accurate classification.

4.8 Delivery of assessments and interventions

Seven studies were of multiple interventions and did not address delivery of assessments and interventions in detail. Of those that did discuss these aspects, most studies used professional staff to do the assessment (14, 54%) and 15 (58%) used professional staff to deliver the intervention. Five studies had no assessment. Of the remaining interventions, 2 were delivered by certified exercise/ fitness instructors (on Tai Chi or Tai Ji Quan) and 2 did not disclose who conducted the exercise programmes ([21] and [18]).

There was poor reporting of the follow-up interventions delivered after the assessment.

4.9 Summary of quality assessment from checklist for studies

Of the 26 studies included in this review, 12 were directly applicable as they met all applicability criteria relevant for this evaluation. Fourteen studies failed to meet one or 2 criteria which were, however, unlikely to change the study results. Thus, the main findings of the economic evaluations are likely to be robust as they appear to have been based on a sound methodology or on the use of extensive sensitivity analyses. Moreover, 4 studies were carried out in the UK, thus making their findings directly applicable to the UK setting. Overall, the study quality was good, as most studies (22 out of 26) presented minor methodological limitations, often related to the relatively short time horizon or the partially limited perspective of the cost analysis. Only 4 studies reported potentially serious limitations, due to the source of evidence (weak study design or use of assumptions).

4.10 Follow-up period

Table 10 provides information on the follow-up period for each study. Eighteen of the economic evaluations were based directly on a clinical trial. The mean follow-up for these was 15.4 months (range 2 months to 96 months). Excluding the study by Beard et al. (which reported on a long-term community-based falls prevention programme in New South Wales, Australia; individual people were not followed up for this period, rather it is the duration of the programme), the mean follow-up was 10.7 months. This is reasonable given the cost and practical difficulties associated with a trial design which has a longer term follow-up, particularly in an older population. However, it may not be sufficient to capture the on-going benefit from a falls prevention programme.

No economic evaluation extrapolated results beyond the follow-up period. No analysis of trend in falls over time was thus available from these economic evaluations. However, we note that there was a one year follow-up of FaME and Otago (Iliffe 2014 paper) and also at 2 years post intervention (Gawler et al.[2]), which reported that the effects on falls did not persist at a 24 months assessment in either exercise intervention.

Table 10: Follow-up periods for included studies

Study	Follow-up (months)	Study	Follow-up (months)
Albert et al.	12	Irvine et al.	12
Beard et al.	96	Jenkyn et al.	12
Campbell et al.	12	Li et al. (2015)	9
Carande-Kulis et al.	Not trial based.	Li et al. (2016)	6
Church et al. (2012)	Not trial based.	Markle-Reid et al.	6
Church et al. (2011)	Not trial based.	McLean et al.	18
Farag et al. (2015)	Not trial based.	Patil et al.	24
Farag et al.(2016)	6	Peeters et al.	12
Fletcher et al.	2.5	Pega et al.	Not trial based.
Frick et al.	Not trial based.	Polinder et al.	12
Hektoen et al.	Annualised costs and benefits based on Otago	Sach et al.	12
Hendriks et al.	12	van der Velde et al.	2
Iliffe et al./ Gawler et al	12[3] and 24 months	Wu et al.	Not trial based.

[2] Gawler, Skelton, Dinan-Young, Masud, Morris, Griffin, Kendrick, Iliffe, for the ProAct65+ team. Reducing falls among older people in general practice: The ProAct65+exercise intervention trial. Archives of Gerontology and Geriatrics 67 (2016) 46–54.

[3] Note the follow up study on FaME (Gawler et al[1]) had a 24 months follow-up on falls and activity.

4.11 Summary of evidence statements reported by intervention

4.11.1 Strength and balance

Half of the studies included in the analysis (13 of 26) have assessed the value for money of interventions coming under the broad category of strength and balance. However, some heterogeneity among studies was found in terms of type of strength and balance programme and/or its setting, comparators considered and clinical outcomes of the analysis.

For example, some studies considered group-based strength and balance exercises versus no intervention, some studies compared group-based strength and balance exercise versus home-based strength and balance exercise, other studies compared different type of strength and balance exercises (eg resistance, Tai Chi, Tai Ji Quan), other studies considered exercise among a range of other falls preventive programmes (eg multifactorial risk assessment).

Therefore, it seems difficult and inappropriate to synthesise evidence of all these studies together, but it is necessary to create subgroup of interventions/comparisons, in order to try to draw some conclusions on the cost-effectiveness of strength and balance exercise related interventions.

(a) Group-based exercise

One study (Iliffe, 2014) compared group-based exercise using the Falls Management Exercise (FaME) programme to usual care and home-based exercise using the Otago programme to usual care in older people (65 years or over) living in England, of whom 16.2% had experienced a fall in the 12 months. More people reported at least 150 minutes of moderate to vigorous physical activity per week in the FaME arm at 12 months (49% versus 43% in Otago and 38% in the usual-care arm) and this relative benefit was sustained at 12 months after the intervention. At this time point there was a statistically significant reduction in falls rate in the FaME arm compared with the usual-care arm (incidence rate ratio 0.74, 95% CI 0.55 to 0.99; p=0.042). There were no statistically significant difference between the Otago arm and usual care (incidence rate ratio 0.76). However, quality-adjusted life-years declined very slightly from baseline in the FaME arm (0.672 to 0.667) whilst there was no change in the other arms. FaME was more expensive than OEP to deliver (£241 versus £100). Under a conventional cost-utility analysis Otago would be judged more cost effective than FaME (cheaper and higher quality adjusted life years) but FaME was more clinically effective in terms of falls avoided and the reduction in falls remained one year after intervention finished.

Two studies compared group-based exercise versus no intervention ([18], [21]) alongside RCTs, one was conducted in Australia (McLean 2015) and the other was set in Finland (Patil 2016). In both cases, people aged over 70 years were recruited. In each study, group-based exercises (which were generally supplemented by home training) were more expensive (€42.5 per person and £45.87 per person) but led to a reduced rate of falls per person. McLean and colleagues also estimated the QALY gain associated with the reduction of falls, was 0.0009 per person. The incremental cost per QALY (ICER) was £51,483 and the probability for the intervention of being cost-effective was extremely low at a threshold of £20,000-£30,000 per QALY. However, in the women only group the ICER was more favourable at £22,986 per QALY, which is broadly within the cost-effectiveness threshold.

Patil and colleague did not calculate the quality of life associated with the reduction of falls and concluded that "with a willingness to pay of €3,000 per injurious fall prevented, there was an 85.6% chance of the exercise intervention being cost-effective". There is no equivalent acceptability threshold in England.

Two Australian studies, both conducted by Church and colleagues in year 2011 and 2012 [22] [2] compared group-based exercise with no intervention and with several alternative programmes. These analyses used decision models to compare cost-effectiveness of several programmes using data from the literature. In both cases, group-based exercise had high cost-effectiveness ratios AUS$72,765 and AUS$70,834 per QALY, respectively) and Church 2012 showed that group-based exercise was extendedly dominated by other interventions.

Similar conclusions were made in another Australian study conducted by Farag and colleagues (2016) [14] where group exercise (or minimally supervised home exercise, when group exercise was not feasible) was compared to no intervention in participants with Parkinson's disease alongside a RCT. It was found that the incremental cost per QALY was AUS$338,000. However, it was estimated that the intervention had an 80% probability of being cost-effective, relative to the control, at a threshold of AUS$2,000 per fall prevented.

Finally, Fletcher et al (2012) [23] in a study conducted in the UK also estimated the cost-effectiveness of group exercise with minimally supervised home exercise compared to no intervention in participants with Parkinson's disease alongside a RCT.

The intervention comprised 10 once weekly group exercise sessions, delivered by a physiotherapist, with twice weekly home exercises, commencing 10 weeks after the initial assessment. The exercises delivered were drawn from the Falls Management Exercise programme (FaME). In this case, the intervention was cost saving (−£128) and more effective (0.003 QALY gained), although none of

these differences were statistically significant. In a sensitivity analysis, it was found that there was more than an 80% probability that the exercise option was a cost-effective strategy relative to no intervention.

(b) Home-based exercise

The 2 studies conducted by Church and colleagues previously mentioned, also estimated the cost-effectiveness of home-based exercise versus no intervention. In both studies, home-based exercise were not cost-effective (AUS$96,205 and $93,432 per QALY) and this programme was dominated by other preventive interventions.

Similar findings were reported in the study by Campbell and colleagues (2005) [20] that assessed the cost-effectiveness of the Otago home-based programme (plus vitamin D supplementation) compared to no intervention alongside a RCT in New Zealand. They found that Otago was dominated (less effective and more costly) than usual care. However, the patient group was people aged ≥75 years with severe visual impairment and had poor adherence to the programme.

The Otago programme was also analysed in a more recent USA study. In this cost-benefit analysis, Otago was cost saving by $122 with a RoI of 36%. The same conclusions were drawn in a Dutch study by Hektoen and colleagues [19] where Otago was dominant (more effective and less expensive) over no intervention. However, this study has some potentially serious limitations (see Appendix G: Completed checklists).

(c) Tai Chi exercise and Tai Ji Quan

In the 2 studies by Church and colleagues [2,22], exercise based on Tai Chi was compared to no intervention in more mobile older people. Tai Chi showed the lowest incremental cost per QALY among all the exercise interventions compared to no intervention (in both cases slightly less than AUS$45k per QALY). The 2012 Church paper also reported that Tai Chi was dominant compared to several other preventive options (among these, home exercise). In their cost-benefit Carande-Kulis and colleagues [24] found a very high RoI (509%) and was cost saving ($529) compared to other home and group exercises.

Two studies by Li and colleagues [15], conducted in the USA, assessed the cost-effectiveness of Tai Ji Quan. The first analysis, conducted in 2015, compared Tai Ji Quan with 2 other strength and balance options (resistance and stretching) alongside a RCT in people with Parkinson’s disease. Tai Ji Quan was less expensive and led to a reduced number of falls and better utility scores than the 2 comparators. In the 2016 analysis, Tai Ji Quan was compared to no

intervention in a before and after study. The intervention was more effective but more costly with an incremental cost of $917 per fall prevented.

Frick et al. [31] reported that medication reviews and Tai Chi were the least-costly and most-effective options, but they were also the least studied and were thus excluded from their detailed modelling.

(d) Multifactorial risk assessment

Twelve studies assessed the cost-effectiveness of a multifactorial risk assessment programme with some contrasting results. The 2 studies by Church [2] [22], based on decision models previously reported for exercise, also investigated cost and effects of multifactorial programmes (risk assessment and referral; risk assessment and active management). The first consisted of multifactorial falls risk assessment and follow-up by a physician, 1-hour occupational therapy home visit and a 2-hour nurse interview; the second consisted of falls risk assessment (as per above) plus an exercise programme once a week, home hazard modification by an occupational therapist, a vision assessment, a medication review and counselling. Neither intervention was cost-effective compared to no intervention, with incremental cost per QALYs ranging from AUS$125,000 to AUS$130,000 for risk assessment and active management and from AUS$165,000 to AUS$172,000 for risk assessment and referral. These interventions were dominated by other options.

A model approach was used also in a US study by Frick et al [25] that estimated the cost-effectiveness of an individualised multifactorial population-based approach for older people and of an individualised multifactorial approach for high-risk older people or those who had fallen in the previous year. Neither approach was cost-effective, being more expensive and less effective than other options (eg home modifications, Tai Chi).

Similar findings were presented in the study by Jenkyn et al (2012) [26] that compared, in a pragmatic RCT, individually customised multifactorial intervention (including a comprehensive geriatric assessment coupled with referral to existing health services) with no intervention in the Canadian setting. It reported that the intervention was not cost-effective with an incremental cost of Can$122k per fall averted.

The Peeters et al study (2011) [27] had similar conclusions. In this analysis, a multifactorial fall risk assessment conducted by the geriatrician to identify modifiable fall risk factors was compared to no intervention with an economic analysis alongside a RCT in the Netherlands. Again, it was found that the intervention was more expensive (€902 more per person) but did not lead to QALY gains (-0.004), and the sensitivity analyses showed that there was little chance of the intervention being cost-effective.

Another 2 studies ([28] and [29]) also showed limited or no effect of multidisciplinary risk assessment interventions with active management (compared to usual care) and both concluded that the intervention was not cost-effective. These were set in Canada and in the Netherlands, respectively.

In contrast, 4 studies reported good value for money for multifactorial risk assessment programmes. In a recent US study, Albert and colleagues [16] compared a risk assessment intervention, the “Healthy Steps for Older Adults” (HSOA), which offered screening for falls risk and education regarding falls prevention to no intervention. They found that this programme was cost-saving (-$840 per person) and associated with a slight gain in QALYs (0.008).

The cost-effectiveness of a risk assessment multifactorial programme plus education had also been shown in a previous Australian analysis by Beard and colleagues (2006) [30] that compared the “Stay on your feet” multifactorial preventive programme with usual care. A cost-benefit analysis was conducted and it reported that savings due to reduced hospitalisations due to falls, and savings of other direct and indirect costs, were up to 20 times greater than the cost of the programme itself.

In England a study by Sach and colleagues (2012) [17] assessed the cost-effectiveness of an individualised, multi-factorial intervention programme which adopted the recommendations in NICE clinical falls guidelines. An economic study was conducted alongside a RCT. This found that the intervention was cost-saving (-£1,551 per person) and reduced the mean number of falls (-5.34 per person) and increased QALYs (0.01). At a willingness to pay of £20,000 (£30,000) per QALY there was an 89.0% (92.3%) chance of the community falls prevention service group being cost-effective.

Wu et al (2010) [31] found that the Falls Rehabilitation Program (FRP), a multifactorial risk assessment to any eligible Medicare beneficiary who has fallen within the preceding 12 months, with referral to appropriate interventions such as exercise might be a cost-effective option, especially in older individuals.

Finally, in an English study, Irvine and colleagues [32] assessed the cost-effectiveness of a day hospital multidisciplinary falls prevention programme, including physiotherapy, occupational therapy, nurse, medical review and referral to other specialists based on a pragmatic trial with 12-month time horizon. It was found that the intervention increased costs of £578 per person, reducing falls of 0.17 per person, with an incremental cost per fall prevented of £3,320. The probability that the intervention was cost-effective was always less than 40%, even if decision-makers were willing to pay more than £5,000 per fall averted. As noted there is no such threshold applied in England. This limits the interpretation one can make on this study about its cost-effectiveness.

(e) Home modifications

There was consistency across 3 of the 4 studies of home assessment and modification programmes. In a recent study conducted in New Zealand, Pega and colleagues [33] (2016) assessed the impact of home safety assessment and modification in reducing injurious falls in community-dwelling older adults and its impact on total costs, using a Markov model. The incremental cost per QALY for the intervention was $9,000 per QALY in the base case, and the intervention was cost-effective for all age groups, level of risk and regardless of ethnicity.

In another New Zealand analysis, (Campbell et al, 2005 [20]) the same intervention was analysed alongside a RCT. This study also concluded that home assessment and modification was cost-effective compared to no intervention with an incremental cost per fall averted of NZ$650.

Home modifications were included in the analysis by Frick and colleagues (2010) [25] and was compared with several other preventive interventions (eg exercise, multifactorial assessment, medical review, vitamin D supplementation). It found that home modification was most likely to have the highest economic benefit when QALYs are valued at $50,000.

Church 2012 [2] reported that home hazard modification in people who had previously fallen had an incremental cost per QALY of AUS$57,856 compared to usual care. This is slightly higher than the willingness to pay threshold of AUS$50,000.

Medicines reviews and reduction in use of fall-risk-increasing-drugs

Two studies assessed the cost-effectiveness of withdrawal of fall-risk-increasing drugs in the older age groups. Van der Velde et al (2008) [34] in a Dutch observational study with a 2-month follow-up found that withdrawal of fall-risk increasing drugs reduced falls (-2.3 per person) and reduced costs (-€1,691 per person) and was therefore a dominant option compared to no withdrawal. Polinder and colleagues (2016) [35] in a cost-consequences analysis also conducted in the Netherlands estimated the cost-effectiveness of withdrawing fall-risk-increasing drugs alongside a RCT. It found the intervention led to 0.005 QALYs gained at an incremental cost per person of €39. None of these differences were statistically significant and no ICERs (incremental cost-effectiveness ratios) were calculated.

Withdrawal of psychotropic medication withdrawal was also analysed in the 2 studies by Church and colleagues and by Frick et al that have been previously described. The 2 Church analyses showed relatively good value for money for

psychotropic medication withdrawal compared to no intervention (AUS$16k and AUS$17k, respectively), and in the study by Frick [25] medication management was cost saving and more effective than several alternative options including exercise and multifactorial risk assessment.

(f) Cardiac pacing and expedited cataract surgery

The 2 studies by Church and colleagues ([22] and [2]) also evaluated the cost-effectiveness of cardiac pacing and expedited cataract surgery. In the study published in 2011, cardiac pacing was reported to increase costs per person by AUS$4,545 with a cost/QALY gained of AUS$80,257 compared to no intervention. The 2012 study reported cardiac pacing increased costs per person by AUS$9,652, saved 2.987 falls, and increased QALYs by 0.172. The cost per fall avoided was $3,231 and $56,111 per QALY gained. The 2012 study had a longer time horizon than the 2011 (lifetime versus 10 years) so this may account for the differences. Over the longer time horizon it still just fails to be cost-effective at the AUS$50,000 threshold.

These 2 studies also reported on expedited cataract surgery. In 2011 the cost per QALY was $2,211 but in 2012 this intervention was reported to dominate no intervention being cost saving and improving quality of life.

4.12 Equity

Only one study addressed equity aspects [36]. Results were stratified by age, gender and ethnicity and demonstrated home safety assessment was cost-effective among all studied ethnic groups and genders. No studies considered the effects stratified by ethnic minority or between genders.

5. Discussion

5.1 Findings in context

The findings from this review serve several purposes but are primarily to inform the development of an economic model of cost-effective interventions. It has identified the costs and benefits of several different interventions across a range of differently funded and resources health care system, with different sub-groups and different comparators. Given the increasing fiscal restraint in the NHS and social services, coupled with a growing population of older adults, implementing only programmes which are cost-effective is necessary to optimise health care spending. Hence we anticipate these findings will be relevant to commissioners, providers, health and social care policy makers and planners as they seek to achieve a better understanding of optimal falls prevention programmes.

However, to achieve this objective, analyses must be conducted using results which are expressed using generic ratios (incremental cost/QALY gained) which have widely adopted thresholds. Other measures, such as cost per fall, are not useful in deciding on whether an intervention should be funded relative to interventions addressing other diseases or disorders.

5.2 Implications of findings

The review of the economic evidence provides some clear findings for each group of interventions.

5.3 Key messages from strength and balance related studies

1. Group-based exercise for women over 70 years, with or without a history of falls, seems to be cost-effective when judged using an incremental cost per QALY (ICER £22,986).
2. A comparison of FaME and Otago showed both had very similar quality adjusted life year changes from baseline, FaME was more expensive by about £141 per person but was more clinically effective in terms of falls avoided.
3. Group-based exercise using the FaME exercise programme might be cost-effective in certain groups of people such as those with Parkinson’s disease.

4. There were inconsistent results on the cost-effectiveness of the Otago programme. Taking the evidence as a whole this programme was evaluated better than others, and may be cost saving as well as reducing falls in groups who adhere to the programme. However, the efficacy is dependent on implementing the programme and it must be implemented with fidelity to the original programme reported in the RCTs.
5. Other home-based exercises have not been shown to be cost-effective.
6. Of the strength and balance interventions appraised, Tai Chi and Tai Ji Quan were consistently the most cost-effective interventions when delivered to more mobile older people.

Key messages from multifactorial risk assessment and management studies:

There is contrasting evidence on the cost-effectiveness of multifactorial risk assessment interventions with or without active management.

1. Three studies considered risk assessment only with referral to medical colleagues as appropriate. None were cost-effective.
2. Nine studies evaluated risk assessment plus active management of risk factors through, for example, exercise. Five were cost-effective and 4 were not. Two of the ‘were nots’ were informed by decision models comparing several strategies and QALYs gained were used as measure of benefits. A third was a day hospital multidisciplinary falls prevention programme, including physiotherapy, occupational therapy, nurse, medical review and referral to other specialists which was not shown to be cost-effective in England.
3. Of the 4 multifactorial risk assessment that were cost-effective, 2 supplemented interventions with an educational programme, for example, the Healthy Steps for Older Adults” in USA and the “Stay on your feet” in Australia.
4. One of the 4 cost-effective studies was conducted in England and reported that an individualised multi-factorial intervention programme undertaken following the NICE clinical falls guidelines was cost-effective (Sach 2012 [17]). This suggests that it is important that evidence based interventions are adopted within the management phase. This study is the most generalisable to the English setting.

Key messages from home assessment and modification studies:

1. The published evidence suggests that home assessment and modification is likely to be a cost-effective intervention for fall prevention in the older age groups;

2. The applicability of the published results to the English NHS and social care setting is uncertain (2 studies conducted in New Zealand and one study in the USA).

Key messages from medicine review

1. Withdrawal of fall-risk increasing drugs is likely to be a cost-effective option for prevention of falls.

5.4 Limitations of the evidence

We only searched for studies that specifically described an older person population in the title, abstract or indexing of the database record. It is possible some studies reported a falls intervention for patients with conditions such as stroke, Parkinson's disease, or Alzheimer's disease in older people - but did not explicitly mention an older population in the title or abstract - and these may have been missed. Including these types of conditions, in addition to the older people concept, in the search strategy would have resulted in an unacceptably high volume of irrelevant records, which could not have been processed within the resource constraints of this project.

We only searched for studies that explicitly describe the falls outcome in the title, abstract or indexing of the database record. For example, the strategy did not search specifically for economic evaluations of fracture prevention programmes, or exercise groups for older people, medication reviews etc. unless the database record was clear that these interventions were designed to prevent falls. It could therefore have missed studies that only reported the impact on falls as an outcome in the full text of the paper. As above, broadening the search strategy to address this would have resulted in the retrieval of an unacceptably high volume of irrelevant records.

Both of the above limitations are also found in the approach taken by the Cochrane review [8] and also the searches undertaken to inform NICE guidance [1].

We only searched for English language studies so could have missed a relevant study in a non-English language journal.

Most studies had poor descriptions of participant characteristics, the intervention and control. Often this arose from the purpose of the study, being to model individual interventions using data from a range of sources, with none described in detail. Hence it was not possible to apply Lamb taxonomy [9] to many of the studies for these reasons.

Heterogeneity in participants and study types was not controlled for. We also did not check for publication bias.

Also there was poor reporting of important aspects of clinical studies such as drop-outs, blinding of participants and investigators, potential reporting bias and potential confounders.

There was generally poor reporting of economic results with no consistency in terms of relevant form of analysis or cost-effectiveness measure or approach to addressing uncertainty. Sensitivity analyses were performed in almost all studies, but the methodology used and the presentation of the results were not always appropriate or clear. Hence the precision with which the treatment effect of an intervention can be estimated was not well described.

The methodological approach used in the studies differed substantially depending on the type of study (modelling or RCT) and also on the instrument used to assess the health impact of the interventions (falls or QALYs). A conventional threshold for the value for money has been defined using QALYs as the summary benefit measure, but such a threshold is not clear when using the reduction in falls. Thus, when falls are used as benefit measure, no conclusion can be drawn on the cost-effectiveness of the intervention.

Studies were carried out in countries with different health care systems and reimbursement systems, thus caution is required when extrapolating the study findings to other countries.

The perspective of the economic analysis varied in the studies, thus the categories of costs included were not always comparable. Moreover, only 3 (Fletcher [28], Irvine [32] and Sach [37]) adopted an NHS and personal social care perspective, as is appropriate for those appraised by PHE. This is an important weakness given the high costs imposed by falls on this setting. In addition, the estimation of costs reflects the health care system of the country where the study was performed, which may not be comparable among countries. Finally some studies were inadequately powered due to difficulty in recruitment.

Despite these limitations we do not judge that they have introduced bias into the results. Rather they are common to all such reviews of economic studies and none seriously challenge the validity of the findings.

5.5 Limitations of the review and impacts on findings

We have sought to conduct a literature review, which complies with best practice. We have thus assessed the methodological quality of included economic studies and put less weight on those of poor quality and of little

relevance to the decision problem. However, this has only been a narrative synthesis. No meta-analysis has been conducted whereby the quantitative results of separate, but similar studies, are combined. Hence it has not been possible to provide measure of uncertainty around results. We have also not formally measured heterogeneity across studies informing the evidence base for a single intervention such as home assessments and modifications.

Other issues include the mean follow-up period of around 10 to 11 months (excluding Beard et al.) may not be sufficiently long to capture benefits in the year after the intervention, assuming some protective effect continues to around 24 months.

A further limitation is the range of end points used in the studies. In economic evaluations for NICE and PHE, the measure of benefit preferred is gain in quality adjusted life year, using a standardised instrument for measuring generic health status, such as the EQ-5D tool. This endpoint enables results to be compared to threshold values of willing to pay for a QALY. There is no equivalent threshold for studies reporting cost per fall avoided. This gives rise to a mismatch between study objectives and the value for money measure. Thus an intervention may demonstrate statistically significant clinical benefits in terms of falls avoided but fail to detect a material difference in quality of life, possibly because the tool is not sufficiently sensitive to capture aspects such as reduced fear of falling.

These limitations impact on the nature of the recommendations we can make. The strengths include that the recommendations have been informed by:

- a structured review of the available economic evidence
- evidence tables listing key characteristics of individual studies
- quality assessment including judging relevance and applicability to the English health and care system as well as methodological quality
- evidence profiles for each intervention

However, we are mindful that the economic studies rely on the quality of the underlying clinical study and these have not been evaluated. The risk is that well-conducted economic studies have been conducted for poor clinical studies and the recommendation herein are informed by the quality of the economic evidence only.

By focusing on economic evaluations, previous clinical studies informing the clinical evidence base have not been reviewed. This is particularly relevant for the FaME intervention as the initial RCT was conducted in a different population which did not have an accompanying economic evaluation. The pivotal study included women aged 65 years or over, living in their own home and with a history of 3 or more falls in the previous year, Hence by including only economic

evaluations we may be failing to capture all the populations that would benefit clinically and where the intervention would be cost effective due to the absence of evidence.

This can be addressed partially at the next stage of the process whereby, for the cost-effective interventions agreed with the Steering Group, we will go back to the clinical studies to extract the key components of the intervention to inform the resource use in the model. If at that stage we judge a clinical study is badly flawed we shall advise PHE and agree the best way forward.

At this stage we shall also explore generalisability in depth, with members of the Steering Group and sub-group to ensure the interventions modelled are reflective of those found to be cost-effective and appropriate for English participants and designed to be delivered efficiently given the settings available.

In this review we have included all economic analyses and models. The better quality studies are in the main those that accompany an RCT, which has collected resource use and quality of life data along with the clinical outcomes. This consistency of data sources is a real strength over some studies, which modelled multiple interventions without necessarily having a great deal of insight into the delivery of each.

Discrepant findings from different studies of similar interventions may arise because of differences in the manner of delivery. We note virtually all studies used trained professionals to deliver interventions but important aspects may be aspects such as prior training before delivery, outcome recording and review and level of quality assurance in place. These aspects are not addressed in any economic evaluation.

6. Conclusion

The conclusions of the assessment are informed by 26 methodologically robust studies judged applicable to the English setting and for community-dwelling older people. There was consistency in the direction and magnitude of results for some interventions but for others the results across studies were inconsistent, or adopted a cost per fall measure, and thus difficult to interpret.

Based on the evidence we recommend that the model includes the following interventions:

- Otago strength and balance programme for people aged over 80 years (mean age 82 years) who have a similar falls risk to those in the clinical studies, being 43% had a fall(s) in previous 12 months ;
- Group exercise for women aged 70 years or over (mean age 76 years) with a falls risk equivalent to about 6% a month;
- Group exercise using the FaME programme in people aged 65 and over (mean age 71 years) with a falls risk equivalent to 16% having a fall(s) in the 12 months before the intervention;
- Tai Chi or Tai Ji Quan in people with mean age of 75 years and 35% have 2 or more falls in the previous 6 months;
- Common aspects of the 4 multifactorial risk assessment and management studies that were cost-effective, with a focus on that delivered by Sach and colleagues in the East Midlands in a high-risk population group in people aged over 60 years (median 82 years) and 81% having 2 or more falls in past 3 months;
- Home assessment and modification;
- Medication reviews. These will be delivered as an intervention within the multifactorial risk assessment and management programme so the same age and falls risk characteristics apply.

7. References

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Appendix A: Full Search Strategies

A.1: Source: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R)

Interface / URL: OvidSP
Database coverage dates: 1946 to present. Updated daily.
Search date: 06/12/16
Retrieved records: 2108
Search strategy:

Database: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:

1	Accidental Falls/ (19978)
2	(fall or falls or falling or faller$1 or fallen or fell).ti,ab,kf. (212820)
3	(trip or trips or tripped or tripping or stumbl$ or slip or slips or slipped or slipping).ti,ab,kf. (22831)
4	or/1-3 (239886)
5	exp Aged/ (2803738)
6	(elder$ or older or old people$ or old person$ or old wom#n$1 or old m#n$1 or old male$1 or old female$1 or old adult$1 or old age$ or aging or geriatric$ or senior citizen$ or seniors or pensioner$ or veteran$ or sexagenarian$ or septuagenarian$ or octogenarian$ or nonagenarian$ or centenarian$).ti,ab,kf. (1076676)
7	5 or 6 (3441155)
8	economics/ (28596)
9	exp "costs and cost analysis"/ (217016)
10	economics, dental/ (1917)
11	exp "economics, hospital"/ (23030)
12	economics, medical/ (9389)
13	economics, nursing/ (4000)
14	economics, pharmaceutical/ (2804)
15	(economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (635524)
16	(expenditure$ not energy).ti,ab. (24924)
17	(value adj2 money).ti,ab. (1402)
18	budget$.ti,ab. (24600)
19	or/8-18 (781501)
20	((energy or oxygen) adj cost).ti,ab. (3631)
21	(metabolic adj cost).ti,ab. (1199)
22	((energy or oxygen) adj expenditure).ti,ab. (22816)
23	or/20-22 (26731)
24	19 not 23 (775581)

25 ((return$ or gain$1) adj3 investment$1).ti,ab,kf. (2060)
26 (ROI or ROIs).ti,ab,kf. (11326)
27 24 or 25 or 26 (786968)
28 4 and 7 and 27 (3556)
29 exp animals/ not humans/ (4669486)
30 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3520225)
31 28 not (29 or 30) (3470)
32 limit 31 to yr="2003 -Current" (2526)
33 limit 32 to english language (2381)
34 remove duplicates from 33 (2108)

A.2: Source: Embase

Interface / URL: OvidSP
Database coverage dates: 1974 to 05/12/16
Search date: 06/12/16
Retrieved records: 2955
Search strategy:

Database: Embase <1974 to 2016 December 05>
Search Strategy:
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1 falling/ or fall risk/ (33722)
2 (fall or falls or falling or faller$1 or fallen or fell).ti,ab,kw. (250486)
3 (trip or trips or tripped or tripping or stumbl$ or slip or slips or slipped or slipping).ti,ab,kw. (23536)
4 or/1-3 (283835)
5 aged/ or aged hospital patient/ or frail elderly/ or very elderly/ (2554485)
6 (elder$ or older or old people$ or old person$ or old wom#n$1 or old m#n$1 or old male$1 or old female$1 or old adult$1 or old age$ or aging or geriatric$ or senior citizen$ or seniors or pensioner$ or veteran$ or sexagenarian$ or septuagenarian$ or octogenarian$ or nonagenarian$ or centenarian$).ti,ab,kw. (1320201)
7 5 or 6 (3355573)
8 Health Economics/ (37226)
9 exp Economic Evaluation/ (263181)
10 exp Health Care Cost/ (249636)
11 pharmacoeconomics/ (7723)
12 or/8-11 (465294)
13 (econom$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (780439)
14 (expenditure$ not energy).ti,ab. (30282)
15 (value adj2 money).ti,ab. (1845)
16 budget$.ti,ab. (29753)
17 or/13-16 (809053)
18 12 or 17 (1014191)
19 (metabolic adj cost).ti,ab. (1126)
20 ((energy or oxygen) adj cost).ti,ab. (3578)

21 ((energy or oxygen) adj expenditure).ti,ab. (25284)
22 or/19-21 (29074)
23 18 not 22 (1008218)
24 ((return$ or gain$1) adj3 investment$1).ti,ab,kw. (2321)
25 (ROI or ROIs).ti,ab,kw. (17427)
26 23 or 24 or 25 (1025488)
27 4 and 7 and 26 (4342)
28 (animal/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not exp human/ (5357793)
29 letter/ or editorial/ or note/ (2100842)
30 case report/ or case report.ti. (2190210)
31 27 not (28 or 29 or 30) (4162)
32 limit 31 to yr="2003 -Current" (3253)
33 limit 32 to english language (3096)
34 remove duplicates from 33 (2955)

A.3: Source: PubMed

Interface / URL: https://www.ncbi.nlm.nih.gov/pubmed
Database coverage dates: 1946 to current.
Search date: 06/12/16
Retrieved records: 259
Search strategy:

Search Query Items found
#35 Search (#35 NOT #36) 259
#34 Search medline[sb] 8708410
#33 Search #28 NOT (#29 OR #30) Filters: Publication date from 2003/01/01; English 2133
#32 Search #28 NOT (#29 OR #30) Filters: Publication date from 2003/01/012271
#31 Search #28 NOT (#29 OR #30) 3197
#30 Search news[pt] OR comment[pt] OR editorial[pt] OR letter[pt] OR case reports[pt] OR case report[ti] 3341232
#29 Search animals [mh] NOT humans [mh:noexp] 4271572
#28 Search #4 AND #7 AND #27 3278
#27 Search #24 OR #25 OR #26 734726
#26 Search ROI[tiab] OR ROIs[tiab] 9840
#25 Search (return*[tiab] OR gain[tiab] OR gains[tiab] OR gained[tiab] OR gaining[tiab]) AND investment*[tiab] 3900
#24 Search #19 NOT #23 723925
#23 Search #20 OR #21 OR #22 23967
#22 Search energy expenditure[tiab] OR oxygen expenditure[tiab] 20347
#21 Search metabolic cost[tiab] 1079
#20 Search energy cost[tiab] OR oxygen cost[tiab] 3403
#19 Search #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 729415
#18 Search budget*[tiab] 23393
#17 Search value for money[tiab] 1173

#16 Search expenditure*[tiab] NOT energy*[tiab] 22868
#15 Search economic*[tiab] OR cost[tiab] OR costs[tiab] OR costly[tiab] OR costing[tiab] OR price[tiab] OR prices[tiab] OR pricing[tiab] OR pharmacoeconomic*[tiab] 604462
#14 Search "Economics, Pharmaceutical"[Mesh:NoExp] 2642
#13 Search "Economics, Nursing"[Mesh:NoExp] 3942
#12 Search "Economics, Medical"[Mesh:NoExp] 8867
#11 Search "Economics, Hospital"[Mesh] 21669
#10 Search "Economics, Dental"[Mesh:NoExp] 1882
#9 Search "Costs and Cost Analysis"[Mesh] 200410
#8 Search "Economics"[Mesh:NoExp] 26730
#7 Search #5 OR #6 3188209
#6 Search elder*[tiab] OR older[tiab] OR old people*[tiab] OR old person*[tiab] OR old women*[tiab] OR old woman*[tiab] OR old men*[tiab] OR old man*[tiab] OR old male*[tiab] OR old female*[tiab] OR old adult*[tiab] OR old age*[tiab] OR aging[tiab] OR geriatric*[tiab] OR senior citizen*[tiab] OR seniors[tiab] OR pensioner*[tiab] OR veteran*[tiab] OR sexagenarian*[tiab] OR septuagenarian*[tiab] OR octogenarian*[tiab] OR nonagenarian*[tiab] OR centenarian*[tiab] 988559
#5 Search "Aged"[Mesh] 2595328
#4 Search #1 OR #2 OR #3 223150
#3 Search trip[tiab] OR trips[tiab] OR tripped[tiab] OR tripping[tiab] OR stumbl*[tiab] OR slip[tiab] OR slips[tiab] OR slipped[tiab] OR slipping[tiab] 21217
#2 Search fall[tiab] OR falls[tiab] OR falling[tiab] OR faller[tiab] OR fallers[tiab] OR fallen[tiab] OR fell[tiab] 197936
#1 Search "Accidental Falls"[Mesh:NoExp] 18338

A.4: Source: Cochrane Database of Systematic Reviews (CDSR)

Interface / URL: Cochrane Library, Wiley
Database coverage dates: Issue 12 of 12, December 2016
Search date: 06/12/16
Retrieved records: 13
Search strategy:

ID Search Hits
#1 [mh ^"Accidental Falls"] 1249
#2 (fall or falls or falling or faller* or fallen or fell):ti,ab,kw 16827
#3 (trip or trips or tripped or tripping or stumbl* or slip or slips or slipped or slipping):ti,ab,kw 480
#4 #1 or #2 or #3 17229
#5 [mh Aged] 1043
#6 (elder* or older or old next people* or old next person* or old next wom?n* or old next m?n* or old next male* or old next female* or old next adult* or old next age* or aging or geriatric* or senior next citizen* or seniors or pensioner* or veteran* or sexagenarian* or septuagenarian* or octogenarian* or nonagenarian* or centenarian*):ti,ab,kw 50919
#7 #5 or #6 51282
#8 [mh ^economics] 63

#9 [mh ^"costs and cost analysis"] 3874
#10 [mh ^"economics, dental"] 4
#11 [mh "economics, hospital"] 1757
#12 [mh ^"economics, medical"] 41
#13 [mh ^"economics, nursing"] 19
#14 [mh ^"economics, pharmaceutical"] 244
#15 (economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic*):ti,ab 50680
#16 (expenditure* not energy):ti,ab 922
#17 (value near/2 money):ti,ab 134
#18 budget*:ti,ab 495
#19 #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 52869
#20 ((energy or oxygen) next cost):ti,ab 300
#21 (metabolic next cost):ti,ab 77
#22 ((energy or oxygen) next expenditure):ti,ab 2294
#23 #20 or #21 or #22 2579
#24 #19 not #23 52441
#25 ((return* or gain*) near/3 investment*):ti,ab,kw 59
#26 (ROI or ROIs):ti,ab,kw 442
#27 #24 or #25 or #26 52882
#28 #4 and #7 and #27 324
#29 #28 Publication Year from 2003, in Cochrane Reviews (Reviews and Protocols) 13

A.5: Source: Health Technology Assessment Database (HTA Database)

Interface / URL: Cochrane Library, Wiley
Database coverage dates: Issue 4 of 4, October 2016
Search date: 06/12/16
Retrieved records: 27
Search strategy:

ID Search Hits
#1 [mh ^"Accidental Falls"] 1249
#2 fall or falls or falling or faller* or fallen or fell 20817
#3 trip or trips or tripped or tripping or stumbl* or slip or slips or slipped or slipping 1103
#4 #1 or #2 or #3 21633
#5 [mh Aged] 1043
#6 elder* or older or old next people* or old next person* or old next wom?n* or old next m?n* or old next male* or old next female* or old next adult* or old next age* or aging or geriatric* or senior next citizen* or seniors or pensioner* or veteran* or sexagenarian* or septuagenarian* or octogenarian* or nonagenarian* or centenarian* 64933
#7 #5 or #6 65287
#8 #4 and #7 5290
#9 #8 Publication Year from 2003, in Technology Assessments 27

A.6: Source: NHS Economic Evaluation Database (NHS EED)

Interface / URL: Cochrane Library, Wiley
Database coverage dates: Issue 2 of 4, April 2015
Search date: 06/12/12
Retrieved records: 102
Search strategy:

ID	Search	Hits
#1	[mh ^"Accidental Falls"]	1249
#2	fall or falls or falling or faller* or fallen or fell	20817
#3	trip or trips or tripped or tripping or stumbl* or slip or slips or slipped or slipping	1103
#4	#1 or #2 or #3	21633
#5	[mh Aged]	1043
#6	elder* or older or old next people* or old next person* or old next wom?n* or old next m?n* or old next male* or old next female* or old next adult* or old next age* or aging or geriatric* or senior next citizen* or seniors or pensioner* or veteran* or sexagenarian* or septuagenarian* or octogenarian* or nonagenarian* or centenarian*	64933
#7	#5 or #6	65287
#8	#4 and #7	5290
#9	#8 Publication Year from 2003, in Economic Evaluations	102

A.7: Source: Cochrane Central Register of Controlled Trials (CENTRAL)

Interface / URL: Cochrane Library, Wiley
Database coverage dates: Issue 11 of 12, November 2016
Search date: 06/12/16
Retrieved records: 278
Search strategy:

ID	Search	Hits
#1	[mh ^"Accidental Falls"]	1249
#2	fall or falls or falling or faller* or fallen or fell	20817
#3	trip or trips or tripped or tripping or stumbl* or slip or slips or slipped or slipping	1103
#4	#1 or #2 or #3	21633
#5	[mh Aged]	1043
#6	elder* or older or old next people* or old next person* or old next wom?n* or old next m?n* or old next male* or old next female* or old next adult* or old next age* or aging or geriatric* or senior next citizen* or seniors or pensioner* or veteran* or sexagenarian* or septuagenarian* or octogenarian* or nonagenarian* or centenarian*	64933
#7	#5 or #6	65287
#8	[mh ^economics]	63
#9	[mh ^"costs and cost analysis"]	3874
#10	[mh ^"economics, dental"]	4
#11	[mh "economics, hospital"]	1757

#12 [mh ^"economics, medical"] 41
#13 [mh ^"economics, nursing"] 19
#14 [mh ^"economics, pharmaceutical"] 244
#15 economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic* 76527
#16 expenditure* not energy 1819
#17 value near/2 money 388
#18 budget* 1132
#19 #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 77026
#20 (energy or oxygen) next cost 332
#21 metabolic next cost 84
#22 (energy or oxygen) next expenditure 2737
#23 #20 or #21 or #22 3040
#24 #19 not #23 76382
#25 (return* or gain*) near/3 investment* 93
#26 ROI or ROIs 495
#27 #24 or #25 or #26 76842
#28 #4 and #7 and #27 2123
#29 #28 Publication Year from 2003, in Trials 278

A.8: Source: EconLit

Interface / URL: OvidSP
Database coverage dates: 1886 to November 2016
Search date: 06/12/16
Retrieved records: 76
Search strategy:

1 (fall or falls or falling or faller$1 or fallen or fell).ti,ab,kw. (19776)
2 (trip or trips or tripped or tripping or stumbl$ or slip or slips or slipped or slipping).ti,ab,kw. (3003)
3 1 or 2 (22715)
4 (elder$ or older or old people$ or old person$ or old wom#n$1 or old m#n$1 or old male$1 or old female$1 or old adult$1 or old age$ or aging or geriatric$ or senior citizen$ or seniors or pensioner$ or veteran$ or sexagenarian$ or septuagenarian$ or octogenarian$ or nonagenarian$ or centenarian$).ti,ab,kw. (15575)
5 3 and 4 (628)
6 l1*.cc. (46339)
7 5 and 6 (97)
8 limit 7 to yr="2003 -Current" (80)
9 limit 8 to english (76)
10 remove duplicates from 9 (76)

A.9: Source: Allied and Complementary Medicine Database (AMED)

Interface / URL: OvidSP
Database coverage dates: 1985 to November 2016
Search date: 07/12/16
Retrieved records: 53
Search strategy:

Database: AMED (Allied and Complementary Medicine) <1985 to November 2016>
Search Strategy:

1	accidental falls/ (1910)
2	(fall or falls or falling or faller$1 or fallen or fell).ti,ab. (3784)
3	(trip or trips or tripped or tripping or stumbl$ or slip or slips or slipped or slipping).ti,ab. (393)
4	or/1-3 (4348)
5	exp aged/ (13152)
6	(elder$ or older or old people$ or old person$ or old wom#n$1 or old m#n$1 or old male$1 or old female$1 or old adult$1 or old age$ or aging or geriatric$ or senior citizen$ or seniors or pensioner$ or veteran$ or sexagenarian$ or septuagenarian$ or octogenarian$ or nonagenarian$ or centenarian$).ti,ab. (18060)
7	5 or 6 (22044)
8	economics/ (3384)
9	exp "costs and cost analysis"/ (1222)
10	"cost of illness"/ (306)
11	(economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (6887)
12	(expenditure$ not energy).ti,ab. (266)
13	(value adj2 money).ti,ab. (19)
14	budget$.ti,ab. (192)
15	or/8-14 (9663)
16	((energy or oxygen) adj cost).ti,ab. (322)
17	(metabolic adj cost).ti,ab. (86)
18	((energy or oxygen) adj expenditure).ti,ab. (526)
19	or/16-18 (859)
20	15 not 19 (9236)
21	((return$ or gain$1) adj3 investment$1).ti,ab. (15)
22	(ROI or ROIs).ti,ab. (34)
23	20 or 21 or 22 (9269)
24	4 and 7 and 23 (80)
25	limit 24 to yr="2003 -Current" (55)
26	limit 25 to english (53)
27	remove duplicates from 26 (53)

A.10: Source: Social Policy & Practice

Interface / URL: OvidSP
Database coverage dates: 1890S to October 2016
Search date: 07/12/16
Retrieved records: 200
Search strategy:

Database: Social Policy and Practice <201610>
Search Strategy:

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1 (fall or falls or falling or faller$1 or fallen or fell).ti,ab,de,hw. (4753)
2 (trip or trips or tripped or tripping or stumbl$ or slip or slips or slipped or slipping).ti,ab,de,hw. (717)
3 1 or 2 (5427)
4 (elder$ or older or old people$ or old person$ or old wom#n$1 or old m#n$1 or old male$1 or old female$1 or old adult$1 or old age$ or aging or geriatric$ or senior citizen$ or seniors or pensioner$ or veteran$ or sexagenarian$ or septuagenarian$ or octogenarian$ or nonagenarian$ or centenarian$).ti,ab,de,hw. (87442)
5 (economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab,de,hw. (41944)
6 (expenditure$ not energy).ti,ab,de,hw. (5904)
7 (value adj2 money).ti,ab,de,hw. (1461)
8 budget$.ti,ab,de,hw. (5701)
9 or/5-8 (49571)
10 ((energy or oxygen or fuel) adj cost).ti,ab,de,hw. (24)
11 (metabolic adj cost).ti,ab,de,hw. (0)
12 cost of living.ti,ab,de,hw. (284)
13 ((energy or oxygen or fuel) adj expenditure).ti,ab,de,hw. (131)
14 or/10-13 (433)
15 9 not 14 (49183)
16 ((return$ or gain$1) adj3 investment$1).ti,ab,de,hw. (192)
17 (ROI or ROIs).ti,ab,de,hw. (22)
18 15 or 16 or 17 (49277)
19 3 and 4 and 18 (307)
20 imit 19 to yr="2003 -Current" (200)
21 remove duplicates from 20 (200)

A.11: Source: Physiotherapy Evidence Database (PEDro)

Interface / URL: https://search.pedro.org.au
Database coverage dates: 1929 – current. Updated monthly.
Search date: 07/12/16
Retrieved records: 85
Search strategy:

Advanced search function used. https://search.pedro.org.au/advanced-search

This allows the combination of terms with AND or – but only one Boolean operator may be used per search. Due to this basic functionality, 2 simple searches were undertaken in the Abstract & Title fields, date limited to studies published since 2003.

falls and cost* 64 records
falls and economic* 21 records

A.12: Source: Cumulative Index to Nursing and Allied Health Literature (CINAHL)
Interface / URL: EBSCO
Database coverage dates: 1937 to current.
Search date: 08/12/16
Retrieved records: 1022
Search strategy:

S44 S39 NOT (S40 OR S41) Limiters - Publication Year: 2003-2016 Narrow by Language: - english 1,022
S43 S39 NOT (S40 OR S41) Limiters - Publication Year: 2003-2016 1,043
S42 S39 NOT (S40 OR S41) 1,233
S41 TI("case report") 29,937
S40 PT(letter OR editorial OR commentary) 528,083
S39 S36 OR S38 1,253
S38 S37 AND S10 128
S37 (MH "Accidental Falls Economics") 174
S36 S6 AND S10 AND S35 1,213
S35 S29 OR S30 OR S31 OR S32 OR S33 OR S34 83,860
S34 MJ EC 81,382
S33 AB(ROI OR ROIs) 920
S32 TI(ROI OR ROIs) 223
S31 AB((return* OR gain*) N3 investment*) 543
S30 TI((return* OR gain*) N3 investment*) 267
S29 S6 AND S10 AND S28 1,178
S28 S20 NOT S27 198,536
S27 S21 OR S22 OR S23 OR S24 OR S25 OR S26 5,033
S26 AB((energy OR oxygen) N1 expenditure) 3,516
S25 TI((energy OR oxygen) N1 expenditure) 1,672
S24 AB("metabolic cost") 136
S23 TI("metabolic cost") 66
S22 AB((energy OR oxygen) N1 cost) 586
S21 TI((energy OR oxygen) N1 cost) 274
S20 S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 199,612
S19 AB(budget*) 4,531
S18 TI(budget*) 3,754
S17 AB(value N2 money) 422
S16 TI(value N2 money) 195
S15 AB(expenditure* NOT energy) 5,787
S14 TI(expenditure* NOT energy) 1,772

S13 AB(economic* OR cost OR costs OR costly OR costing OR price OR prices OR pricing OR pharmacoeconomic*) 100,472
S12 TI(economic* OR cost OR costs OR costly OR costing OR price OR prices OR pricing OR pharmacoeconomic*) 54,440
S11 (MH "Economics") OR (MH "Costs and Cost Analysis+") OR (MH "Economics, Dental") OR (MH "Economic Aspects of Illness") OR (MH "Economics, Pharmaceutical") 97,760
S10 S7 OR S8 OR S9 688,703
S9 AB(elder* OR older OR “old people*” OR “old person*” OR “old woman*” OR “old women*” OR “old man*” OR “old men*” OR “old male*” OR “old female*” OR “old adult*” OR “old age*” OR aging OR geriatric* OR “senior citizen*” OR seniors OR pensioner* OR veteran* OR sexagenarian* OR septuagenarian* OR octogenarian* OR nonagenarian* OR centenarian*) 166,735
S8 TI(elder* OR older OR “old people*” OR “old person*” OR “old woman*” OR “old women*” OR “old man*” OR “old men*” OR “old male*” OR “old female*” OR “old adult*” OR “old age*” OR aging OR geriatric* OR “senior citizen*” OR seniors OR pensioner* OR veteran* OR sexagenarian* OR septuagenarian* OR octogenarian* OR nonagenarian* OR centenarian*) 129,549
S7 (MH "Aged+") 580,856
S6 S1 OR S2 OR S3 OR S4 OR S5 42,577
S5 AB(trip OR trips OR tripped OR tripping OR stumbl* OR slip OR slips OR slipped OR slipping) 2,478
S4 TI(trip OR trips OR tripped OR tripping OR stumbl* OR slip OR slips OR slipped OR slipping) 1,992
S3 AB(fall OR falls OR falling OR faller* OR fallen OR fell) 24,449
S2 TI(fall OR falls OR falling OR faller* OR fallen OR fell) 12,434
S1 (MH "Accidental Falls") 15,257

A.13: Source: CEA Registry

Interface / URL: http://healtheconomics.tuftsmedicalcenter.org/cear4/Home.aspx
Database coverage dates: Not specified
Search date: 08/12/16
Retrieved records: 65
Search strategy:

Freely available version of the database searched. No search functionality beyond the use of single terms – no capacity for phrases/Boolean/truncation etc. Searched on the single term – “falls”.

65 results.

A.14: Source: Chartered Society of Physiotherapy

Interface/URL: http://www.csp.org.uk/
Search date: 9 December 2016
Records retrieved: 2
Search strategy:

A section titled “Resources” was browsed for relevant studies.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site:www.csp.org.uk/ falls AND (cost OR economic)

A.15: Source: College of Occupational Therapists

Interface/URL: https://www.cot.co.uk/
Search date: 9 December 2016
Records retrieved: 1
Search strategy:

A section titled “COT Publications” was browsed for relevant studies.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site:www.cot.co.uk/ falls AND (cost OR economic)

A.16: Source: British Geriatrics Society

Interface/URL: http://www.bgs.org.uk/
Search date: 9 December 2016
Records retrieved: 1
Search strategy:

Special Interest section for “Falls and Bones” was browsed for relevant studies.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site:www.csp.org.uk/ falls AND (cost OR economic)

A.17: Source: British Orthopaedic Association

Interface/URL: https://www.boa.ac.uk/
Search date: 9 December 2016
Records retrieved: No records were retrieved
Search strategy:

Sections titled “Professional Practice” and “Research” were browsed for relevant studies.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site: www.boa.ac.uk/ falls AND (cost OR economic)

A.18: Source: Age UK
Interface/URL: http://www.ageuk.org.uk/
Search date: 9 December 2016
Records retrieved: 1
Search strategy:

A section titled “Health & Wellbeing” was browsed for relevant studies.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site: www.ageuk.org.uk/ falls AND (cost OR economic)

A.19: Source: National Osteoporosis Society
Interface/URL: http:// https://nos.org.uk/
Search date: 9 December 2016
Records retrieved: No records were retrieved
Search strategy:

Sections titled “For Health Professionals” and “Our Research” were browsed for relevant results.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site:www.nos.org.uk/ falls AND (cost OR economic)

A.20: Source: Royal College of Nursing
Interface/URL: http://www.rcn.org.uk/
Search date: 9 December 2016
Records retrieved: 2
Search strategy:

Sections titled “Clinical” and “Older people” were browsed for relevant studies.
A site-wide search option was selected using *falls* as a search term. Result list was browsed for relevant studies.
Google site search was used and the result list was browsed for relevant studies.
site:www.rcn.org.uk/ falls AND (cost OR economic)

Appendix B: PRISMA Table

Table 10: PRISMA Table

Section/topic	#	Checklist item	Reported in Section #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (eg, Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (eg, PICOS, length of follow-up) and report characteristics (eg, years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (eg, databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (ie, screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (eg, piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (eg, PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (eg, risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (eg, I^2) for each meta-analysis.	

Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (eg, publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (eg, sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (eg, study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (eg, sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (eg, healthcare providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (eg, risk of bias), and at review-level (eg, incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (eg, supply of data); role of funders for the systematic review.	

Appendix C: Summary of county of origin

Table 11: Summary of Country of Origin

Author	Year	Title	Country
Frick	2010	Evaluating the cost-effectiveness of fall prevention programmrs that reduce fall-related hip fractures in older adults.	Several.
Church	2011	An economic evaluation of community and residential aged care falls prevention strategies in NSW	Several.
Pega	2016	Home safety assessment and modification to reduce injurious falls in community-dwelling older adults: cost-utility and equity analysis.	Several.
Farag	2015	Economic modelling of a public health programme for fall prevention	Several.
Hektoen	2009	Cost-effectiveness in fall prevention for older women.	Norway costs; New Zealand intervention
Hendriks	2008	Cost-effectiveness of a multidisciplinary fall prevention program in community-dwelling elderly people: a randomized controlled trial.	UK costs; RCT in Netherlands
Wu	2010	A cost-effectiveness analysis of a proposed national falls prevention programme.	Several.
Carande-Kulis	2015	A cost-benefit analysis of 3 older adult fall prevention interventions.	New Zealand Otago; USA Tai Chi and Australia
Church	2012	The cost-effectiveness of falls prevention interventions for older community-dwelling Australians.	Several.
Farag	2016	Economic evaluation of a falls prevention exercise programme among people with Parkinson's disease (PD).	Australia.
McLean	2015	Economic evaluation of a group-based exercise programme for falls prevention among the older community-dwelling population.	Australia.
Beard	2016	Economic analysis of a community-based falls prevention programme.	Australia.
Campbell	2005	Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial.	New Zealand.
Li	2015	Economic Evaluation of a Tai Ji Quan Intervention to Reduce Falls in People With Parkinson Disease, Oregon, 2008-2011.	USA.
Li	2016	Implementing an Evidence-Based Fall Prevention Intervention in Community Senior Centres.	USA
Albert	2016	Cost-effectiveness of a statewide falls prevention programme in Pennsylvania: Healthy Steps for Older Adults.	USA.
Fletcher	2012	An exercise intervention to prevent falls in Parkinson's: an economic evaluation.	England.
Iliffe	2014	Multicentre cluster randomised trial comparing a community group exercise programme and home-based exercise with usual care for people aged 65 years and over in primary care.	England.
Irvine	2010	Cost-effectiveness of a day hospital falls prevention programme for screened community-dwelling older people at high risk of falls.	England.

Author	Year	Title	Country
Sach	2012	Community falls prevention for people who call an emergency ambulance after a fall: an economic evaluation alongside a randomised controlled trial	England.
Jenkyn	2012	How much are we willing to pay to prevent a fall? Cost-effectiveness of a multifactorial falls prevention programme for community-dwelling older adults.	Canada.
Markle-Reid	2010	The effects and costs of a multifactorial and interdisciplinary team approach to falls prevention for older home care clients 'at risk' for falling: a randomized controlled trial.	Canada.
Patil	2016	Cost-effectiveness of vitamin D supplementation and exercise in preventing injurious falls among older home-dwelling women: findings from an RCT.	Finland.
Peeters	2011	Multifactorial evaluation and treatment of persons with a high risk of recurrent falling was not cost-effective	Netherlands
Van der Velde	2008	Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients.	Netherlands.
Polinder	2016	Cost-utility of medication withdrawal in older fallers: results from the improving medication prescribing to reduce risk of FALLs (IMPROveFALL) trial.	Netherlands.

Table 12 Summary of Country of Origin

Summary	
Country	**Number of Studies**
Several	7
England	4
Netherlands	4
Australia	3
USA	3
Canada	3
New Zealand	2
Finland	1

Appendix D: Taxonomy table

Table 13: Taxonomy Table: Domains 1 to 3

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
Church	2012	The cost-effectiveness of falls prevention interventions for older community-dwelling Australians.	Evaluate the cost-effectiveness of strategies designed to prevent falls among older people.	Model of interventions designed to prevent falls. Populations were from included studies. Primary and secondary prevention (P & S).	Recruitment varied across studies. Interventions delivered in community based sites.	A range of assessments.	A range of interventions so multiple providers.	A range of assessments and components.
Beard	2016	Economic analysis of a community-based falls prevention programme.	Undertake a cost–benefit analysis of a community-based falls prevention programme.	People aged over 60 years in moderate to good health and living independently. P & S.	Recruitment not described. Interventions delivered in community.	There were 5 strands: raise awareness of problem of falls; community education; develop falls-prevention polices; home hazard reduction & work with professionals. Each had several activities, delivered in many locations, by health and local government staff. Outputs included guides on eg drug review, checklists for home assessments & information for GPs, nurses,	There were 5 strands: raise awareness of problem of falls; community education; develop falls-prevention polices; home hazard reduction & work with professionals. Each had several activities, delivered in many locations, by health and local government	There were 5 strands: raise awareness of problem of falls; community education; develop falls-prevention polices; home hazard reduction & work with professionals. Each had several activities, delivered in many locations, by health and local government staff. Outputs included guides on eg drug review, checklists for home

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
						AHPs and people at risk of falling.	staff. Outputs included drug review, checklists for home assessments & information for GPs, nurses, AHPs and people at risk of falling.	assessments & information for GPs, nurses, AHPs and people at risk of falling.
Campbell	2005	Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial.	Undertake economic evaluation on effectiveness of 2 home based strategies to prevent falls.	People aged over 75 years and with eye disorders. P & S.	Recruitment at outpatients and private clinic and delivered in B230 person's home.	Trained professionals and delivered in patients' homes.	Physiotherapists and occupational therapists.	Single and multiple intervention.
Carande-Kulis	2015	A cost-benefit analysis of 3 older adult fall prevention interventions.	Undertake a cost–benefit analysis to identify fall interventions that were feasible, effective, and have good RoI.	Model of interventions designed to prevent falls. Populations were from included studies. P & S.	Recruitment not described and interventions delivered in community based sites.	A range of assessments.	A range of interventions so multiple providers.	A range of assessments and components.
Albert	2016	Cost-effectiveness of a statewide falls prevention programme in Pennsylvania: Healthy Steps for Older Adults.	Evaluate the cost effectiveness of 'Healthy Steps for Older Adults'.	All people aged over 50 years and living independently. P & S.	Recruitment not described and interventions delivered in community based sites.	Trained professionals did assessment in the community centres.	Trained professionals delivered interventions in community centres.	Balance and mobility assessments. Unclear if multiple interventions or multifactorial.
Church	2011	An economic evaluation of community and residential aged care falls	Evaluate the cost-effectiveness of different falls prevention strategies.	Model of interventions designed to prevent falls. Populations were from included	Recruitment varied across studies. Interventions delivered in community.	A range of assessments	A range of interventions so multiple providers.	A range of assessments and components.

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
		prevention strategies in NSW		studies. Model was for people aged 75 years or over. P & S.				
Farag	2015	Economic modelling of a public health programme for fall prevention	Model a falls prevention programme.	Model of interventions designed to prevent falls. Populations were from included studies. P & S.	Model was people aged 65 years, no history of falls and living in community.	A range of assessments.	A range of interventions so multiple providers.	A range of assessments and components.
Farag	2016	Economic evaluation of a falls prevention exercise programme among people with Parkinson's disease.	Evaluate the cost-effectiveness of an exercise programme for people with PD.	People aged over 40 (mean was> 70), with PD and 1 or more falls in last 12 months or at risk of falling. P & S.	Recruitment not specified. Interventions delivered at community based sites and where not possible in home.	Trained professionals; location not described.	Physiotherapists	Standardized combination.
Fletcher	2012	An exercise intervention based on the FaME exercise programme to prevent falls in patients with Parkinson's: an economic evaluation.	Evaluate the cost-effectiveness of an exercise programme based on FaME for people with PD.	Mean age was> 71, all with PD and 2 or more falls in last 12 months. Secondary (S) only.	Recruitment at specialist clinics, primary care, and PD support groups. Delivered in the main in the community.	No assessment.	Physiotherapists	Standardized combination.
Frick	2010	Evaluating the cost-effectiveness of fall prevention programmes that reduce fall-related hip fractures in older adults.	Model the incremental cost-effectiveness of 7 interventions for preventing falls.	Model of interventions designed to prevent falls. Populations were from included studies. P & S.	Recruitment varied across studies Interventions delivered in community based sites.	A range of assessments.	A range of interventions so multiple providers	A range of assessments and components.
Hektoen	2009	Cost-effectiveness in fall prevention for	Model the cost-effectiveness of an exercise programme.	Based on 1 RCT of Otago so women >80 years living at	No details reported but based on Otago studies.	No details reported but based on Otago studies.	No details reported but based on	No details reported but based on Otago

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
		older women.		home. P & S.			Otago studies.	studies.
Hendriks	2008	Cost-effectiveness of a multidisciplinary fall prevention programme in community-dwelling elderly people: a randomized controlled trial.	Model the cost-effectiveness of a multidisciplinary falls prevention programme.	Age over 65 years and attending setting because of a fall. S only.	Recruited at A&E and out of hours service at a hospital. Intervention delivered in hospital setting and at home.	The medical assessment was performed by geriatrician, geriatric nurse and rehabilitation physician in hospital.	Occupational therapist.	Standardized combination.
Iliffe	2014	Multicentre cluster randomised trial comparing a community group exercise programme and home-based exercise with usual care for people aged 65 years and over in primary care.	Evaluate the economic impact of 2 falls prevention programmes to encourage physical activity in older people.	Age over 65 years, patients were excluded if they had 3 or more falls in the previous year. P & S.	Recruited via GPs and delivered in community sites.	No assessments.	Group exercise was delivered by Postural Stability Instructors and Otago was supported by trained peer mentors.	Single intervention.
Irvine	2010	Cost-effectiveness of a day hospital falls prevention programme for screened community-dwelling older people at high risk of falls.	Evaluate the cost-effectiveness of day hospital referral, exercise and home hazard assessment.	Aged over 70 years and living in the community. P & S.	Recruited via GPs and delivered in day hospital.	Medical assessment.	Relevant professional staff.	A range of assessments and components.
Jenkyn	2012	How much are we willing to pay to prevent a fall?	Evaluate the cost-effectiveness of a multifactorial falls	Participants were from a random sample, of WWII and	Random sample from Veterans Affairs Canada listing.	Geriatrician, geriatric nurse, or physiotherapist	Intervention was referrals to other health	Single intervention.

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
		Cost-effectiveness of a multifactorial falls prevention programme for community-dwelling older adults.	prevention programme.	Korean War veterans and their caregivers who had completed a questionnaire on modifiable risk factors and had 1 to 5 modifiable risk factors. P & S.	Conducted in day hospitals and home.	trained in falls.	professionals.	
Li	2015	Economic Evaluation of a Tai Ji Quan Intervention to Reduce Falls in People With Parkinson Disease, Oregon, 2008-2011.	Evaluate the cost-effectiveness of Tai Ji Quan to reduce falls among patients with mild-to-moderate PD.	Clinical diagnosis of PD and aged from 40 to 85 years: mean age not stated. P & S.	Recruitment vis newspaper adverts, support groups, medical clinics and medical referrals. Conducted in community settings.	Nil.	Certified exercise/ fitness instructors.	Single intervention.
Li	2016	Implementing an Evidence-Based Fall Prevention Intervention in Community Senior Centres.	Aim to evaluate the cost-effectiveness of Tai Ji Quan to reduce falls among older people in the community.	Aged over 65 years or over, physically mobile, no severe cognitive disorder and provided medical clearance. P & S.	Recruitment directly from members of 36 community senior centres and delivered in 32 centres.	Nil.	Certified exercise/ fitness instructors.	Single intervention.
Markle-Reid	2010	The effects and costs of a multifactorial and interdisciplinary team approach to falls prevention for older home care clients 'at risk' for falling: a randomized controlled trial.	Evaluate the cost-effectiveness of a multifactorial and interdisciplinary team intervention to reduce falls.	Aged 75 years and older, at risk of falling, eligible for home support services and living in community. P & S.	Recruitment from referrals for home support. Delivery in the home.	Care manager, nurse, OT, physiotherapist and dietitian.	Care manager, nurse, OT, physiotherapist and dietitian.	Multifactorial (individual combination).
McLean	2015	Economic evaluation of a	Undertake cost utility analysis of a group	Aged over 70 years and live in	Recruitment by electoral roll and	Nil.	Not stated.	Single intervention.

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
		group-based exercise programme for falls prevention among the older community-dwelling population.	based exercise programme.	community. P & S.	delivery in community.			
Patil	2016	Cost-effectiveness of vitamin D supplementation and exercise in preventing injurious falls among older home-dwelling women: findings from an RCT.	Undertake cost-effectiveness analysis of vitamin D supplements and exercise.	Women aged 70 to 80 years, living in the community, had at least 1 fall in last year, and took < less than 2 h of moderate to vigorous exercise per week. S only.	Recruitment not disclosed. Delivery in community.	Nil.	Not stated.	Multiple (standardized combination).
Peeters	2011	Multifactorial evaluation and treatment of persons with a high risk of recurrent falling was not cost-effective	Undertake cost-effectiveness analysis of a multifactorial intervention.	People over 65 years, living independently in community or assisted living facility, living in vicinity of hospital and having experienced a fall. S only.	Had attended emergency department or GP following a fall and judged at high risk of fall using validated tool (LASA). Delivered initially in geriatric outpatient clinic, then community / home / clinic depending on intervention.	Assessment delivered by clinic staff in outpatients.	Ranged but always trained healthcare professional.	Multifactorial (individual combination) C302
Pega	2016	Home safety assessment and modification to reduce injurious falls in community-dwelling older adults: CUA and	A199: Aim to undertake cost-utility analysis of home safety assessment and modification intervention.	Not disclosed as no single study, rather adopted effectiveness measure from Cochrane Systematic Review. P & S.				Single intervention.

Bibliographic information			Domain 1 Approach		Domain 2 Base			Domain 3 Components
Author	**Year**	**Title**	**Primary Aims**	**Primary selection criteria**	**Recruitment and main site of delivery**	**Assessments undertaken by**	**Interventions delivered by**	**Components**
		equity analysis.						
Polinder	2016	Cost-utility of medication withdrawal in older fallers: results from the improving medication prescribing to reduce risk of FALLs (IMPROveFALL) trial.	Undertake cost-utility analysis of improving medication prescribing to reduce falls.	Patients age 65 years or older, visited the A&E due to a fall & community dwelling. Also must have been taking one or more fall-risk increasing drugs. S only.	Following the ED visit, patients were contacted by telephone and if interested attended outpatient clinic and received a fall-related assessment.	Research physician.	Research physician, senior geriatrician, and if necessary prescribing physician plus a research nurse.	Single intervention.
Sach	2012	Community falls prevention for people who call an emergency ambulance after a fall: an economic evaluation alongside a randomised controlled trial	Undertake cost-effectiveness analysis of referring fallers to a falls clinic.	Aged over 60, lived at home or in a care home (only 5%) and had contacted the East Midlands Ambulance Service due to a fall but had not been taken to hospital. S only.	Recruitment used ambulance service records, with a researcher visiting those indicating interest at home. Delivery primarily in participants' homes, with some group sessions in community centres.	4 community fall teams, of occupational therapists, physiotherapists, and nurses.	4 community fall teams, of occupational therapists, physiotherapists, and nurses.	
Van der Velde	2008	Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients.	A199: Aim to undertake cost-effectiveness analysis of withdrawing falls-increasing drugs	All referrals to a geriatric outpatient clinic and diagnostic day centre aged ≥ 65 years.	Recruitment was from outpatient clinic and day centre.	Research physician who consulted prescribing physician where change was suggested.	Nil.	Medication review.
Wu	2010	A cost-effectiveness analysis of a proposed national falls prevention programme.	A199: Aim to undertake cost-effectiveness analysis of a national falls prevention programme.	None as paper models a Falls Rehabilitation Program (FRP) which includes data from systematic reviews and meta-analyses on many interventions. FRP is a multifactorial fall prevention intervention. P & S.		Physician led assessment to identify falls risk.	Trained professionals.	Multifactorial (individual combination).

Table 14: Taxonomy Table (continued) Domain 4

Bibliographic information			Domain 4: Descriptors		
Author	**Year**	**Title**	**Intervention**	**Post intervention follow-up**	**Control**
Church	2012	The cost-effectiveness of falls prevention interventions for older community-dwelling Australians.	Range on interventions including exercise, Tai Chi, medicines review, surgery, cardiac pacing, home assessments in active and control arm. Current care was main control in the contributing studies.		
Beard	2016	Economic analysis of a community-based falls prevention programme.	There were 5 strands: raise awareness of problem of falls; community education; develop falls-prevention polices; home hazard reduction & work with professionals. Each had several activities, delivered in many locations, by health and local government staff. Outputs included guides on eg drug review, checklists for home assessments & information for GPs, nurses, AHPs and people at risk of falling.	There were 5 strands: raise awareness of problem of falls; community education; develop falls-prevention polices; home hazard reduction & work with professionals. Each had several activities, delivered in many locations, by health and local government staff. Outputs included guides on eg drug review, checklists for home assessments & information for GPs, nurses, AHPs and people at risk of falling.	There were 5 strands: raise awareness of problem of falls; community education; develop falls-prevention polices; home hazard reduction & work with professionals. Each had several activities, delivered in many locations, by health and local government staff. Outputs included guides on eg drug review, checklists for home assessments & information for GPs, nurses, AHPs and people at risk of falling.
Campbell	2005	Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial.	Home assessments; Gait, strength and balance. Individual exercises during 5 home visits (week 1, 2, 4, 8 and 26) [Otago]. Also Vitamin D.	Written, telephone and personal follow up.	Usual care plus 2 social visits.
Carande-Kulis	2015	A cost-benefit analysis of 3 older adult fall prevention interventions.	Gait, strength and balance. Individual exercises during 5 home visits (week 1 x1 hr; 3*30 mins 2, 4, 8 and 26) [Otago]. D103 Tai Chi. General exercise at 7 *3 hour group sessions + home visits. Also had education [Stepping on].	Personal follow up for Stepping on intervention.	No control as the 3 interventions were compared.
Albert	2016	Cost-effectiveness of a statewide falls prevention programme in	Referrals to physicians, home assessment, demonstrate exercises and education.	Monthly telephone follow-up.	Usual care.

Bibliographic information			Domain 4: Descriptors		
Author	**Year**	**Title**	**Intervention**	**Post intervention follow-up**	**Control**
		Pennsylvania: Healthy Steps for Older Adults.			
Church	2011	An economic evaluation of community and residential aged care falls prevention strategies in NSW.	Range on interventions including: Group-based exercise, Home-based exercise, Tai Chi, Vitamin D supplements, Education, Home hazard assessment and modification, Psychotropic medication withdrawal, Clinical medication, Expedited cataract surgery, Vision and eye exam, Cardiac pacing, Multiple interventions, Exercise and home hazard, Exercise and falls advice, Exercise and supplementation, Multifactorial interventions, Assessment and referral, Assessment and active intervention. Current care was main control.		
Farag	2015	Economic modelling of a public health programme for fall prevention	No single intervention described; rather effectiveness measure from Cochrane review.	Nil	Usual care.
Farag	2016	Economic evaluation of a falls prevention exercise programme among people with Parkinson's disease.	Monthly exercise class and 2 to 4 home visits from physiotherapist over 6 months and booklet.	Nil	Usual care and booklet.
Fletcher	2012	An exercise intervention based on FaME to prevent falls in Parkinson's: an economic evaluation.	10-week group exercise based on FaME exercise interventions, supplemented with home exercises.	Nil	Usual care.
Frick	2010	Evaluating the cost-effectiveness of fall prevention programs that reduce fall-related hip fractures in older adults.	A range on interventions including: Multifactorial, all older people; Multifactorial, high-risk older people; Muscle balance training; Home modifications; Psychotropic withdrawal; Tai Chi. Current care was main control.		
Hektoen	2009	Cost-effectiveness in fall prevention for older women.	No details reported but based on Otago studies.	No details reported but based on Otago studies.	Usual care.
Hendriks	2008	Cost-effectiveness of a multidisciplinary fall prevention programme in community-dwelling older people: a randomized controlled trial.	The medical assessment comprised a comprehensive general examination, and detailed assessment of vision, hearing, balance, mobility, peripheral nervous system, feet, footwear, cognition and medication use. Suggested referrals to relevant services made to participant's GP. After the medical assessment, an occupational therapist visited the participants at home for an assessment of daily functioning, environmental hazards, and psychological consequences of the fall. Recommendations made on behavioural change, functional needs, and safety with copy to GPs.		Usual care.
Iliffe	2014	Multicentre cluster randomised trial comparing a community group exercise programme and home-based exercise with usual care for people	2 interventions: Otago home -based exercise programme & a community-based group exercise programme [Falls Management Exercise (FaME).	Both groups followed up for 12 months[4] post intervention but no activity during this	Usual care.

[4] In clinical study follow-up was 24 months (see Gawler et al[1])

Bibliographic information			Domain 4: Descriptors		
Author	**Year**	**Title**	**Intervention**	**Post intervention follow-up**	**Control**
		aged 65 years and over in primary care.		period.	
Irvine	2010	Cost-effectiveness of a day hospital falls prevention programme for screened community-dwelling older people at high risk of falls.	Strength and balance training, home hazards assessment and onward referrals to specialists.	Nil	Usual care and booklet.
Jenkyn	2012	How much are we willing to pay to prevent a fall? Cost-effectiveness of a multifactorial falls prevention programme for community-dwelling older adults.	Intervention was referrals to other health professionals.	Nil	GPs in control group were advised of patient's modifiable risk factors and managed by usual care.
Li	2015	Economic Evaluation of a Tai Ji Quan Intervention to Reduce Falls in People With Parkinson Disease, Oregon, 2008-2011.	6-month of 60-minute classes of Tai Ji Quan and Resistance training 2 times weekly with a 3-month follow-up.	Nil	6-month of 60-minute classes of stretching 2 times weekly with a 3-month follow-up.
Li	2016	Implementing an Evidence-Based Fall Prevention Intervention in Community Senior Centres.	2 years of 60-minute classes of Tai Ji Quan 2 times weekly.	Nil	No direct control: rather used falls rate at start of programme as baseline.
Markle-Reid	2010	The effects and costs of a multifactorial and interdisciplinary team approach to falls prevention for older home care clients 'at risk' for falling: a randomized controlled trial.	Usual care + home visit from team monthly for 6 months plus may refer to a geriatrician and community pharmacist. Team conducted a falls risk factors assessment using validated screening instruments; regularly assessed manageable risk factors; provided support and education.		Usual care ie arrange and coordinate of nursing and AHP input, provide information and referral to community agencies; and monitor and evaluate care plan.
McLean	2015	Economic evaluation of a group-based exercise programme for falls prevention among the older community-dwelling population.	No Falls trial being a weekly 1-hour group-based exercise class for 15 weeks, plus daily home exercises. Class used graded exercises to improve flexibility, leg strength and balance.	Nil	Usual care.
Patil	2016	Cost-effectiveness of vitamin D supplementation and exercise in preventing injurious falls among older home-dwelling women: findings from an RCT.	Exercise and vitamin D in combination and individually.	Nil	Usual care.
Peeters	2011	Multifactorial evaluation and treatment of persons with a high risk of recurrent falling was not cost-effective.	Geriatric clinic for multifactorial falls risk assessment, then individual treatment regimen eg withdrawal psychotropic drugs, balance and strength, home hazard, onward referral to ophthalmologist or cardiologist.	At 12 months, people had 2nd .visits to reassess activities of daily living, quality of life and physical	Usual care.

Bibliographic information			Domain 4: Descriptors		
Author	**Year**	**Title**	**Intervention**	**Post intervention follow-up**	**Control**
				performance. Questionnaires issued at 3, 6, and 12 months.	
Pega	2016	Home safety assessment and modification to reduce injurious falls in community-dwelling older adults: cost-utility and equity analysis.	Home safety assessment and modification.	Not disclosed.	Not disclosed.
Polinder	2016	Cost-utility of medication withdrawal in older fallers: results from the improving medication prescribing to reduce risk of FALLs (IMPROveFALL) trial.	Systematic assessment of Fall-Risk-Increasing-Drugs aim to withdraw/modify where possible safely plus counselling,	Follow-up every 3 months falls and other events followed up.	Usual care.
Sach	2012	Community falls prevention for people who call an emergency ambulance after a fall: an economic evaluation alongside a randomised controlled trial	The interventions at home included strength and balance for 6+ sessions, home hazards assessment & modifications including provision of equipment and minor adaptations and advice on getting up, drugs and blood pressure review plus referral to other agencies. Also 12 group sessions, each 2 hours, on fall prevention eg strength and balance training led by a physiotherapist, education and functional activities led by an occupational therapist, nutrition, pacing, strategies for coping with activities of daily living, hazards, footwear.	Nil.	Usual care
Van der Velde	2008	Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients.	Medication review plus 2 weekly call for 1 month to check safety and compliance.	Nil	Usual care.
Wu	2010	A cost-effectiveness analysis of a proposed national falls prevention programme.	Individualized management may comprise medication adjustment, behavioural recommendations, home modifications, rehabilitation therapy, and exercise programmes.	Not stated	Not stated.

Appendix E: Evidence tables

Table 15: Evidence Tables for Economic Evaluation Studies

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Albert S M, Raviotta, J, Lin C J et al (2016). Cost-Effectiveness of a Statewide Falls Prevention Program in Pennsylvania: Healthy Steps for Older Adults. Am J Manag Care; 22(10):638-644. **[16]**	Economic evaluation alongside a clinical study.	Potentially serious limitations Partially applicable.	USA Community	The intervention was the "Healthy Steps for Older Adults" (HSOA), which offers screening for falls risk and education regarding falls prevention.	Usual care (no intervention)	814 participants in the intervention group and 1,019 in the control group.	Older adults 50 years or older living in the community. The mean age and standard deviation (SD) of study participants was 75.5 (8.5) years.	Analysis was based on a decision tree model with a one-year time horizon. Clinical data and resource use were taken from a longitudinal study. Costs represent reimbursement rates and tariffs. Perspective of the study was not clearly stated. Deterministic and probabilistic sensitivity analyses (DSA) (PSA) were carried out.	Expected costs per participant were $3013 in the HSOA arm and $3853 in the comparison group. Mean QALYs were 0.833 in HSOA participants and 0.825 in the control group. Thus the HSOA programme dominated. Sensitivity analyses confirmed base case results.	Analyses used self-reported data and most costs were based on average values rather than on real data. Outpatient care and indirect medical costs were not included. Overhead costs associated with senior centres and administration costs were not included.	Funding from the Centers for Disease Control and Prevention and the University of Pittsburgh Health Promotion and Disease Prevention Research Center

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
[30] Beard J, Rowell D, Scott D (2006). Economic analysis of a community-based falls prevention program. Public Health 120, 742–751.	Cost-benefit analysis.	Minor limitations Directly applicable.	Australia Community.	'Stay on Your Feet' (SOYF), a community-based falls prevention programme targeting older people at all levels of risk.	Usual care.	About 90,000 people aged over 60 years living in the New South Wales in 1992 to 1996.	People aged over 60 years and living independently	Cost-benefit analysis compared RoI in SOYF. Costs of SOYF came from programme managers. Economic benefits were the monetary valuation of disability adjusted life years (DALY) lost from falls and the direct medical costs saved (derived from official estimates). 3 perspectives adopted (the Government, the Commonwealth Government and Australian community). The time horizon was 7 years. 8% annual discount rate. Uncertainty was investigated using alternative scenarios.	Cost of the SOYF to the NSW Government was AUS$781,829. Net present value was AUS$5,864,287 for the State Government, AUS$9,989,834 for the Commonwealth Government, & AUS$15,766,210 for the Australian Community. The benefit–cost ratio was, respectively, 8.5:1, 13.75:1, and 20.6:1. SOYF programme was highly cost-effective in preventing falls among older people.	The authors noted that some costs borne by the community have not been included in the analysis. 2 analytic model were used in the study and both have their strengths and weaknesses	Funding from the Australian National Health and Medical Research Council.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Campbell J, Robertson M C, La Grow S J et al (2005). Randomised controlled trial of prevention of falls in people aged ≥75 with severe visual impairment: the VIP trial. BMJ, doi:10.1136/bmj.38601.447731.55. **[20]**	Economic evaluation alongside a RCT.	Minor limitations Partially applicable	New Zealand Community	Home safety assessment and modification programme with a 6 month follow up, 1 year Otago exercise programme prescribed during home visits by a physiotherapist plus vitamin D supplementation	Standard care (no intervention)	391 participants: 100 in the home safety assessment and modification programme, 97 in the exercise programme, 98 in both interventions and 96 in standard care.	Older people aged ≥ 75 years with poor vision who were living in the community. Poor vision was defined as visual acuity of 6/24 or worse in the better eye after the best possible correction. Patients were recruited from the Royal New Zealand Foundation of the Blind register, the University of Auckland optometry clinic, Dunedin and Auckland hospital low vision outpatient clinics, and a private ophthalmology practice.	CEA. 2×2 factorial design. One year of follow-up. Societal perspective. No discounting. One-way sensitivity analyses.	Exercise programme was not effective in reducing falls. Incremental cost per fall prevented with the home safety programme was $NZ650 (£234). Estimates ranged from $NZ460 to $NZ1569 per fall prevented for the different cost scenarios	There was no expected interaction between the 2 interventions and authors could not explain why that home safety programme seemed less effective when the person was also receiving the exercise programme. Participants were not selected based on ability to participate in an exercise programme	The Health Research Council of New Zealand funded the study.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Carande-Kulis V, Stevens J.A., Florence C S. (2015). Journal of Safety Research 52, 65–70. **[24]**	Economic evaluation	Minor limitations. Partially applicable.	USA Community	3 fall prevention interventions: the Otago Exercise Programme (muscle strengthening and balance-retraining exercises), Tai Chi-Moving for Better Balance and Stepping On (group sessions led by an occupational therapist).	No intervention	N.A.	People aged over 65 years and living independently	Net benefit (benefit from averting fall-attributable medical costs minus intervention cost) and ROI. Third-party payer perspective adopted. Time horizon was 1 year. Costs of programme used national salaries. Effectiveness data were from published RCTs. Univariate sensitivity analyses carried out.	For Otago Exercise, net benefit was $121.85 per participant and ROI was 36%: for persons aged ≥80 net benefit was $429.18 and ROI 127%. Tai Chi: Moving for Better Balance had a net benefit of $529.86 and ROI of 509%. Stepping On had a net benefit of $134.37 and an ROI of 64%. The sensitivity analyses confirmed base case results.	Benefits may be underestimated, because analysis only included benefits from averting direct medical costs and did not include benefits from averting other costs such as productivity losses or other material costs caused by a fall.	No funding reported.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Church J, Goodall S., Norman R et al (2011). An economic evaluation of community and residential aged care. falls prevention strategies in NSW. NSW Public Health Bulletin. Vol. 22(3–4). **[22]**	Economic evaluation.	Partially applicable to UK Minor limitations.	Australia Community.	Interventions were: Group-based exercise – 2 group classes and 1 home exercise session. Home-based exercise. Tai Chi. Expedited cataract surgery. Cardiac pacing. Psychotropic medication withdrawal. Multiple – based on the Stepping On Programme. Multifactorial intervention (referral only) – risk assessment. Multifactorial – risk assessment plus exercise programme. Vitamin D supplementation. Clinical medication review.	Usual care.	Hypothetical cohort of older people.	People aged 65 years and over living in the community (mean age 75 years).	Analysis based on a decision analytic Markov model. Time horizon 10 years. Costs and benefits were discounted at 5%. Data came from different sources including a systematic review and meta-analysis of trials, published literature on falls prevention, expert opinion, the Australian Bureau of Statistics, the Australian Institute of Health and Welfare, and reports released by the NSW Government. Costs were from official sources and published literature. DSA were carried out.	Incremental cost per QALY was AUS$44,879 with Tai Chi, AUS$72,765 with Group exercise, AUS$4,186 with Multiple – Stepping On Programme, AUS$96205 with Home-based exercise, AUS$130 139 with Multifactorial – active, AUS$ 172 009 with Multifactorial – referral, AUS$ 2211 with Expedited cataract surgery, AUS$16,584 with psychotropic medication withdrawal, and AUS$80,257 with Cardiac pacing. Fear of falling was main driver of results,	The authors acknowledged that studies included in the meta-analysis did not take account of heterogeneity. Evidence for the effectiveness of some interventions was based on limited data from a small number of studies or studies with few participants. Some interventions were targeted at specific patient groups; therefore extrapolating the effectiveness results to a general population may yield different	No funding was explicitly reported.

									followed by efficacy and cost of interventions.	results.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Church J, Goodall S. Norman R. et al (2012). The cost-effectiveness of falls prevention interventions for older community-dwelling Australians. Australian And New Zealand Journal Of Public Health. 36:241-8. **[2]**	Cost-utility analysis and cost-effectiveness analysis.	Minor limitations Directly applicable	Australia Community	In general population: Tai Chi, home exercise, group-based exercise, multiple interventions, multifactorial interventions with only referral, and multifactorial interventions with an active component. In a high-risk population: group-based exercise, multifactorial intervention, and home hazard modification. In specific populations: expedited	No intervention	Not applicable	Hypothetical cohort of individuals aged 65 years or older: general population and high-risk population.	Decision analytic Markov model. CEA and CUA. Data from published literature, expert opinion, and official government data. Perspective of the health care system (third-party payer). Time horizon 100 years (lifetime). Discount rate was 5%. Univariate DSA and multivariate PSA were carried out.	In the general population, compared with no intervention incremental cost per QALY gained was AUS$44,205 with Tai Chi, AUS$70,834 with group-based exercise, AUS$72,306 with multiple interventions, AUS$93,432 with home exercise, AUS$125,868 with factorial interventions with only referral, and AUS$165,841 with multifactorial interventions with an active component. Tai	The authors acknowledged that the model relied on limed effectiveness data.	The project was part of the Costing for Health Economic Evaluation Programme funded by NSW Health and the Cancer Institute NSW.

				cataract surgery, psychotropic medication withdrawal and cardiac pacing.					Chi was only cost-effective intervention for general population. In high-risk population, ICERs were all far above threshold of AUS$30,000 per QALY. Specific population results showed Expedited cataract surgery was cost-effective; ICERs of Psychotropic medication withdrawal and Cardiac pacing were AUS$ 17,207 and AUS$ 56,111, respectively. Fear of falling was driver of result.		

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Farag I, Howard K, Ferreira M L et al (2015). Economic modelling of a public health programme for fall prevention. Age and Ageing; 44: 409–414. **[38]**	Economic evaluation	Minor limitations Partially applicable.	Australia Community	Public health falls prevention programme.	No intervention	Hypothetical patient population	Individuals aged 65 with no prior history of falls and living independently in the community.	Analysis was based on a decision analytic Markov model. Probabilities were from a report to NSW Health, Australian statistics and a RCT. Utilities from published sources. Most costs were from a published study. Perspective was health funder. Lifetime perspective used. Uncertainty was explored using DSA and PSA.	Incremental cost per QALY gained with the public health fall prevention programme was AUS$ 28,931. The programme was highly cost-effective under multiple scenarios.	Peculiarities of model structure made the study results not comparable to other studies on the cost-effectiveness of these interventions. Generalisability is limited by the use of Australian data for most inputs (except utilities were from UK source). Model assumes participants derive same level of benefit from the programme each year but there may be a threshold above which no further gains can be made. A lifetime horizon appears to have been adopted but no discounting was reported.	One researcher received salary support from the National Health Medical Research Council.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Farag, I, Sherrington C, Hayes A (2016). Economic Evaluation of a Falls Prevention Exercise Program Among People With Parkinson's Disease. Movement Disorders, Vol. 31, No. 1. [14]	Economic evaluation alongside a RCT.	Minor limitations Partially applicable.	Australia Community.	6-month minimally supervised exercise programme for people with PD (monthly exercise class and 2 to 4 home visits from a physical therapist over 6 months).	Usual care (no intervention).	Of the 231 participants recruited, 116 were randomized to the control group and 115 in the intervention group.	Eligibility criteria included a diagnosis of idiopathic PD; age 40 years or over; able to walk independently. Mean age was 71.4 +/- 8.1 years in intervention group and 69.9 +/- 9.3 years in control group.	CEA and CUA. QALYS were calculated using the Short Form-6D tool. Clinical data and resource use were from a published RCT. A health care system perspective. Costs were from national sources Ie Medicare Benefits Schedule. Scenario and sensitivity analyses were presented.	Incremental cost-effectiveness of the programme relative to usual care was AUS$574 per fall prevented, AUS$9,570 per extra person avoiding mobility deterioration, and AUS$338,800 per QALY gained. The intervention had an 80% probability of being cost-effective, relative to the control, at a threshold of AUS$2,000 per fall prevented.	Authors noted limitations related to the use of QALYs in the PD population and use of the SF-6D tool. More participants from intervention group than control elected not to participate in the post-programme physical assessment, and this may have biased the results. Caution is required when extrapolating study results due to strict inclusion criteria.	This study was funded by an Australian National Health and Medical Research Council and the Harry Secomb Foundation.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Fletcher E, Goodwin V A, Richards S H et al (2012). An exercise intervention to prevent falls in Parkinson's: an economic evaluation. BMC Health Services Research, 12:426. **[23]**	Economic evaluation alongside a RCT.	Minor limitations Directly applicable.	Community UK	A targeted exercise programme in patient with PD: ten-week group exercise based on the FaME exercise programme with supplementary home exercises.	Usual care	130 participants	Participants with a diagnosis of PD and self-reported history of 2 or more falls in the preceding 12 months.	Clinical data were from a published RCT (GETuP). Time horizon was 20 weeks. Perspective of NHS and Personal Social Services adopted. Resource use was from RCT, while unit costs were based on UK tariffs. PSA used to measure uncertainty.	Results favoured exercise intervention but no statistically significant difference between groups in costs or QALYs at 20 weeks. Exploration of uncertainty suggested there is more than 80% probability that the exercise intervention is a cost-effective strategy relative to usual care.	Authors noted difficulties in collecting some data on community-based primary care services. Analysis excluded patients when not possible to collect full data on health and social care. Excluded patients had higher healthcare costs at entry to trial so may have had more severe disease. Short time horizon limits assessment of all relevant costs and benefits.	The authors declared that they had no competing interests.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Frick K F, Kung J Y, Parrish J M et al (2010). Evaluating the Cost-Effectiveness of Fall Prevention Programs that Reduce Fall-Related Hip Fractures in Older Adults. J Am Geriatr Soc 58:136–141 **[25]**	Economic evaluative.	Minor limitations Partially applicable.	Community USA	7 interventions: medical management (withdrawal) of psychotropics), group Tai Chi, vitamin D supplementation, muscle and balance exercises, home modifications, multifactorial individualised programmes for all older people, and multifactorial individualized treatments.	No intervention.	Hypothetical patient population.	Adults aged 65 and older.	CUA using an epidemiological model. Data were from different sources including a systematic review and meta-analysis of trials, published literature on falls, and US tariffs. An integrated healthcare system perspective was adopted. Time horizon was lifetime. A 3% annual discount rate was applied. PSA analysis was performed.	Medical management and group Tai Chi were the least-costly, most-effective options, but they were also the least studied and were thus excluded. The least-expensive, most-effective options were vitamin D supplementation and home modifications. Vitamin D supplementation cost less than home modifications, but home modifications cost only $14,794 per QALY gained more than vitamin D. PSA showed that home modification was most likely to have the highest economic benefit when QALYs are valued at $50,000 or $100,000.	Authors stated primary limitation was it was based on secondary and not primary research. Also study was not able to compare cohort effects according to risk status. Analyses focused on single interventions separately, not in combination or when overlapping is implemented by decision-makers.	Authors had no financial or any other kind of personal conflicts.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Hektoen L F, Aas E, Luras H (2009). Cost-effectiveness in fall prevention for older women. Scandinavian Journal of Public Health, 37: 584–589. **[19]**	Economic evaluation.	Potentially serious limitation Partially applicable.	Norway Community.	Home-based exercise programme.	No intervention.		Home-dwelling women in the =/>80-year age group.	CEA with a short-term time horizon. A societal perspective was adopted. Efficacy data were from a published New Zealand RCT. Costs were from Norwegian tariffs and authors' assumptions about resource use. The study did not address uncertainty.	Compared to no intervention, the programme saved NOK 2,962 and reduced the mean number of falls by 0.52. Thus, the home-based exercise programme was dominant.	Authors noted the analysis was based on critical assumptions. Key data on efficacy came from a New Zealand study, and results may not apply in Norway. Efficacy might be overestimated because the impact of other interventions not considered. Time horizon was too short. Psychosocial costs were not included although potentially relevant. No sensitivity analyses conducted.	Authors had no conflicts of interest regarding financial or personal connections to the study.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Hendriks M R C, Evers S M A A, Bleijlevens M H C et al (2008). Cost-effectiveness of a multidisciplinary fall prevention program in community-dwelling elderly people: A randomized controlled trial (ISRCTN 64716113). International Journal of Technology Assessment in Health Care, 24:2, 193–202. **[29]**	Economic evaluation alongside a RCT.	Minor limitations Partially applicable	The Netherlands Community	The interdisciplinary intervention programme consisted of a medical and occupational-therapy assessment that aimed to assess and address potential risk factors for falls.	Usual care	166 participants were allocated to the experimental group and 167 to the control group.	Community-dwelling people 65 years of age or older who experienced a fall.	CEA and CUA. Clinical data were from RCT. Societal perspective. Costs included programme costs, other healthcare costs, and patient and family costs. Resources valued using official tariffs. Time horizon 1 year. PSA performed.	The analysis showed no effect of the intervention on falls, daily functioning, or quality of life measures, thus the interdisciplinary intervention was not cost-effective compared to usual care.	The authors noted 3 limitations: the short time horizon, baseline differences in healthcare utilization were not corrected, the analyses were not restricted to costs related to falls only.	The study was funded by The Netherlands Organization for Health Research and Development, Committee Health Care Efficiency Research Programme.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Iliffe S, Kendrick D, Morris R et al. (2014). Multicentre cluster randomised trial comparing a community group exercise programme and home-based exercise with usual care for people aged 65 years and over in primary care. Health Technol Assess;18(49). **[39]**	Economic evaluation alongside a RCT.	Minor limitations Directly applicable.	Community England.	Community group exercise programme and home-based exercise: class-based exercise [Falls Management Exercise (FaME) programme] and home-based exercise [Otago Exercise Programme (OEP)].	Usual care	A total of 1,256 people: 387 were allocated to the FaME arm, 411 to the OEP arm and 458 to usual care.	People aged ≥65 years living in the community.	Clinical data, resource use and costs were from the RCT. Participant and NHS costs were included. Time horizon for economic evaluation 1 year. Limited sensitivity analyses.	FaME increased self reported moderate physical activity. No change in the OEP or usual-care, or between groups in terms of QALYs. FaME was more expensive than OEP and usual care by £1,740 per extra person exercising. The incidence rate ratio for falls were 0.74 (significant reduction) and 0.76 for FaME and Otago (non	Authors noted that per-participant costs for FaME were affected by class size. Costs excluded participants' costs. Study recruited GP patients some of whom were already achieving 150 minutes of exercise at baseline.	Funding for this study was provided by the Health Technology Assessment programme of the National Institute for Health Research.

									significant reduction) vs. usual care.		

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Irvine L, Conroy S P, Sach T et al (2010). Cost-effectiveness of a day hospital falls prevention programme for screened community-dwelling older people at high risk of falls. Age and Ageing; 39: 710–716. **[32]**	Economic evaluation alongside a RCT.	Minor limitations Partially applicable.	Community UK.	A day hospital multidisciplinary falls prevention programme, including physiotherapy, occupational therapy, nurse, medical review and referral to other specialists plus an information leaflet.	Usual care plus information leaflet	One hundred and eighty-one were randomised into the control arm and 183 into the intervention arm.	People aged ≥70, living in the community and identified as high risk of falling.	CEA used. Clinical data and resource use were from the RCT. Time horizon was 1 year. Perspective was NHS and personal social services (PSS) and NHS Reference costs were used. PSA adopted to measure uncertainty	Intervention increased cost by £578 per patient. Mean falls rate was lower in intervention (2.07 per person / year), than control (2.24). ICER was £3,320 per fall averted. Compared with usual care, probability intervention was cost-effective was less than 40%, at a willingness	Authors noted key limitations. Baseline costs were not measured, thus it is unclear if there were previous differences between groups. Participant costs were not considered. Using the number of falls prevented as benefit measure limited comparability of results with other	Funding for the trial was obtained from Nottinghamshire, Derbyshire and Lincolnshire research alliance, Research into Ageing, the British Geriatrics Society and Nottingham University Hospitals NHS trust.

									to pay of £5,000 per fall averted.	health care interventions	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Jenkyn K B, Hock J S, Speechley M (2012). How Much Are We Willing to Pay to Prevent A Fall? Cost-Effectiveness of a Multifactorial Falls Prevention Program for Community-Dwelling Older Adults. Canadian Journal on Aging, 31 (2): 121– 137. **[26]**	Economic evaluation alongside a clinical trial.	Partially applicable	Community Canada.	A falls prevention programme consisting of an individually customized multifactorial intervention, including a comprehensive geriatric assessment coupled with referral to existing health services.	Usual care (community-based primary care).	348 participants (veterans and caregivers) randomized to receive either the fall prevention intervention (n = 188) or usual care (n = 160).	Community-dwelling older adults.	Analysis of clinical data and resource use from a pragmatic RCT. CEA used and net benefit regression framework (NBRF), which determines a value for the maximum acceptable WTP per unit of health gain. Time horizon was 1 year. Societal perspective. Costs were from Ontario tariffs and	Mean number of falls in the intervention group was 1.29 compared to 1.37 in usual-care. Intervention had extra cost of CAN$9,780 vs usual-care. ICER was CAN$122,110 per fall and not cost-effective also with the NBRF approach and in the regression analyses.	There was a low level of adherence to the programme. The control group received a minimum intervention in the primary care setting, which might have reduced the effect of the prevention programme in the intervention group. There was some risk of under-reporting of data in the intervention group. The generalisability of the study was limited by small sample size. A number	The study was supported by funding received through a Transdisciplinary Understanding and Training on Research – Primary Health Care Program training fellowship, and from the Ontario Neurotrauma Foundation in support of Injury Prevention and the Health Canada and Veterans Affairs Canada.

								mean prices for professional help and travel expenses. Statistical and regression analyses conducted.		of costs were not possible to include in the study. Resource use was collected at the end of the study but a shorter recall time would have been more accurate.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Li, F, Harmer P. Economic Evaluation of a Tai Ji Quan Intervention to Reduce Falls in People With Parkinson Disease, Oregon, 2008-2011 Prev Chronic Dis2015;12() :E120. **[15]**	Economic evaluation based on RCT.	Directly applicable Minor limitation.	US Community	Tai Ji Quan. This began practicing a set of 6 adapted Tai Ji Quan movements that were progressively integrated into a complete 8-form routine	Resistance training; stretching. Resistance training consisted of progressive Strength-training protocol that involved body weight and additional external weights. Stretching was based on an exercise regimen that encompassed various	There was a total of 195 participants, 65 per group.	Patients had clinical diagnosis of PD and aged 40 to 85 years; 2) at least 1 or 2 motor symptoms of tremor, rigidity, postural stability, or bradykinesia for at least 1 limb; 3) stable medication; 4) the ability to stand unaided and walk; 5)	CEA and CUA Clinical outcomes and resource use from RCT. US tariffs were applied Quality of life was assessed by EQ-5D Time horizon was 9 months Societal Perspective. Subgroup and univariate sensitivity	Mean number of falls were 1.33 with Tai Ji Quan, 2.65 with Resistance training and 4.11 with Stretching. A 9-month, mean utility was 0.74 with Tai Ji Quan, 0.63 with Resistance training and 0.59 with Stretching. Mean cost	The authors stated that the main limitations of the study were the self-reporting of falls and the lack of long-term analysis. We agree these are the main issues plus a more sophisticate sensitivity analysis would have	The work was supported by grants from the National Institute of Neurological Disorders and Stroke and the National Institute on Aging.

					seated and standing stretches involving the upper body and lower extremities, using gentle joint extension and flexion and trunk rotation.		medical clearance; and 6) willingness to accept any of the 3 interventions.	analyses were conducted.	per patient was $1,238, $1,368 and $1,721, respectively. Tau Ji Quan was dominant option. Subgroup and sensitivity analyses confirmed robustness of base case results.	been useful.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Li, F, Harmer P, Fitzgerald K. Implementing an Evidence-Based Fall Prevention Intervention in Community Senior Centers Am J Public Health 2016;106(11): 2026-2031. [40]	Economic evaluation based on single-arm study.	Partially applicable Potentially serious limitation.	US Community senior centers.	Moving for Better Balance (TJQMBB) programme's adoption based on Tai Ji Quan. The programme included: (1) 60-minute sessions delivered twice-weekly over a 48-week period,	No TJQMBB.	A total of 511 patients enrolled, and 323 provided completed data 6 months post-intervention follow-up.	Community-dwelling older adults who were (1) aged 65 years or older, (2) physically mobile (3) without severe cognitive deficits defined by the Mini-Mental	CEA. Reduction in rate of falling was difference between falls 6 months before and after the intervention. Intervention costs from real-world data during programme implementation, costs of falling were not	Of 263 participants who reported at least 1 fall at baseline, 141 reported no falls during the 12-month intervention (54% reduction). At end of the intervention, there were 327 fewer falls than at baseline (n =	The authors highlighted that a key limitation of the analysis was the use of a single group for clinical effectiveness. More rigorous studies possibly based on RCTs should confirm these	The study was supported by a research grant from the National Institute on Aging, National Institutes of Health.

				(2) adherence to the teaching and training protocols specified in the teaching plan, and (3) a class participation rate of 75% or better.			State Examination (greater or equal 19).	considered Time horizon was 18 months. Perspective was not clearly reported. No sensitivity analysis was conducted	672), resulting in a 49% reduction in the number of falls. Cost for implementing the twice weekly, 48-week TJQMBB programme with 511 participants in 32 classes was $601 per participant Cost was $917 per fall prevented; for multiple fallers at baseline and during the 48-week intervention period, the cost was $676 per fall prevented.	results. Other important limitations of the analysis are the lack of an incremental analysis, the lack of sensitivity analysis and the fact the costs of falling were not estimated, thus the real cost per fall prevented of implementing the programme might be lower than that calculated. Study result cannot be transferred to the UK setting due to all these limitations.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Markle-Reid M; Browne G; Gafni A et al. The effects and costs of a multifactorial and interdisciplinary team approach to falls prevention for older home care clients 'at risk' for falling: a randomized controlled trial Can J Aging 2010;29(1):139-61. **[28]**	Economic evaluation alongside a multicentre RCT.	Partially applicable Potentially serious limitations	Canada Community	Standard care plus a multifactorial fall risk assessment including home visit by a dedicated team of professionals a minimum of 1 per month for 6 months. Activities included: (1) assess to identify known risk factors for falls using validated screening instruments; (2) regular assess and manage modifiable fall risk factors; (3) client support; (4) educate clients about falls prevention.	Standard home care services arranged by the Community Care Access Centres. (CCAC). These included (1) routine follow-up by the CCAC case manager to assess eligibility for in-home health services; (2) arrange nursing, occupational therapy, physiotherapy, social work, and other services. (3) Providing information and referral to community agencies; and (4) monitor care plan	49 patients in the intervention group and 43 in the control group.	Adults aged 75 years and older, newly referred to home support services and living in the community, at risk of fall as determined by a questionnaire and with a score 24 or higher on the Standardized Mini-Mental State Examination	CCA was based on RCT with a 6 month follow-up that recorded number of falls, other clinical outcomes and resource use. Costs came from Canadian tariffs. SF-36 and risk of falls questionnaires were administered at baseline and after 6 months. Societal perspective was adopted.	Intervention and usual home-care groups did not differ in mean falls at 6 months (1.45 vs. 1.33, p = 0.70) or change in falls from baseline to follow up (–0.31 vs. –0.35, p =0.04). Intervention group had greater gain in emotional health but not statistical significance. Mean 6-month costs for health services decreased by 78% (from $22,956 at baseline to	The authors acknowledged the low recruitment rate, the potential under reporting of falls, and short time horizon of the analysis. The main limitations of the study are low sample size with no power to detect differences in costs and the lack of incremental analysis.	Funding was received from various Canadian agencies. Future trials with an economic evaluation and higher power are needed to detect cost differences. Results reflect outcomes in 2 home care programmes, these may not generalise to other care homes. Generalizability also depends on extent to which intervention and standard care can be provided in different areas.

				An evidence based fall risk management protocol was used.	through in-home assessments with clients.				$4,973 at 6 months). However, there were no statistically significant differences between the 2 groups Subgroup analyses showed intervention effectively reduced falls in men (75–84 years old) with a fear of falling or negative fall history.		

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
McLean K, Day L, Dalton A Economic evaluation of a group-based exercise program for falls prevention among the older community-dwelling population BMC geriatr 2015;15():33. **[21]**	Economic evaluation based on a decision model.	Directly applicable Minor limitations	Australia Community	An exercise programme which consisted of a weekly one hour group-based exercise class for 15 weeks, supplemented by daily home exercises.	Routine care and activity, considered standard care	A total of 541 patients were randomised to the treatment group and 549 to standard care group.	Older community-dwelling population (mean age: 76.1 years)	CEA and CUA. A decision analytic model was used to estimate costs and QALYs. Clinical and economic data were collected in a RCT with a 18-month follow-up Unit costs were from standard Australian sources. Utility scores were taken from the literature using the EQ-5D. Perspective was the healthcare system. A PSA was conducted	The rate of falls per year in the exercise group was 0.309 compared to 0.390 in the routine activity group. QALYs were 1.4953 in the exercise group and 1.4943 in the control group. Cost per participant were £84.98 in the exercise group and £38.94 in the control group. Incremental cost per fall averted was £652 (£616 for women only) and ICER was £51,483 per QALY. In a sensitivity analysis with minimised programme implementation	Analysis excluded mortality, lifetime costs of falls such as nursing home placement or other longer term injury complications, and societal costs to families and friends providing support following falls. There were differences between the study population and the general community-dwelling older population which may limit the generalisability of the results. The use of pounds might help in transferring	No funding specific to this study was reported

									costs the ICER was £25,678 per QALY. For women only the ICER was £22,986 per QALY. Probability of being cost-effective at threshold of £20,000 to £30,000 per QALY was extremely low for the base case but higher for women only.	results to the UK setting, but caution is required given the differences in some cost and epidemiologic characteristics.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Patil R, Kolu P, Raitanen, J et al. Cost-effectiveness of vitamin D supplementation and exercise in preventing injurious falls among older home-dwelling women: findings from an RCT Osteoporos Int 2016;27(1):193-201. [18]	Economic evaluation alongside a multicentre RCT.	Partially applicable Minor limitation.	Finland Community.	Exercise (note: also exercise plus vitamin D and vitamin D were included in the study but not considered here). Exercise consisted of supervised group training classes 2 times a week for the first 12 months and once a week for the remaining 12 months. The training programme was progressive and	Placebo (no exercise).	There were 103 patients in the exercise group and 102 in the control group (409 in total considering also the other 2 groups).	Community-dwelling, independently living Finnish women aged 70 to 80 years who had fallen at least once in the previous year.	CEA with efficacy and resources use from an RCT with 2 years follow-up. Health care fall-related costs were from hospital medical records. Finnish tariffs were used for unit costs. Travel expenses and time costs related to use of health services were not known, and so excluded. Statistical analysis	Incidence rate ratio (95 % CI) for medically attended falls was lower in exercise groups than placebo: 0.46 (0.22 to 0.95). Costs per person year (including costs of the 2-year intervention) were lowest in placebo group €30.9 vs €73.4 in exercise group. ICER for exercise group vs placebo was €708 per injurious fall avoided. There was 86% chance exercise	The authors noted limitations including that study was not powered for costs but for falls. The results are specific to the study intervention in this population of healthy, vitamin D replete, community-dwelling women who had fallen at least once in the previous year and may not be applicable to men, or those in residential care. Transferability of healthcare costs to the English setting might	No funding was reported.

				consisted of strength, balance, agility, and mobility training.				and PSA performed. Societal perspective adopted.	cost effective at threshold of €3000 per injurious fall prevented. This was confirmed by univariate sensitivity analysis.	be difficult. However, resource use and unit costs were reported separately and in detail which might allow reproducibility of the study.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Peeters GM, Heymans MV, de Vries OJ et al. Multifactorial evaluation and treatment of persons with a high risk of recurrent falling was not cost-effective. Osteoporos Int 2011;22(7):2187-96. [27]	Economic evaluation alongside a multicentre RCT.	Directly applicable Minor limitations	The Netherlands Community.	A multifactorial fall risk assessment conducted by the geriatrician to Identify modifiable fall risk factors. The assessment consisted of a general medical history, a fall and mobility history, and physical examination. Additional diagnostic tests were performed if indicated. An individually	Usual care (which mainly consisted of treatment of the consequences of the fall).	A total of 106 patients in the intervention group and 111 in the usual care group.	Persons of 65 years and older who consulted their general practitioner or the A&E department after a fall accident. Only patients at high risk of falling (LASA risk score greater or equal 8) were	CEA and CUA. Efficacy and resource used from a RCT with a 12 month follow-up. EQ-5D was administered at baseline and after 12 months. DSA and PSA performed. Societal perspective was adopted.	During 1 year, 52% and 56% of intervention and usual care participants reported at least one fall, respectively (-4%). QALYs were almost identical between 2 groups (difference 0.004 in favour of usual	The authors acknowledged some limitations as that the study was not powered for QALYs and costs but for fallers; only 150 of 227 patients completed the cost questionnaire, and some assumptions needed on costs and missing values.	No funding was reported.

				tailored treatment regimen aimed at reduction of the fall risk. The multifactorial treatment consisted of, for example, withdrawal of psychotropic drugs, balance and strength exercises by a physical therapist, home hazard reduction by an occupational therapist or referral to an ophthalmologist or cardiologist.			included in the study.		group). Mean costs were € 7,740 in intervention group and €6,838 in usual care group (mean difference €902. Incremental cost to obtain 1% less fallers was €226. When QALYs were used intervention was slightly dominated, but sensitivity analyses showed most QALYs values were around the origin.	Analysis applies to a high-risk group and cannot be generalised to low-risk people.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Pega F, Kvizhinadze G; Blakely T et al. Home safety assessment and modification to reduce injurious falls in community-dwelling older adults: cost-utility and equity analysis Inj Prev 2016;22(6): 420-426. [33]	Economic evaluation based on a decision model.	Directly applicable Minor limitations	New Zealand (NZ) Community.	Home safety assessment and modification (HSAM).	No HSAM.	N.A.	Older population (65 years and above) who resided in private dwellings (subgroup analysis were conducted by age, risk-level and ethnicity).	CUA. A Markov model with annual cycles was used and a lifetime horizon. Reduction in rate of falling was based on a synthesis-based estimate from a Cochrane review. Intervention costs came from a NZ-RCT of HSAM in the general population. Healthcare costs came from official NZ sources. Utility values came from published sources. A health system perspective was used and a 3% discount rate. CIs were used and subgroup analyses reported.	HSAM programme costs a total were US$98 m. (CI US$65 to US$139 m) to implement nationally. Accrued net health system costs were US$74 m (95% CI: cost saving to US $132 m). Health gains were 34,000 QALYs. ICER was US$9,000 (95% CI: cost saving to US $20,000). Hence HSAM was cost-effective. HSAM was cost-effective for all age groups, level of risk and ethnicity.	Authors' limitations included a potential overestimation of falls rate due to administrative data available and possible underestimation of costs not related to an injurious fall. Study results may generalise to other countries.	This study was funded by the Health Research Council of New Zealand and the University of Otago via a Health Sciences Career Development Postdoctoral Fellowship to Pega.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Polinder S, Boye NDA,.Mattace-Raso, FUS (2016)Cost-utility of medication withdrawal in older fallers: results from the improving medication prescribing to reduce risk of FALLs (IMPROveFALL) trial BMC geriatr 2016;16(1):179 [41]	Economic evaluation alongside a multicentre RCT.	Directly applicable Minor limitations.	The Netherlands Community.	The intervention group consisted of a systematic Fall-risk-increasing drugs (FRIDs) assessment combined with FRIDs withdrawal or modification, if safely possible. Proposed changes in medication were discussed with a senior geriatrician, and if necessary with the prescribing physician.	No FRIDs (usual care).	A total of 319 fallers received FRIDs and 293 patients were included in the control group.	Patients aged 65 years or older, visited the ED due to a fall, use of one or more FRIDs. Mini-Mental State Examination (MMSE) score of at least 21 out of 30 points], ability to walk independently and community dwelling.	CEA and CUA. Efficacy, resource use and EQ-5D were from a RCT with a 12 month follow-up months. Societal perspective.	At 12 months, control group had greater decline in EQ-5D utility score than intervention group; QALY gain 0.05 (p =0.02).Mean cost of intervention was €120 per patient. Fall-related healthcare costs were similar. (€2204 intervention vs €2285 control). Reducing FRIDs reduced medication costs by €38 per person. Mean total costs were €2324 per patient in the FRID	Authors note recruitment problems and a relatively high drop-out during the study (32 patients). The main limitation was no ICER was calculated. The authors stated that this was due to no statistically significant difference in costs, but a calculation using mean values, plus a stochastic sensitivity analysis could have provided information on the ICER and its uncertainty.	The study was funded by a grant from The Netherlands Organization for Health Research and Development.

									group and €2285 in the control (p=NS).	Caution is required in generalising results to English setting.	

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Sach, TH, Logan PA, Coupland, CAC (2012) Community falls prevention for people who call an emergency ambulance after a fall: an economic evaluation alongside a randomised controlled trial Age Ageing 2012;41(5):635-41. [17]	Economic evaluation alongside a RCT.	Directly applicable Minor limitations	England Community	Community falls prevention service provided by 4 community fall prevention teams which included occupational therapists, physiotherapists and nurses. An individualised multi-factorial intervention programme was undertaken following the NICE clinical falls guidelines.	Usual care (England)	157 participants (82 intervention and 75 control) were included in the base case economic analysis using only complete cases.	People aged >60 years and living at home or in care homes in 4 Nottinghamshire primary care trusts who had contacted the East Midlands Ambulance Service through the emergency telephone system because of a fall, but who were not transported to hospital.	CEA and CUA. Clinical and economic data were collected alongside a RCT with a 12-month follow-up. Unit costs were from standard English sources. Utility scores were estimated using EQ-5D, which was administered at baseline, 6 and 12 months. An NHS and PSS	Mean number of falls per patient during 12-month follow-up was 2.61 (SD 4.13) for intervention and 7.95 (SD: 6.61) for control (difference −5.34; P < 0.01). Mean utility per patient at baseline, and 12 months were 0.438, & 0.344 for intervention & 0.481 & 0.263 for control.	The authors acknowledged some limitations including potential respondent bias since patients were not blind to allocation; the short time-horizon, and the uncertainty around QALY results. These appear the main potential limitations of the analysis which was otherwise well conducted	This study was funded by a post-doctoral training scholarship awarded to Dr Philippa Logan from the NHS National Institute of Health Research. Future research required to test the generalisability of the findings & to investigate whether similar levels of cost-effectiveness can be found across multiple study sites.

								perspective was used. Patient and carer costs were included in scenarios analysis. PSA reported.	QALY difference 0.010 in favour of intervention. Mean NHS and PSS cost per participant was £15,266 in intervention vs. £16,818 in control; difference of £-1,551. Intervention was dominant at a willingness to pay of £20,000 (£30,000) per QALY there is an 89.0% (92.3%) chance of this falls prevention service being cost-effective in this population.		

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Van der Velde N, Meerding WJ, Looman, CW et al Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients Drugs Aging 2008;25(6):521-9. [34]	Economic evaluation alongside a clinical study.	Directly applicable Minor limitation.	The Netherlands Community.	Withdrawal of fall-risk-increasing drugs. In particular, If a person had fallen at least once during the previous year, fall-risk-increasing drugs were stopped if considered redundant, or reduced in dose.	No withdrawal of fall-risk increasing drugs.	A total of 75 fallers received drug withdrawal and 65 patients did not withdraw any fall-risk-increasing drug.	Patients aged ≥65 years with history of falling, a Mini-Mental State Examination (MMSE) score of ≥21 points and able to walk 10 metres without a walking aid.	CEA based on an observational study with a 2-month follow-up that assessed reduced risk of falling with drug withdrawal. Several statistical analyses were conducted to deal with confounders and take account of uncertainty in results. Cost of the intervention were from the clinical study; cost of falls from a published Dutch study. Perspective was for a health service provider. PSA Performed.	Mean number of falls during follow-up was 0.8 (SD 2.4) for intervention & 3.1 (SD 11.5) for the control (p = 0.03). Intervention costs were €98 per patient, drug savings €12 and medical savings per prevented injury €1775. Mean total cost savings per patient €1,691 (95% CI 662, 2181). Withdrawal of fall-risk-increasing drugs was dominant. Caution is required in generalising results to English setting.	The authors noted limitations were the non-randomised approach used, the high number of patients that refused to participate in the study (60 of 201) and that cost of falls and injuries were taken from another study. Other limitations are the short time-horizon and no quality of life outcome measure. Also it is unclear why authors estimated savings per fall prevented, given the dominance of the intervention.	This study was funded by the Erasmus University Medical Center, Merck Sharp & Dohme and Will-Pharma.

Bibliographic reference	Study type	Study quality	Setting	Intervention	Comparator	Number of participants	Participant characteristics	Methods of analysis	Results	Limitations	Additional comments
Wu S, Keeler EB, Rubenstein, LZ et al. A cost-effectiveness analysis of a proposed national falls prevention program Clin Geriatr Med 2010;26(4):751-66. [42]	Economic evaluative.	Directly applicable Minor limitations	US Community	The Falls Rehabilitation Program (FRP), a multifactorial risk assessment to any eligible Medicare beneficiary who has fallen within the preceding 12 months. The FRP programme includes a detailed evaluation of the risk of falling, and an individualized management approach, such as medication adjustment, behavioural recommendations, home modifications rehabilitation therapy, and exercise programmes.	No FRP	5.26 million community-dwelling Medicare beneficiaries aged 65 to 74 years who had fallen recently and 6.13 million persons aged 75 years and older.	All Medicare beneficiaries who had had fallen in last 12 months.	CEA. Risk reduction of falls with FRP was assumed equal to that in meta-analyses for multifactorial programmes. Cost of falls was from an observational cost of falls study of 1017 people aged 72 years and older. Cost of FRP from Medicare tariffs. Medicare perspective; all payer perspective in sensitivity analyses. 1 year time-horizon. 1-way sensitivity analysis on key parameters.	Overall, Medicare would pay $1.88 bn annually to FRP providers, this would be offset by $1.44 bn in avoided health care expenses. With a 18% risk reduction of falls, the incremental cost is $850 per person prevented from having a recurrent fall. This ratio varied by age ($1184 for persons aged 65 to 74 years and $563 for those aged ≥75 years). If the “all payer” perspective	The authors noted analysis excluded costs that Medicare might have to pay to implement the plan developed from the FRP. Also there was material uncertainty in some parameters. Other issues include assuming an 18% reduction on effectiveness of FRP with no evidence. Also using QALYS as a benefit measure would have provided more comparable results Also there are difficulties in transferring US cost values to England given different funding approaches.	No source of funding reported. There was some evidence gaps due to the uncertainty around key parameters and need for assumptions

									was adopted the FRP could be cost saving thus being dominant. The risk of falling and the cost of a fall were cost drivers.		

Appendix F: Evidence profiles

Table 16: Evidence profiles

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
Albert S M, Raviotta, J, Lin C J et al (2016) **[43]** "Healthy Steps for Older Adults" (HSOA) vs no intervention.	Multifactorial risk assessment and education.	Potentially serious limitations.	Partially applicable.	The analysis was based on a decision tree model with a one-year time horizon.	-$840 (cost saving).	0.008 QALYs (calculated).	The HSOA programme was dominant (more effective and less expensive) over the comparator.	The sensitivity analyses confirmed the base case results. Utility values were the most influential inputs.
Beard J, Rowell D, Scott D (2006) **[30]** 'Stay on Your Feet' (SOYF), a community-based falls prevention programme vs no intervention.	Multifactorial risk assessment and education.	Minor limitations.	Partially applicable.	This cost-benefit analysis compared the return on investment in SOYF over a time horizon of 7 years.	Total programme costs were AUS$781,829.	Net savings ranged from AUS$5.4 million for avoided hospitalizations alone to AUS$16.9 million for all avoided direct and indirect costs.	Benefit to cost ratios ranged from 8.4:1 for the State Government (reflecting direct hospitalization costs), 13.6:1 for the Australian Government (hospitalization and other direct costs) and 20.3:1 for the society (ie both Governments and community costs and benefits).	The analysis considered various scenarios with no single base case. Hence a range of results are presented. No other sensitivity analyses were carried out.
Campbell J, Robertson M C, La Grow S J et al (2005). **[44]** 1) Home safety assessment and modification programme vs no intervention.	Home safety assessment and exercise/balance	Minor limitations.	Partially applicable.	The economic evaluation was conducted alongside a RCT over a one-year time horizon.	1) NZ$325 per person for the home assessment intervention. 2) Not calculated because the intervention	1) 41% fewer falls with home safety assessment. 2) Home exercise led to 15% more falls (less effective than the	1) The incremental cost per fall averted was NZ$650 (range: NZ$460 to NZ$1,569). 2) Not calculated because home exercise was not effective in reducing	Alternative costs scenarios were considered. The results of the analysis were robust.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
2) Home exercise programme (Otago) plus vitamin D supplementation vs no intervention.					was not clinically effective.	comparator)	falls.	
Carande-Kulis V, Stevens J.A., Florence C S. (2015). [24] 1) Home exercise programme (Otago) vs no intervention. 2) Tai Chi-Moving for Better Balance. 3) Stepping On (exercise group sessions).	Strength and balance.	Minor limitations.	Partially applicable.	The cost-benefit analysis was carried out over a one-year time horizon.	Mean cost per participant for: 1) Home exercise: $339.15. 2) Tai Chi: $104.02. 3) Stepping on: $211.38.	Mean net benefit. 1) Home exercise: For people ≥65 years $121.85. For≥80 years $429.18. 2) Tai Chi: $529.86. 3) Stepping on: $134.37.	Return on investment (RoI) 1) Home exercise: For people aged ≥ 65 years ROI was 36%, and 127% for those ≥ 80 years. 2) Tai Chi, RoI 509%. 3) Stepping on: RoI 64%.	Univariate sensitivity analyses were performed on several variables. The study results were stable.
Church J, Goodall S., Norman R et al (2011). **[22]** 1) Group-based exercise vs no intervention. 2) Home-based exercise vs no intervention.	Strength and balance. Multifactorial programme. Vision assessment and surgery. Education support. Medication	Minor limitations.	Partially applicable.	The analysis was based on a decision analytic Markov model with a 10-year horizon.	Costs of the interventions were not reported.	Benefits of the interventions were not reported.	The incremental cost per QALY gained was: 1) AUS$ 72,765. 2) AUS$ 96,205. 3) AUS$ 44,879. 4) AUS$ 2,211. 5) AUS$ 80,257.	In the sensitivity analyses, the fear of falling was the main driver of the model, followed by the efficacy and the cost of the interventions.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
3) Tai Chi vs no intervention. 4) Expedited cataract surgery vs no intervention. 5) Cardiac pacing vs no intervention. 6) Psychotropic medication withdrawal vs no intervention. 7) Multiple intervention (Stepping On Program) vs no intervention. 8) Multifactorial intervention (referral only) – risk assessment vs no intervention. 9) Multifactorial intervention – risk assessment plus exercise programme vs no intervention.	review. Cardiac pacing.						6) AUS$ 16,584. 7) AUS$ 74,186 8) AUS$ 172,009. 9) AUS$ 130,139.	
Church J, Goodall S. Norman R. et al (2012). **[2]**	Strength and balance. Multifactorial	Minor limitations.	Directly applicable.	Decision analytic Markov model with a lifetime horizon.	Incremental costs (AUS$): 1) $488.	Incremental QALYs were: 1) 0.011.	Incremental cost per QALY (AUS$): 1) $44,205.	DSA and PSA were carried out. Also some interventions were modelled for

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
1) Tai Chi vs no intervention. 2) Home exercise vs no intervention. 3) Group-based exercise vs no intervention. 4) Multiple interventions vs no intervention. 5) Multifactorial interventions with only referral vs no intervention. 6) Multifactorial interventions with an active component vs no intervention. 7) Expedited cataract surgery vs no intervention. 8) Psychotropic medication withdrawal vs no intervention. 9) Cardiac pacing vs no intervention.	programme. Vision assessment and surgery. Education support. Medication review. Cardiac pacing.				2) $945. 3) $468. 4) $654. 5) $786. 6) $1,116. 7) -$61 (cost saving). 8) $328. 9) $9,652.	2) 0.010. 3) 0.007. 4) 0.009. 5) 0.005. 6) 0.009. 7) 0.010. 8) 0.019. 9) 0.172.	2) $93,432. 3) $70,834. 4) $72,306. 5) $165,841. 6) $125,868. 7) Dominant (more effective and less expensive). 8) $17,207. 9) $56,111. Compared to each other, Tai Chi was the only cost-effective intervention for the general population.	those at high risk. Fear of falling was the driver of the results. If excluded, unlikely that any community-dwelling interventions would be judged cost-effective. In the high risk group, home hazard assessment / modification and group-based exercise were the most cost-effective interventions.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
Interventions were also compared to each other.								
Farag I, Howard K, Ferreira M L et al (2015). **[38]** Falls prevention programme including exercise programme (eg Tai Chi and Otago) and multi-factorial interventions vs no programme.	Strength and balance. Multifactorial programme.	Minor limitations.	Partially applicable.	Cost-utility analysis based on a Markov model with lifetime horizon.	Incremental cost: AUS$379	Incremental QALY gain of 0.0139 QALYs.	AUS$28,931 per QALY gained.	The falls prevention programme remained cost-effective at a threshold of $A50,000 per QALY in all the alternative scenarios and sensitivity analyses.
Farag, I, Sherrington C, Hayes A (2016). **[14]** 6-month minimally supervised exercise programme vs no programme for people with Parkinson's.	Strength and balance.	Minor limitations.	Partially applicable.	Cost-utility analysis based on a RCT with a 6-month time horizon.	Marginal cost of intervention AUS$1,010.	0.005 QALYs and incremental healthcare savings AUS$684 (calculated).	AUS$574 per fall prevented. AUS$338,800 per QALY gained.	The intervention had an 80% probability of being cost-effective, relative to the control, at a threshold of AUS$2,000 per fall prevented. It was not cost effective using a cost/QALY method.
Fletcher E, Goodwin V A, Richards S H et al (2012). **[23]** Targeted exercise based on FaME programme in patients with	Strength and balance.	Minor limitations.	Directly applicable.	The analysis was CEA and CUA alongside a RCT with a time horizon of 20 weeks.	Incremental cost of intervention was £76 per participant. Health care costs: −£128 (saving) reducing to -£35 when	0.03 QALY gain (95% CI: -0.02 to 0.03).	No statistically significant differences were found in both costs and QALYs. Intervention likely to be cheaper and more effective so dominant	PSA showed more than 80% probability that exercise is a cost-effective strategy relative to no intervention.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
Parkinson's vs no intervention.					social care costs included.			
Frick K F, Kung J Y, Parrish J M et al (2010). [25] 1) Medical management (withdrawal) of psychotropics. 2) Group Tai Chi. 3) Vitamin D supplementation. 4) Muscle and balance exercises. 5) Home modifications. 6) Multifactorial individualized programs for all older people. 7) Multifactorial individualized treatments. Interventions were compared to each other and to no intervention.	Strength and balance. Education. Home safety assessment. Multifactorial programme. Medication review.	Minor limitations.	Partially applicable.	The CUA was based on an epidemiological model with a lifetime horizon.	Intervention costs: Group Tai Chi $104. Muscle balance $371 Home safety assessment $326. Multifactorial programme all £272; high risk £361. Medication review $160. Vitamin D $99.	QALYs were not reported.	$14,794 per QALY gained with home modification compared to vitamin D. The latter was the cheapest intervention. The other interventions were excluded by dominance or extended dominance. Note medication review was the cheapest and most effective but management of withdrawal from psychotropics was assumed difficult to sustain and hence this option removed from incremental analyses.	At $50,000/QALY, home modification had the highest net benefit in 54% of iterations and vitamin D supplements in 30%. However this removed medication review as assumed unsustainable.
Hektoen L F, Aas E, Luras H (2009). **[19]**	Strength and balance.	Potentially serious limitation.	Partially applicable.	The study was a CEA with a short-term time horizon.	Incremental net costs of -NOK 2,962 (cost-saving)	- 0.52 falls.	The home-based exercise programme was dominant (more effective and less	The study did not address the issue of uncertainty.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
Home-based exercise programme (Otego) vs no intervention in women.							expensive) over the comparator.	
Hendriks M R C, Evers S M A A, Bleijlevens M H C et al (2008). **[29]** Medical and occupational-therapy assessment to assess and address potential risk factors vs no intervention.	Risk assessment and occupational therapy.	Minor limitations.	Partially applicable.	The study undertook CEA and CUA over one year.	Cost of intervention €385, net savings from societal perspective -€134 (calculated).	-0.02 (calculated).	ICERs were not calculated because the intervention was not effective.	PSA confirmed that there were no differences in effects or costs between the groups.
Iliffe S, Kendrick D, Morris R et al. (2014). **[39]** Community group exercise programme (FaME) vs home-based exercise (Otago). ***the option "usual care was included only in the efficacy analysis and not in the economic evaluation**	Strength and balance.	Minor limitations.	Directly applicable.	This HTA was carried out alongside a RCT over a time horizon of one year for economic evaluation but the RCT had longer term follow-up on adherence and falls..	Incremental cost of interventions was £181 higher with FaME over Otago in London and £101 more expensive in Nottingham.	EQ-5D (quality of life) score declined with FaME from baseline by 0.009 but was not changed for Otago, so gain of 0.009 for Otago relative to FaME.	The Otago programme appears dominant using a cost/QALY yardstick as it had slightly more QALYs and less expensive than FaME. However, FaME was more effective at reducing fall and promoting physical activity.	The study did not address the issue of uncertainty.
Irvine L, Conroy S	Physiotherapy,	Minor	Partially	CEA based on a	£578 per	-0.17 (falls per	£3,320 per fall	The probability that

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
P, Sach T et al (2010) **[32]** Day hospital multidisciplinary falls prevention programme plus leaflet vs leaflet alone.	Occupational therapy, medicines review and modification to drugs.	limitations.	applicable.	pragmatic trial with 12-month time horizon.	person.	person/year).	averted.	the intervention was cost-effective was always less than 40%, even if decision-makers were willing to pay more than £5,000 per fall averted.
Jenkyn K B, Hock J S, Speechley M (2012). **[26]** Multifactorial intervention vs usual care.	Multifactorial risk assessment.	Minor limitations.	Partially applicable.	CEA based on a pragmatic trial with 12-month time horizon.	Can$9,780 per person.	-0.08 (average number of falls).	Can$122,110 per fall prevented.	The intervention was not cost-effective in any analyses.
Li, F, Harmer P. (2015) **[15]** 1) Tai Ji Quan Vs Resistance 2) Tai Ji Quan Vs Stretching.	Strength and balance.	Minor limitations.	Directly applicable.	CEA conducted alongside a RCT over a 9-month time horizon	1) -$130 per person. (cost saving) (calculated) 2) -$483 per person. (cost saving) (calculated)	1) –1.33 (mean no of falls) 1) 0.11 (utility scores from PDQ-8) 2) –2.78 (mean no of falls) 2) 0.15 (utility scores from PDQ-8)	Tai Ji Quan was dominant compared both to Resistance and Stretching (more effective and less expensive).[5]	Subgroup and sensitivity analyses confirmed the robustness of basecase results.
Li, F, Harmer P, Fitzgerald K (2016) **[45]** Tai Ji Quan Vs no	Strength and balance.	Potentially serious limitation.	Partially applicable.	CEA based on a before and after study of 48-week period	$601 per person.	49% reduction in falls.	$917 per fall prevented and $676 per fall prevented for multiple falls.	Not conducted.

[5] The authors calculated savings per fall avoided but this has no economic meaning.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
intervention.								
Markle-Reid M; Browne G; Gafni A et al (2010) **[28]** Multifactorial and and interdisciplinary team approach Vs no intervention.	Multifactorial risk assessment and education.	Potentially serious limitation.	Partially applicable.	Cost-consequences analysis alongside a multicentre RCT over a 6-month time horizon.	Values not presented. Report noted change in direct costs of use of health services per person did not differ between the 2 groups (p = 0.41).	No difference in mean number of falls (1.45 vs. 1.33, p = 0.70) or change in mean number of falls (–0.31 vs. –0.35, difference: 0.04, 95 % CI: –1.18 to 1.27).	Not calculated.	Subgroup analyses showed intervention was more effective in men, aged 75 to 84 but no costs presented for group.
McLean K, Day L, Dalton A (2015) **[21]** Group-based exercise vs no intervention.	Strength and balance.	Minor limitations.	Directly applicable.	CUA based on a decision tree with 18-month time horizon.	£45.87 per person.	-0.081 (rate of falls per year; RR: 0.79). 0.0009 QALYs per person.	Incremental cost-effectiveness ratio (ICER) was £51,483 per QALY for whole group, dropping to £22,986 per QALY in the women only group.	The PSA showed that the probability of being cost-effective for the intervention was extremely low at £20k-£30k per QALY. If women only were considered the ICER was reduced to £22,986 per QALY.
Patil R, Kolu P, Raitanen, J et al. (2016) **[18]** Group-based exercise vs no intervention.	Strength and balance.	Minor limitations.	Partially applicable.	CEA conducted alongside a RCT with 2-year time horizon.	€42.5 per person. (calculated).	-0.06 (rate of injurious falls; calculated).	€708 per injurious fall avoided.	At a willingness to pay of €3000 per injurious fall prevented, there was an 86% chance of the exercise intervention being cost-effective.
Peeters GM, Heymans MV, de Vries OJ et al. (2011) **[27]** Multifactorial fall risk assessment	Multifactorial risk assessment.	Minor limitations.	Partially applicable.	CEA conducted alongside a RCT with 1-year time horizon.	€902 per person.	-4% rate of falls. -0.004 QALYs	€226 per 1% less fallers. Since costs were higher and effects were smaller for the outcome recurrent fallers, the	Sensitivity analyses confirmed the intervention was not cost-effective compared with usual care.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
vs no intervention.							intervention was not cost-effective.	
Pega F, Kvizhinadze G; Blakely T et al. (2016) **[33]** Home safety assessment and modification vs no intervention	Home risk assessment and modification (HSAM).	Minor limitations.	Partially applicable.	CEA based on a Markov model with lifetime horizon.	Not reported at individual level. HSAM programme cost US$98m and net benefits to health system costs were US$74m.	Not reported at individual level. Across the programme, health gains were 34,000 QALYs.	ICER of $6,000 per QALY.	The intervention was cost-effective for all age groups, level of risk and regardless ethnicity.
Polinder S, Boye NDA,.Mattace-Raso, FUS (2016) **[41]** Fall-risk-increasing drugs (FRIDs) assessment combined with FRIDs withdrawal or modification vs no intervention	Medicines review and modification to drugs.	Minor limitations.	Partially applicable.	Cost-consequences analysis based on a RCT with 1-year time horizon.	Incremental savings with medication changes was €35 per person: total incremental savings was £39 per person. (calculated).	Incremental QALY gain of 0.05 for each person in intervention group.	Not calculated because no significant difference was found in costs.	Only confidence intervals around means were calculated.
Sach, TH, Logan PA, Coupland, CAC (2012) [17] Multi-factorial intervention programme vs no intervention.	Multifactorial risk assessment.	Minor limitations.	Partially applicable.	CUA based on a RCT with 1-year time horizon.	-£1551 (cost saving) per person.	-5.34 (mean number of falls). Incremental gain of 0.07 QALYs per person.	Dominant.	At a willingness to pay of £20,000 (£30,000) per QALY there is a 89.0% (92.3%) chance of the intervention being cost-effective in this population.
[34]	Medicines review and modification	Minor limitations.	Partially applicable.	Economic evaluation	-€1691 (cost saving) per	-2.3 (number of falls, calculated)	Dominant[6].	Only 95% CIs around mean

[6] The authors calculated savings per fall prevented but this has no economic meaning.

Study	Type of intervention	Limitations	Applicability	Other comments	Incremental			Uncertainty
					Costs	Effects	Cost-effectiveness	
Van der Velde N, Meerding WJ, Looman, CW et al (2008) Withdrawal of fall-risk-increasing drugs vs no withdrawal.	to drugs.			based on an observational study with 2-month follow-up.	person.	per person.		effects and mean costs were calculated.
[42] Wu S, Keeler EB, Rubenstein, LZ et al. (2010) The Falls Rehabilitation Program (FRP), a multifactorial risk assessment vs no FRP.	Multifactorial risk assessment.	Minor limitations.	Partially applicable.	CEA based on several published sources (1-year time horizon)	Not reported at individual level. Intervention would increase Medicare costs by $1.88bn to provide service: with healthcare savings of $1.44bn, giving net cost of 0.44bn.	-18% reduced risk of recurrent falls.	$850 per person prevented from experiencing a recurrent fall.	Cost per person ranged from a net savings of $559 to a cost of $8,175. No great variation by age groups but more cost-effective in older than 75 years.

Appendix G: Completed checklists

Table 17: Completed Checklists

Study identification:	**[16]** Albert S M, Raviotta, J, Lin C J et al (2016)	
Guidance topic:		
Checklist completed by:	Gabriella Giunta	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	US
1.4 Was/were the perspective(s) clearly stated and what were they?	No	Costs appear to refer to the health care system
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Partly	
1.6 Are both costs and health effects discounted appropriately?	N.A.	One-year horizon
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	
2.3 Are all important and relevant health outcomes included?	Yes	
2.4 Are the estimates of baseline health outcomes from the best available source?	Partly	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Partly	
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Partly	

2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Partly	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Potentially serious limitations	Limitations are mainly related to the source of evidence
Other comments:		

Study identification:	**[30]** Beard J, Rowell D, Scott D (2006)	
Guidance topic:		
Checklist completed by:	Gabriella Giunta	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Government and whole community
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Partly	
1.6 Are both costs and health effects discounted appropriately?	Yes	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	DALYs were used
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Directly applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	
2.3 Are all important and relevant health outcomes	Partly	

	included?		
2.4	Are the estimates of baseline health outcomes from the best available source?	Partly	
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Partly	
2.6	Are all important and relevant costs included?	Yes	
2.7	Are the estimates of resource use from the best available source?	Yes	
2.8	Are the unit costs of resources from the best available source?	Yes	
2.9	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10	Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Partly	
2.11	Is there any potential conflict of interest?	Unclear	
2.12	**Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:			

Study identification:	**[44]** Campbell J, Robertson M C, La Grow S J et al (2005)		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Yes	
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	Society
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Partly	
1.6	Are both costs and health effects discounted appropriately?	N.A.	
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Partially applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of		Yes/No/Partly/	Comments

methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Unclear/N.A.	
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	
2.3 Are all important and relevant health outcomes included?	Partly	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Partly	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[24]** Carande-Kulis V, Stevens J.A., Florence C S. (2015).		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??		Yes	
1.2 Are the interventions appropriate for the topic being evaluated??		Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?		Partly	
1.4 Was/were the perspective(s) clearly stated and what were they?		Yes	Third-party payer perspective
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?		Partly	
1.6 Are both costs and health effects discounted appropriately?		N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?		No	Falls prevented
1.8 Are costs and outcomes from other sectors fully		No	

and appropriately measured and valued?		
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	
2.3 Are all important and relevant health outcomes included?	Partly	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Partly	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Partly	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[22]** Church J, Goodall S., Norman R et al (2011).
Guidance topic:	
Checklist completed by:	Gabriella Giunta
Applicability	

Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	Australia
1.4 Was/were the perspective(s) clearly stated and what were they?	Unclear	Health care system

1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	Yes	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	
2.3 Are all important and relevant health outcomes included?	Yes	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	Systematic review
21.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[2]** Church J, Goodall S. Norman R. et al (2012)		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Yes	
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	Health care system
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	Yes	
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	
2.3	Are all important and relevant health outcomes included?	Yes	
2.4	Are the estimates of baseline health outcomes from the best available source?	Partly	
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Partly	
2.6	Are all important and relevant costs included?	Yes	
2.7	Are the estimates of resource use from the best available source?	Partly	
2.8	Are the unit costs of resources from the best available source?	Yes	
2.9	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10	Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity	Yes	

analysis?		
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[38]** Farag I, Howard K, Ferreira M L et al (2015).		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??		Yes	
1.2 Are the interventions appropriate for the topic being evaluated??		Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?		Partly	Australia
1.4 Was/were the perspective(s) clearly stated and what were they?		Yes	Health care funder
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?		Yes	
1.6 Are both costs and health effects discounted appropriately?		No	A lifetime horizon appears to have been adopted but no discounting was reported
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?		Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?		No	The economic analysis was restricted to the perspective of the study
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Partially applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?		Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?		Yes	
2.3 Are all important and relevant health outcomes included?		Yes	
2.4 Are the estimates of baseline health outcomes from the best available source?		Yes	

2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Partly	
2.7 Are the estimates of resource use from the best available source?	Partly	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[14]** Farag, I, Sherrington C, Hayes A (2016).	
Guidance topic:		
Checklist completed by:	Gabriella Giunta	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Partly	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	Australia
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Health care system
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	N.A.	Short-term
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the	N.A.	

nature of the topic under evaluation?		
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	
2.3 Are all important and relevant health outcomes included?	Yes	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Partly	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[23]** Fletcher E, Goodwin V A, Richards S H et al (2012).		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Partly	Limited data on inclusion/exclusion criteria
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Yes	UK
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	Health care system
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	N.A.	Short-term
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			

Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No	Short-term
2.3 Are all important and relevant health outcomes included?	Partly	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	RCT
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6 Are all important and relevant costs included?	Partly	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[25]** Frick K F, Kung J Y, Parrish J M et al (2010)
Guidance topic:	
Checklist completed by:	Gabriella Giunta

Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	US
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Health care system
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Partly	
1.6 Are both costs and health effects discounted appropriately?	Yes	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	

1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	
2.3 Are all important and relevant health outcomes included?	Partly	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Partly	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	Official tariffs
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	No	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[19]** Hektoen L F, Aas E, Luras H (2009)
Guidance topic:	
Checklist completed by:	Gabriella Giunta

Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Partly	The study considered women aged more than 80 years
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	Norway
1.4 Was/were the perspective(s) clearly stated and	Yes	Society but only direct

what were they?		medical costs were included
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Partly	
1.6 Are both costs and health effects discounted appropriately?	N.A.	Short-term
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	No modelling
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	Short-term
2.3 Are all important and relevant health outcomes included?	Yes	
2.4 Are the estimates of baseline health outcomes from the best available source?	Partly	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Partly	
2.6 Are all important and relevant costs included?	Partly	Costs outside the health sector were not included
2.7 Are the estimates of resource use from the best available source?	Partly	Some estimates were based on authors' assumptions
2.8 Are the unit costs of resources from the best available source?	Yes	Official tariffs
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	No	
2.11 Is there any potential conflict of interest?	No	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Potentially serious limitation	
Other comments:		

Study identification:	**[29]** Hendriks M R C, Evers S M A, Bleijlevens M H C et al (2008).	
Guidance topic:		
Checklist completed by:	Gabriella Giunta	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a])	Yes/No/Partly/ Unclear/N.A.	Comments

This checklist should be used first to filter out irrelevant studies		
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	The Netherlands
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Society
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	N.A.	Short-term
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	Participants were followed up for 2 years.
2.3 Are all important and relevant health outcomes included?	Yes	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	RCT
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study	**[39]**

identification:	Iliffe S, Kendrick D, Morris R et al. (2014).		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Yes	
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Yes	UK
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	NHS
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	N.A.	Short-term
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1	Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	No modelling
2.2	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	2 year follow-up
2.3	Are all important and relevant health outcomes included?	Yes	
2.4	Are the estimates of baseline health outcomes from the best available source?	Yes	RCT
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6	Are all important and relevant costs included?	Partly	NHS perspective
2.7	Are the estimates of resource use from the best available source?	Yes	
2.8	Are the unit costs of resources from the best available source?	Yes	
2.9	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10	Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Partly	Limited sensitivity analyses
2.11	Is there any potential conflict of interest?	Partly	

2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[32]** Irvine L, Conroy S P, Sach T et al (2010).	
Guidance topic:		
Checklist completed by:	Gabriella Giunta	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Yes	UK
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	NHS
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Partly	
1.6 Are both costs and health effects discounted appropriately?	N.A.	Short-term
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	Falls prevented was the outcome
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	No modelling
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	Short-term
2.3 Are all important and relevant health outcomes included?	Partly	
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	RCT
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6 Are all important and relevant costs included?	Partly	Analysis restricted to NHS costs
2.7 Are the estimates of resource use from the best available source?	Yes	

2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	
2.11 Is there any potential conflict of interest?	Partly	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[26]** Jenkyn K B, Hock J S, Speechley M (2012).		
Guidance topic:			
Checklist completed by:	Gabriella Giunta		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??		Yes	
1.2 Are the interventions appropriate for the topic being evaluated??		Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?		Partly	Canada
1.4 Was/were the perspective(s) clearly stated and what were they?		Yes	Society
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?		Partly	
1.6 Are both costs and health effects discounted appropriately?		N.A.	Short-term
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?		No	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?		Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Partially applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?		N.A.	No modelling
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?		Partly	Short-term
2.3 Are all important and relevant health outcomes included?		Partly	

2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Party	Self-reported at the end of follow-up
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Partly	
2.11 Is there any potential conflict of interest?	Partly	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	[15] Li F, Harmer P (2015)	
Guidance topic:		
Checklist completed by:	Marco Barbieri	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Partly	Eligibility criteria age 40 to 85 years, but mean age 68 and 69 in the groups compared
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	US
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Societal
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Directly applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality)	Yes/No/Partly/ Unclear/N.A.	Comments

This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	Slightly more than 1 year
2.3 Are all important and relevant health outcomes included?	No	Only falls estimated
2.4 Are the estimates of baseline health outcomes from the best available source?	Partly	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	No	Before and after study
2.6 Are all important and relevant costs included?	No	Only costs of programme
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Unclear	Not stated
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	No	Only average cost per fall
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	No	Not performed
2.11 Is there any potential conflict of interest?	No	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Potentially serious limitations	
Other comments:		

Study identification:	[15] Li F, Harmer P (2015)	
Guidance topic:		
Checklist completed by:	Marco Barbieri	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	US
1.4 Was/were the perspective(s) clearly stated and what were they?	No	Not clearly stated
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	No	

Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	9 months
2.3 Are all important and relevant health outcomes included?	Yes	Falls and QALYs
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	Subgroup and univariate sensitivity analyses
2.11 Is there any potential conflict of interest?	No	The authors declared no conflict of interest
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	[28] Markle-Reid M, Browne G, Gafni A, Roberts J, Weir R, Thabane L, *et al.* (2010)
Guidance topic:	
Checklist completed by:	Marco Barbieri

Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	Canada
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Societal
1.5 Are all direct health effects on individuals	Yes	

included, and are all other effects included where they are material?		
1.6 Are both costs and health effects discounted appropriately?	N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Partially applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No	6 months
2.3 Are all important and relevant health outcomes included?	Partially	Various instrument used but no QALYs calculated
2.4 Are the estimates of baseline health outcomes from the best available source?	Partially	No treatment group of a RCT
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Partially	RCT but with low sample size
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	No	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	No	
2.11 Is there any potential conflict of interest?	Unclear	Not stated
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Potentially serious limitations	
Other comments:	This is a cost-consequences analysis with potentially misleading cost results	

Study identification:	[21] McLean K, Day L, Dalton A (2015)		
Guidance topic:			
Checklist completed by:	Marco Barbieri		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Yes	
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	Australia
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	Healthcare system
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	Yes	3% costs and benefits
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	Decision tree
2.2	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	18 months
2.3	Are all important and relevant health outcomes included?	Yes	QALYs estimated
2.4	Are the estimates of baseline health outcomes from the best available source?	Partly	No treatment group of a RCT
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6	Are all important and relevant costs included?	Yes	
2.7	Are the estimates of resource use from the best available source?	Yes	
2.8	Are the unit costs of resources from the best available source?	Yes	
2.9	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10	Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity	Yes	PSA and univariate SA

analysis?		
2.11 Is there any potential conflict of interest?	No	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	[18] Patil R, Kolu P, Raitanen J, Valvanne J, Kannus P, Karinkanta S, et al.(2016)		
Guidance topic:			
Checklist completed by:	Marco Barbieri		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Yes	
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	Finland
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	Societal
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	N.A.	
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Partially applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1	Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	2 years
2.3	Are all important and relevant health outcomes included?	Partly	No quality of life considered
2.4	Are the estimates of baseline health outcomes from the best available source?	Partly	Placebo group in a RCT
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6	Are all important and relevant costs included?	Yes	Travel costs excluded

2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	Standard Finnish sources
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	PSA performed.
2.11 Is there any potential conflict of interest?	No	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[27]** Peeters GMEE, Heymans MW, de Vries OJ, Bouter LM, Lips P, van Tulder MW (2011)	
Guidance topic:		
Checklist completed by:	Marco Barbieri	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	The Netherlands
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Societal
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Directly applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all	Partly	1 year

	important differences in costs and outcomes?		
2.3	Are all important and relevant health outcomes included?	Yes	Percentage of fallers and QALYs
2.4	Are the estimates of baseline health outcomes from the best available source?	Yes	RCT (usual care)
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6	Are all important and relevant costs included?	Yes	
2.7	Are the estimates of resource use from the best available source?	Yes	
2.8	Are the unit costs of resources from the best available source?	Yes	Standard Dutch tariffs
2.9	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10	Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	PSA performed.
2.11	Is there any potential conflict of interest?	No	The authors declared no conflict of interest
2.12	**Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:			

Study identification:	**[33]** Pega F, Kvizhinadze G, Blakely T, Atkinson J, Wilson N 2016		
Guidance topic:			
Checklist completed by:	Marco Barbieri		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Yes	
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	New Zealand
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	Health system
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	Yes	3% costs and benefits
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			

Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	Markov model
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	Lifetime
2.3 Are all important and relevant health outcomes included?	Yes	QALYs
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	Confidence intervals around mean values and scenario analyses
2.11 Is there any potential conflict of interest?	No	The authors declared no conflict of interest
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[41]** Polinder S, Boye NDA, Mattace-Raso FUS, Van der Velde N, Hartholt KA, De Vries OJ, et al 2016
Guidance topic:	
Checklist completed by:	Marco Barbieri

Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	The Netherlands
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Societal
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted	N.A.	

appropriately?		
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Directly applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	1 year
2.3 Are all important and relevant health outcomes included?	Yes	Falls avoided and QALYs
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	RCT
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Partly	The authors did not make any incremental analysis but it might be calculated
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	No	No sensitivity analysis
2.11 Is there any potential conflict of interest?	No	The authors declared no conflict of interest
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[17]** Sach TH, Logan PA, Coupland CAC, Gladman JRF, Sahota O, Stoner-Hobbs V, et al. (2012)		
Guidance topic:			
Checklist completed by:	Marco Barbieri		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1	Is the study population appropriate for the topic being evaluated??	Partly	Aged 60 years or more
1.2	Are the interventions appropriate for the topic being evaluated??	Yes	
1.3	Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Yes	UK
1.4	Was/were the perspective(s) clearly stated and what were they?	Yes	NHS and PSS
1.5	Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6	Are both costs and health effects discounted appropriately?	N.A.	
1.7	Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	Yes	
1.8	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].		Yes/No/Partly/ Unclear/N.A.	Comments
2.1	Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	1 year
2.3	Are all important and relevant health outcomes included?	Yes	Falls avoided and QALYs
2.4	Are the estimates of baseline health outcomes from the best available source?	Yes	RCT
2.5	Are the estimates of relative 'treatment' effects from the best available source?	Yes	RCT
2.6	Are all important and relevant costs included?	Yes	
2.7	Are the estimates of resource use from the best available source?	Yes	
2.8	Are the unit costs of resources from the best available source?	Yes	
2.9	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	

2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	PSA performed.
2.11 Is there any potential conflict of interest?	No	None declared
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments:		

Study identification:	**[34]** van der Velde N, Meerding WJ, Looman CW, Pols HAP, van der Cammen TJM (2008)	
Guidance topic:		
Checklist completed by:	Marco Barbieri	
Applicability		
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies	Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??	Yes	
1.2 Are the interventions appropriate for the topic being evaluated??	Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?	Partly	The Netherlands
1.4 Was/were the perspective(s) clearly stated and what were they?	Yes	Health Service Providers
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?	Yes	
1.6 Are both costs and health effects discounted appropriately?	N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?	No	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'	Directly applicable	
Other comments:		
Quality		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the clinical guideline[b].	Yes/No/Partly/ Unclear/N.A.	Comments
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No	2 months
2.3 Are all important and relevant health outcomes included?	Partly	Quality of life not considered
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	

2.5 Are the estimates of relative 'treatment' effects from the best available source?	Partly	Observational study but a solid statistical analysis conducted
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	From Dutch observational study
2.8 Are the unit costs of resources from the best available source?	Yes	Standard tariffs
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	DSA and PSA.
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments: The main issue of the study is the use of an observational study for clinical outcomes		

Study identification:	**[42]** Wu S, Keeler EB, Rubenstein LZ, Maglione MA, Shekelle PG (2010)		
Guidance topic:			
Checklist completed by:	Marco Barbieri		
Applicability			
Section 1: Applicability (relevance to specific topic review question(s) and the NICE reference case[a]) This checklist should be used first to filter out irrelevant studies		Yes/No/Partly/ Unclear/N.A.	Comments
1.1 Is the study population appropriate for the topic being evaluated??		Yes	
1.2 Are the interventions appropriate for the topic being evaluated??		Yes	
1.3 Is the healthcare system in which the study was conducted sufficiently similar to the current UK context?		Partly	US
1.4 Was/were the perspective(s) clearly stated and what were they?		Yes	Medicare
1.5 Are all direct health effects on individuals included, and are all other effects included where they are material?		Yes	
1.6 Are both costs and health effects discounted appropriately?		N.A.	
1.7 Is the value of health effects expressed in terms of quality-adjusted life years (QALYs)?		No	
1.8 Are costs and outcomes from other sectors fully and appropriately measured and valued?		Partly	
Overall judgement: directly applicable/partially applicable/not applicable There is no need to complete section 2 of the checklist if the study is considered 'not applicable'		Directly applicable	
Other comments:			
Quality			
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been		Yes/No/Partly/ Unclear/N.A.	Comments

decided that the study is sufficiently applicable to the context of the clinical guideline[b].		
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	N.A.	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	1 year
2.3 Are all important and relevant health outcomes included?	Partly	Quality of life and mortality not considered
2.4 Are the estimates of baseline health outcomes from the best available source?	Yes	
2.5 Are the estimates of relative 'treatment' effects from the best available source?	Yes	Meta-analyses of trials
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Unclear	From observational study
2.8 Are the unit costs of resources from the best available source?	Yes	Standard tariffs
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters, whose values are uncertain, subjected to appropriate sensitivity analysis?	Yes	Univariate analysis
2.11 Is there any potential conflict of interest?	Unclear	
2.12 **Overall assessment:** minor limitations/potentially serious limitations/very serious limitations	Minor limitations	
Other comments: A key assumption drives the analysis, namely that the efficacy of the programme delivered is the same as that found in published studies of other programmes		

Appendix H: Excluded studies table

Table 18: Excluded studies

Bibliographic details	Exclusion reason
Archer S. Tai Chi Training Proves Cost-Effective. IDEA Fitness Journal. 2011;8(9):77-77.	Duplicate record
Beasley B, Patatanian E. Development and implementation of a pharmacy fall prevention program. Hosp Pharm. 2009;44(12):1095-102.	Ineligible study design
British Geriatrics Society. Cost-effectiveness of a home-exercise program among older people after hospitalisation [webpage]. London: British Geriatrics Society; 2015. Last updated 26 February 2015. [cited December 2016]. Available from: http://www.bgs.org.uk/fallsbones/sigfalls/falls-news-march-2015/home-exercise-against-falls.	Ineligible study design
Campbell AJ, Robertson MC, Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ, et al. Randomised controlled trial of prevention of falls in people aged >75 with severe visual impairment: The VIP trial. BMJ. 2005; (7520): 817-20. Available from: http://www.bmj.com/content/bmj/331/7520/817.full.pdf.	Duplicate record
Chapman SA, Keating N, Eales J. Client-centred, community-based care for frail seniors. Health Soc Care Community. 2003;11(3):253-61.	Ineligible outcomes
Chartered Society of Physiotherapy. The cost of falls [webpage]. London: Chartered Society of Physiotherapy; 2015. Last updated 2016. [cited December 2016]. Available from: http://www.csp.org.uk/professional-union/practice/your-business/evidence-base/cost-falls.	Ineligible outcomes
Cherubini A, Cesari M, Landi F, Zia G, Corca AM, Van Der Vliet J, et al. Integrated intervention against physical FRailty, a European Study in older Persons living in the Community for the Active & Healthy Ageing European Innovation Partnership (I2-FRESCO). Eur Geriatr Med. 2013;4:S41-S42.	Ineligible outcomes
Cohen MA, Miller J, Xiaomei S, Sandhu J, Lipsitz LA. IMPROVING CARE. Prevention Program Lowered The Risk Of Falls And Decreased Claims For Long-Term Services Among Elder Participants. Health Aff. 2015;34(6):971-77.	Ineligible outcomes
Comans T, Brauer S, Haines T. A break-even analysis of a community rehabilitation falls prevention service. Aust N Z J Public Health. 2009;33(3):240.	Ineligible outcomes
Corrieri S, Heider D, Riedel-Heller SG, Matschinger H, Konig H-H. Cost-effectiveness of fall prevention programs based on home visits for seniors aged over 65 years: a systematic review. Int Psychogeriatr. 2011;23(5):711-23.	Ineligible study design
Corrieri S, Heider D, Riedel-Heller SG. Cost-effectiveness of fall prevention programs based on home visits for seniors aged over 65 years. Int Psychogeriatr. 2011;23(5):711-23.	Ineligible study design
Ghimire E, Colligan EM, Howell B, Perlroth D, Marrufo G, Rusev E, et al. Effects of a Community-Based Fall Management Program on Medicare Cost Savings. Am J Prev Med. 2015;49(6):e109-16.	Ineligible outcomes
Giangregorio L, Papaioannou A, MacIntyre N, Ashe M, Heinonen A, Shipp K, et al. Too fit to fracture: A consensus on exercise recommendations for individuals with osteoporosis and osteoporotic vertebral fractures. J Bone Miner Res. 2012;27(Suppl 1):A1225.	Ineligible outcomes
Haas M. Economic analysis of Tai Chi as a means of preventing falls and falls related injuries among older adults (Structured abstract). NHS Economic Evaluation Database (NHSEED). 2006(2):1-14.	Ineligible study design
Hayward-Giles S, Palma S. A UK approach to using economic modelling to support service improvement and cost reduction: A falls prevention example. Physiotherapy. 2015;101:eS549-eS50.	Ineligible outcomes
Heuer S, Cesarotti E, Posin J, Smith D. Cost effective outpatient fall prevention/intervention program. Commun Nurs Res. 2007;40:402-02.	Ineligible study design
Keall MD, Pierse N, Howden-Chapman P, Guria J, Cunningham CW, Baker MG. Cost-benefit analysis of fall injuries prevented by a programme of home modifications: a cluster randomised controlled trial. Inj Prev. 2016;16:16.	Ineligible comparator

Bibliographic details	Exclusion reason
Kelly A, Dowling M. Reducing the likelihood of falls in older people. Nurs Stand. 2004;18(49):33-40.	Ineligible outcomes
Landis S. Fall screening program in primary care practices. J Am Geriatr Soc. 2013;61:S17.	Ineligible outcomes
Li F, Harmer P. Tai Chi training to reduce falls in patients with Parkinson's disease - A cost-effectiveness analysis. Mov Disord. 2013;28:S104.	Ineligible outcomes
Losa Iglesias ME, Becerro de Bengoa Vallejo R, Palacios Pena D. Impact of soft and hard insole density on postural stability in older adults. Geriatr Nurs. 2012;33(4):264-71.	Ineligible outcomes
Martins AC, Andrade S, Santos D. Screening and assessment of the risk of fall-an initiative to prevent falls in community dwelling older adults. Physiotherapy. 2015;101:eS958.	Ineligible outcomes
Miake-Lye IM, Amulis A, Saliba D, Shekelle PG, Volkman LK, Ganz DA. Formative evaluation of the telecare fall prevention project for older veterans. BMC Health Serv Res. 2011;11:119.	Ineligible outcomes
Mitchell MD, Kinosian B, Day S, Gabriel P, Wynne C, Weiner M, et al. Prevention of falls in community-dwelling elderly persons (Structured abstract). HTA Database. 2009; (4).	Ineligible study design
Moeskops SJ, Weisfelt M, Kalisvaart KJ. Evaluation of a falls and mobility clinic in Haarlem, The Netherlands. Eur Geriatr Med. 2013;4:S93-S94.	Ineligible outcomes
Moore M, Williams B, Ragsdale S, Logerfo JP, Goss JR, Schreuder AB, et al. Translating a multifactorial fall prevention intervention into practice: a controlled evaluation of a fall prevention clinic. J Am Geriatr Soc. 2010;58(2):357-63.	Ineligible outcomes
Mori T, Crandall CJ, Ganz DA. Cost-effectiveness of combined fall prevention exercise and oral bisphosphonate therapy for fracture prevention. J Am Geriatr Soc. 2014;62:S131-S32.	Ineligible intervention
National Institute for Health Research. A multi-centre cluster randomised controlled trial to evaluate the Guide to Action Care Home fall prevention programme in care homes for older people (FinCH) (Project record). HTA Database. 2016; (4):	Ineligible study design
Nelson A, Powell-Cope G, Gavin-Dreschnack D, Quigley P, Bulat T, Baptiste AS, et al. Technology to promote safe mobility in the elderly. Nurs Clin North Am. 2004;39(3):649-71.	Ineligible outcomes
Pekkarinen TA, Loyttyniemi E, Valimaki MJ. Prevention of hip fractures with an educational program in elderly finnish women: A population-based randomized clinical trial. Osteoporos Int. 2012;23:S58.	Ineligible outcomes
Poole CD, Smith J, Davies JS. Cost-effectiveness and budget impact of Empirical vitamin D therapy on unintentional falls in older adults in the UK. BMJ Open. 2015;5(9):e007910.	Ineligible intervention
Pyer M, Campbell J, Ward A, Knights A, Jones J. Falls assessment and prevention in older people: an evaluation of the Crisis Response Service. J Paramed Prac. 2015;7(2):68-72.	Ineligible intervention
Rantz M, Popejoy LL, Galambos C, Phillips LJ, Lane KR, Marek KD, et al. The continued success of registered nurse care coordination in a state evaluation of aging in place in senior housing. Nurs Outlook. 2014;62(4):237-46.	Ineligible setting
Reuben DB, Roth C, Kamberg C, Wenger NS. Restructuring primary care practices to manage geriatric syndromes: the ACOVE-2 intervention. J Am Geriatr Soc. 2003;51(12):1787-93.	Ineligible outcomes
Sadowski CA. Prevention of falls in older adults. Can Pharm J. 2011;144(Special Issue):S17-S19.	Ineligible outcomes
Shier V, Trieu E, Ganz DA. Implementing exercise programs to prevent falls: systematic descriptive review. Injury Epidemiology. 2016; 3(16): epub. Available from: http://injepijournal.springeropen.com/articles/10.1186/s40621-016-0081-8.	Ineligible outcomes
Shumway-Cook A, Ciol MA, Hoffman J, Dudgeon BJ, Yorkston K, Chan L. Falls in the Medicare population: incidence, associated factors, and impact on health care. Phys Ther. 2009;89(4):324-32.	Ineligible outcomes
Sievanen H, Karinkanta S. Fallscreen: A collaborative effort for feasible and effective prevention of falling in community. Osteoporos Int. 2014;25:S133.	Ineligible outcomes

Bibliographic details	Exclusion reason
Snooks HA, Carter B, Dale J, Foster T, Humphreys I, Logan PA, et al. Support and Assessment for Fall Emergency Referrals (SAFER 1): cluster randomised trial of computerised clinical decision support for paramedics. PLOS ONE. 2014;9(9):e106436.	Ineligible intervention
Spetz J, Jacobs J, Hatler C. Cost effectiveness of a medical vigilance system to reduce patient falls (Structured abstract). Nursing Economics. 2007;25(6):333.	Ineligible setting
Steultjens E, Clemson L. A preventative home safety programme for community-dwelling older people with low vision reduced falls and was more cost-effective than an exercise programme: Commentary. Aust Occup Therap J. 2006;53(3):243-44.	Ineligible study design
Taylor D, Hale L, Philip S, Waters D, Binns E, McCracken H, et al. A randomised controlled trial investigating the effectiveness and cost-effectiveness of Tai Chi as a community based falls prevention intervention. Physiotherapy. 2011;97:eS1219.	Ineligible outcomes
Vieira ER, Palmer RC, Chaves PHM. Prevention of falls in older people living in the community. BMJ. 2016; 353: i1419. Available from: http://www.bmj.com/content/353/bmj.i1419.	Ineligible study design
Yeong K, Ralphson A, Lisk R. Prevention of falls in care homes-a model of integrated care. Eur Geriatr Med. 2013;4:S60-S61.	Ineligible outcomes

Appendix I: Review team

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