Preventing Falls and Harm From Falls in Older People

Best Practice Guidelines
for Australian Community Care
2009

AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE

ISBN: 978-0-9806298-3-5

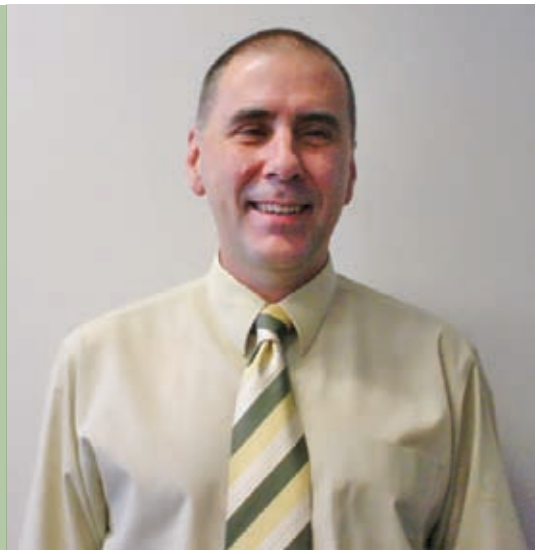
ACSQHC was established in January 2006 by the Australian health ministers to lead and coordinate improvements in safety and quality in Australian health care.

Copies of this document and further information on the work of ACSQHC can be found at http://www.safetyandquality.gov.au or from the Office of the Australian Commission on Safety and Quality in Health Care on telephone: +61 2 9263 3633 or email to: mail@safetyandquality.gov.au.

Other resources available from http://www.safetyandquality.gov.au:

- *Guidebook to Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Community Care 2009*
- *Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Hospitals 2009*
- *Guidebook to Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Hospitals 2009*
- *Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Residential Aged Care Facilities 2009*
- *Guidebook to Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Residential Aged Care Facilities 2009*
- *Implementation Guide for Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Hospitals and Residential Aged Care Facilities 2009*
- Fact sheets
  - Falls facts for patients and carers
  - Falls facts for doctors
  - Falls facts for nurses
  - Falls facts for allied health professionals
  - Falls facts for support staff (cleaners, food service and transport staff)
  - Falls facts for health managers

Statement from the chief executive



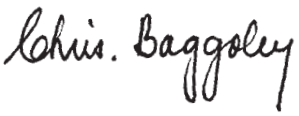
Australians today enjoy a longer life expectancy than previous generations, but for some this is disrupted by falls. As we age, our sure-footedness declines and, at the same time, our bones become increasingly brittle. The comment that 'he fell and broke his hip' is heard all too often — in fact, almost one in three older Australians will suffer a fall each year. Such falls can have extremely serious consequences, including significant disability and even death.

Falls are one of the largest causes of harm in care. Preventing falls and minimising their harmful effects are critical. During care episodes, older people are usually going through a period of intercurrent illness, with the resultant frailty and the uncertainty that brings. They are at their most vulnerable, often in unfamiliar settings, and accordingly attention has been paid to acquiring evidence about what can be done to minimise the occurrence of falls and their harmful effects, and to use these data in the national Falls Guidelines.

These new guidelines consider the evidence and recommend actions in the three main care settings: the community, hospitals and residential aged care facilities. Each of three separate volumes addresses one of these care settings, providing guidance on managing the various risk factors that make older Australians in care vulnerable to falling.

The Australian Commission on Safety and Quality in Health Care is charged with leading and coordinating improvements in the safety and quality of health care for all Australians. These new guidelines are an important part of that work.

The ongoing commitment of staff in community, hospital and residential aged care settings is critical in falls prevention. I commend these guidelines to you.



Professor Chris Baggoley
Chief Executive
Australian Commission on
Safety and Quality in Health Care
August 2009

Contents

Tables

Figures

Acronyms and abbreviations

ACSQHC	Australian Commission on Safety and Quality in Health Care
AMTS	Abbreviated Mental Test Score
BMD	bone mineral density
BPPV	benign paroxysmal positional vertigo
CI	confidence interval
FROP-Com	Falls Risk for Older People (community version) Screening and Assessment tools
GP	general practitioner
HOME FAST	Home Falls and Accidents Screening Tool
ICER	incremental cost-effectiveness ratio
IU	international unit
MMSE	Mini-Mental State Examination
NHMRC	National Health and Medical Research Council
(OH)D	hydroxyvitamin D
PBS	Pharmaceutical Benefits Scheme
ProFaNE	Prevention of Falls Network Europe
QALY	quality-adjusted life year

Preface

Falls are a significant cause of harm to older people. The rate, intensity and cost of falls identify them as a national safety and quality issue. The Australian Commission on Safety and Quality in Health Care (ACSQHC) is charged with leading and coordinating improvements in the safety and quality of health care nationally, and has consequently produced these guidelines on preventing falls and harm from falls in older people.

Health care services are provided in a range of settings. Therefore, ACSQHC has developed three separate falls prevention guidelines that address the three main care settings: the community, hospitals and residential aged care facilities. Although there are common elements across the three guidelines, some information and recommendations are specific to each setting. Collectively, the guidelines are referred to as the Falls Guidelines.

This new document, *Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Community Care 2009*, aims to reduce the number of falls and the harm from falls experienced by older people in the community.

The guidelines and support materials are suitable for use by health professionals for individuals and community groups that:

- do not have a falls prevention program or plan in place
- have recently initiated a falls prevention program or plan
- have a successful falls prevention program or plan in place.

Older people themselves are at the centre of the guidelines. Their participation, to the full extent of their desire and ability, encourages shared responsibility in health care, promotes quality care and focuses accountability.

The guidelines are written to promote independence and rehabilitation. Living in the community involves some risk for many older people. The guidelines do not promote an entirely risk-averse approach to the health care of older people. Some falls are preventable, some are not preventable. However, an excessively custodial and risk-averse approach designed to avoid complaints or litigation from at-risk older people and their carers may infringe on the older person's autonomy and limit rehabilitation.

Whenever possible, these guidelines are based on research evidence and are written to supplement the clinical knowledge, competence and experience applied by health professionals. However, as with all guidelines, and the principles of evidence based practice, their application is intended to be in the context of professional judgment, clinical knowledge, competence and experience of health professionals. The guidelines also acknowledge that the clinical judgment of informed professionals is best practice in the absence of good-quality published evidence. Some flexibility may also therefore be required to adapt these guidelines to specific settings, local circumstances, and to older people's needs, circumstances and wishes.

The following additional materials have been prepared to accompany the guidelines:

- *Guidebook for Preventing Falls and Harm From Falls in Older People: Australian Community Care 2009. A Short Version of* Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Community Care 2009
- Falls Guidelines — fact sheets.

The two other guidelines for hospitals and residential aged care facilities are the result of a review and rewrite of the first edition of the guidelines, *Preventing Falls and Harm from Falls in Older People — Best Practice Guidelines for Australian Hospitals and Residential Aged Care Facilities 2005*,[1] which were developed by the former Australian Council for Safety and Quality in Health Care.

Key messages of the guidelines

- Many falls can be prevented.
- Fall and injury prevention needs to be addressed at the point of care and from a multidisciplinary perspective.
- Managing many of the risk factors for falls (eg delirium or balance problems) will have wider benefits beyond falls prevention.
- Engaging older people themselves is an integral part of preventing falls and minimising harm from falls.
- Best practice in fall and injury prevention includes implementing falls prevention strategies, or identifying falls risk and implementing targeted individualised strategies that are resourced adequately, and monitored and reviewed regularly.
- Multifactorial interventions (ie a combination of interventions tailored to the individual) are effective for reducing the rate of falls in the community setting.
- In the community setting, some single interventions (eg certain exercise programs and home safety programs in high-risk subgroups, and vitamin D with calcium supplementation for older people with low blood levels) can reduce falls and the number of fallers.
- The consequences of falls resulting in minor or no injury are often neglected. Factors such as fear of falling and reduced activity level can profoundly affect function and quality of life, and increase the risk of seriously harmful falls.
- At a strategic level, there will be a time lag between investment in a falls prevention program and improvements in outcome measures.

Acknowledgments

The Australian Commission on Safety and Quality in Health Care (ACSQHC) acknowledges the authors, reviewers and editors who undertook the work of reviewing, restructuring and writing the guidelines.

ACSQHC acknowledges the significant contribution of the Falls Guidelines Review Expert Advisory Group for their time and expertise in the development of the Falls Guidelines 2009.

ACSQHC also acknowledges the contribution of many health professionals who participated in focus groups, and provided comment and other support to the project. In particular, the National Injury Prevention Working Group, a network of jurisdictional policy staff, played a significant role communicating the review to colleagues and providing advice.

The guidelines build on earlier work by the former Australian Council for Safety and Quality in Health Care and by Queensland Health.

The contributions of the national and international external quality reviewers and the Office of the Australian Commission on Safety and Quality in Health Care are also acknowledged.

ACSQHC funded the preparation of these guidelines. Members of the Falls Guidelines Review Expert Advisory Group have no financial conflict of interest in the recommendations in the guidelines.

A full list of authors, reviewers and contributors is provided in Appendix 1.

ACSQHC gratefully acknowledges the kind permission of St Vincent's and Mater Health Sydney to reproduce many of the images in the guidelines.

Falls Guidelines Review Expert Advisory Group

Chair

Associate Professor Stephen Lord — Principal Research Fellow, Prince of Wales Medical Research Institute, The University of New South Wales

Members

Associate Professor Jacqueline Close — Senior Staff Specialist, Prince of Wales Hospital and Clinical School, The University of New South Wales; Honorary Senior Research Fellow, Prince of Wales Medical Research Institute, The University of New South Wales

Ms Mandy Harden — CNC Aged Care Education/Community Aged Care Services, Hunter New England Area Health Services, NSW Health

Professor Keith Hill — Professor of Allied Health, La Trobe University/Northern Health, Senior Researcher, Preventive and Public Health Division, National Ageing Research Institute

Dr Kirsten Howard — Senior Lecturer, Health Economics, School of Public Health, The University of Sydney

Ms Lorraine Lovitt — Leader, New South Wales Falls Prevention Program, Clinical Excellence Commission

Ms Rozelle Williams — Director of Nursing/Site Manager, Rice Village, Geelong, Victoria, Mercy Health and Aged Care

Project manager

Mr Graham Bedford — Policy Team Manager, ACSQHC

External quality reviewers

Associate Professor Ngaire Kerse — Associate Professor, General Practice and Primary Health Care, School of Population Health, Faculty of Medical and Health Sciences, The University of Auckland, New Zealand

Professor David Oliver — Consultant Physician and Clinical Director, Royal Berkshire Hospital, Reading, United Kingdom; Visiting Professor of Medicine for Older People, School of Community and Health Science, City University, London, United Kingdom

Associate Professor Clare Robertson — Research Associate Professor, Department of Medical and Surgical Sciences, Dunedin School of Medicine, University of Otago, New Zealand

Technical writing and editing

Ms Meg Heaslop — Biotext Pty Ltd, Brisbane

Dr Janet Salisbury — Biotext Pty Ltd, Canberra

Summary of recommendations and good practice points

This section contains a summary of the guideline's recommendations and good practice points. These are also presented at the start of each chapter, with accompanying references and explanations.

Part B Standard falls prevention strategies

Chapter 4 Falls prevention interventions

Recommendations

Intervention

- Use effective interventions to reduce falls in the community, for example certain exercise programs, assessment followed by multifactorial treatment, home safety interventions in high-risk groups, and academic detailing for general practitioners by a pharmacist. (Level I)[7]

Single interventions

- Older people should be encouraged to exercise to prevent falls. Certain programs have been shown to be effective and largely focus on balance training. (Level I)[7,40]
- Older people with visual impairment primarily related to cataracts should undergo cataract surgery as soon as practicable. (Level II)[41,42]
- When conducted as a single intervention, home environment interventions are effective for reducing falls in high-risk older people. (Level I)[43]
- For individual older people, gradual and supervised withdrawal of psychoactive medications should be considered to prevent falls. (Level II)[44]
- People with severe visual impairment should receive a home safety assessment and modification program specifically designed to prevent falls. (Level II)[45,46]
- Use cardiac pacing in older people who live in the community, and who have carotid sinus hypersensitivity and a history of syncope or falls, to reduce the rate of falls. (Level II)[47]
- Collaborative review and modification of medication by general practitioners and pharmacists, in conjunction with individual patients, is recommended to prevent falls. (Level II)[48]
- Vitamin D and calcium supplementation should be recommended as an intervention strategy to prevent falls in older people who live in the community, particularly if they are not exposed to the minimum recommended levels of sunlight. Benefits from supplementation are most likely to be seen in people who have vitamin D insufficiency (25(OH)D <50 nmol/L) or deficiency (25(OH)D <25 nmol/L). (Level I)[7] (Level I-*)[49]

Multiple interventions

- The combination of exercise targeting strength and balance, education and home safety intervention (the Stepping On Program) is recommended to reduce the rate of falls in older people who live in the community. (Level I)[43]

Multifactorial interventions

- In older people at risk of falls, individualised assessment leading directly to tailored interventions is recommended. (Level I)[7]

Good practice points

- The general practitioner can 'prescribe' verbal or written instructions for falls prevention interventions (eg exercise programs) for the older person to improve or maintain independence, and encourage adherence.
- Managing many of the risk factors for falls (eg balance problems, medication) will have wider benefits beyond falls prevention.

Part C Management strategies for common falls risk factors

Chapter 5 Falls risk screening and assessment

Recommendations

Screening and assessment

- Older people should be asked about falls at least once every year by their general practitioner or other health care provider.
- Older people with a history of one or more falls in the past year should be assessed using a simple, validated balance test or falls risk screen.
- Older people who perform poorly on a simple test of balance or gait, or on a falls risk screening tool, should undergo a detailed assessment to identify contributory risk factors.
- Falls risk screening and assessment tools used should be evidence based (meaning that they have demonstrated good predictive accuracy, and have been evaluated in the relevant setting in more than one site).
- Falls prevention interventions may need to be modified to make sure they are suitable for the individual, and often the carer(s) and family members will also play important roles in implementing falls prevention actions.

Good practice points

Falls risk screening

- Falls risk screening should be used to guide more detailed assessment and intervention, and the outcomes of the screen should be documented and discussed with the older person and their carer(s).
- When the threshold score of a screening tool is exceeded, a falls risk assessment should be conducted as soon as practicable. If the score is not exceeded, standard falls prevention strategies apply.

Falls risk assessment

- To develop an individualised plan for preventing falls, health care professionals need to identify systematically and comprehensively the factors contributing to the older person's increased risk of falling.
- Interventions delivered as a result of the assessment provide benefit rather than the assessment itself; therefore, it is essential that interventions systematically address the risk factors identified.
- Identifying the presence of cognitive impairment should form part of the falls risk assessment process.

Chapter 6 Balance and mobility limitations

Recommendations

Assessment

- Use assessment tools to:
  - quantify the extent of balance and mobility limitations and muscle weaknesses
  - guide exercise prescription
  - measure improvements in balance, mobility and strength
  - assess whether the older person has a high risk of falling.

Intervention

- Deliver exercise programs to prevent falls in older people who live in the community (eg group exercise classes, strength and balance retraining at home, tai chi classes). (Level I)[7]
- Improve the effectiveness of exercise programs for preventing falls by including challenging balance training and frequent exercise. (Level I)[7,40]
- Encourage exercise for falls prevention in all older people in the community, not only those who have an increased risk. (Level I)[7,40]

Chapter 7 Cognitive impairment

Recommendations

Assessment

- Older people with cognitive impairment have an increased risk of falls and should have their falls risk factors assessed.

Intervention

- Identified falls risk factors should be addressed as part of a multifactorial falls prevention program, and strategies to minimise injuries (such as using hip protectors or vitamin D and calcium supplementation) should be considered. (Level I-*)[49]

Note: there is no evidence that falls can be reduced in older people with cognitive impairment living in the community.[7] See the residential aged care facilities guidelines for further information on providing treatment to older people with cognitive impairment.

Good practice points

- Older people presenting with an acute change in cognitive function should be assessed for delirium and the underlying cause of this change.
- Older people with gradual onset, progressive cognitive impairment should undergo detailed assessment to determine diagnosis, and where possible, reversible causes of the cognitive decline. Reversible causes of acute or progressive cognitive decline should be addressed and treated.
- If an older person with cognitive impairment does fall, reassess their cognitive status, including presence of delirium (eg using the Confusion Assessment Method tool).
- Interventions shown to work in cognitively intact populations should not be withheld from cognitively impaired populations; however, interventions for older people with cognitive impairment may need to be modified and supervised, as appropriate.

Chapter 8 Continence

Recommendations

Assessment

- Older people should be offered a continence assessment to check for problems that can be modified or prevented.

Intervention

- Manage problems associated with urinary tract function as part of a multifactorial approach to care. (Level I-*)[49]

Note: there is no evidence that assessing or treating incontinence will prevent falls in older people living in the community.[7]

Good practice point

- Check the height of the toilet(s) and the need for rails to assist the older person sitting and standing from the toilet(s) in the home.

Chapter 9 Feet and footwear

Recommendations

Assessment

- Assessment should include screening for ill-fitting or inappropriate footwear and for foot pain and other foot problems, because these are risk factors for falls.

Interventions

- Include an assessment of footwear and foot problems as part of an individualised, multifactorial intervention for preventing falls in the community. (Level IV)[196,197]
- Health care providers should provide education and information about footwear features that may reduce falls risk. (Level III-2)[198]

Note: there is no evidence that assessing or addressing footwear and foot problems as a single intervention will prevent falls in older people living in the community.

Good practice points

- Health care providers should educate older people and provide information on foot problems and foot care, and refer them to a podiatrist when necessary.
- Safe footwear characteristics include:
  - *soles*: shoes with thinner, firmer soles appear to improve foot position sense; a tread sole may further prevent slips on slippery surfaces
  - *heels*: a low, square heel improves stability
  - *collar*: shoes with a supporting collar improve stability.

Chapter 10 Syncope

Recommendations

Assessment

- Older people who report unexplained falls or episodes of collapse should be assessed for the underlying cause.

Intervention

- Assessment and management of potential causes of presyncope and syncope should form part of a multifactorial intervention to reduce the rate of falls in older people. (Level I)[7]
- Use cardiac pacing in older people who live in the community, and who have carotid sinus hypersensitivity and a history of syncope or falls, to reduce the rate of falls. (Level II)[47]

Chapter 11 Dizziness and vertigo

Recommendations

Assessment

- Vestibular disorders as a cause of dizziness, vertigo and imbalance need to be identified in the community setting. A history of vertigo or a sensation of spinning is highly characteristic of vestibular pathology.
- Use the Dix–Hallpike test to diagnose benign paroxysmal positional vertigo, which is the most common cause of vertigo among older people, and which can be identified in the community setting. This is the only cause of vertigo that can be treated easily.

Note: there is no evidence from randomised controlled trials that treating vestibular disorders will prevent falls.

Good practice points

- Use vestibular rehabilitation to treat dizziness and balance problems where indicated.
- Use the Epley manoeuvre to manage benign paroxysmal positional vertigo.
- All manoeuvres should only be done by an experienced person.

Chapter 12 Medications

Recommendations

Assessment

- Older people living in the community should have their medications (prescribed and nonprescribed) reviewed at least yearly, and for those on four or more medications, at least six monthly.

Intervention

- Medication review and modification should be undertaken as part of a multifactorial approach to falls prevention. (Level I)[7]
- For individual older people, gradual and supervised withdrawal of psychoactive medications should be considered to prevent falls. (Level II)[44]
- Pharmacist-led education on medication and a program of facilitated medication review by general practitioners should be encouraged in the community setting. (Level II)[48]

Good practice point

- Consider likely pharmacological changes when prescribing any new medication to an older person and avoid prescribing psychoactive drugs if clinically possible.

Recommendations

Assessment

- Include a test of vision as part of a falls risk assessment.
- Encourage older people to have regular eye examinations (every two years) to reduce the incidence of visual impairment, which is associated with an increased risk of falls.

Interventions

- Older people with visual impairment primarily related to cataracts should undergo cataract surgery as soon as practicable. (Level II)[41,42]
- When correcting other visual impairment (eg prescription of new spectacles), explain to the older person and to their family and carers (where appropriate) that extra care is needed while the older person gets used to the new visual information. (Level II)[77]
- Advise older people who take part in regular outdoor activities to avoid bifocals or multifocals and to use single-vision distance spectacles when walking — especially when negotiating steps or walking in unfamiliar surroundings. (Level III-2)[284]
- People with severe visual impairment should receive a home safety assessment and modification program specifically designed to prevent falls. (Level II)[45,46]

Good practice point

- Detailed assessment by an optometrist or orthoptist for a fall-specific eye examination should:
  - identify the presence of eye diseases
  - calculate subjective refraction and determine optimum spectacle correction
  - check for high-contrast visual acuity using the Snellen eye chart and for contrast sensitivity using the Pelli–Robson test charts, the Melbourne Edge Test or similar
  - assess visual fields using the Humphrey Field Analyser or similar
  - assess depth perception.

Recommendations

Assessment

- Include a test of vision as part of a falls risk assessment.
- Encourage older people to have regular eye examinations (every two years) to reduce the incidence of visual impairment, which is associated with an increased risk of falls.

Interventions

- Older people with visual impairment primarily related to cataracts should undergo cataract surgery as soon as practicable. (Level II)[41,42]
- When correcting other visual impairment (eg prescription of new spectacles), explain to the older person and to their family and carers (where appropriate) that extra care is needed while the older person gets used to the new visual information. (Level II)[77]
- Advise older people who take part in regular outdoor activities to avoid bifocals or multifocals and to use single-vision distance spectacles when walking — especially when negotiating steps or walking in unfamiliar surroundings. (Level III-2)[284]
- People with severe visual impairment should receive a home safety assessment and modification program specifically designed to prevent falls. (Level II)[45,46]

Chapter 14 Environmental considerations

Recommendations

Assessment

- Older people considered to be at higher risk of falling should be assessed by an occupational therapist for specific environmental or equipment needs and training to maximise safety.

Intervention

- Environmental review and home hazard modification should be considered as part of a multifactorial approach in a falls prevention program for older people in the community. (Level I)[7]
- When conducted as a single intervention, home environment interventions are effective for reducing falls in high-risk older people. (Level I)[43]

Good practice point

- It is important to help the older person understand the relevance of any environmental modifications, to improve uptake of such interventions.

Chapter 15 Individual surveillance and observation

Good practice points

- Sitter programs (eg using staff or volunteers to sit with at-risk older people) may be useful for individual people.
- Bed, chair or foot alarms can alert a carer that the person is attempting to mobilise.
- A personal alarm, when worn, can trigger an alert that a person has fallen, and minimise the time they lie on the floor.
- Electronic sensor monitoring systems are being developed and tested, but they are not likely to be available widely for some time.

Part D Minimising injuries from falls

Chapter 16 Hip protectors

Recommendations

Assessment

- When assessing an older person's need for hip protectors, the general practitioner or other health professional should consider the older person's recent falls history, age, mobility, disability status, and whether they have osteoporosis or a low body mass index.
- Assess the older person's cognition and independence in daily living skills (eg dexterity in dressing) to help determine whether they will be able to use hip protectors.

Intervention

- Physiotherapists or other members of the health care team should teach older people and their carers how to put hip protectors on properly, because their effectiveness is reduced when they are not worn correctly. (Level II)[330]
- When using hip protectors as part of a falls prevention strategy, the health care team or carer should check regularly that the older person is wearing their protectors, that the hip protectors are in the correct position, and that they have not stopped wearing them because of discomfort, inconvenience or other reasons. (Level I)[331]

Note: hip protectors have not been shown to prevent hip fractures in the community setting.

Good practice point

- Hip protectors should not be relied on to reduce falls-related injuries in the community setting, due to problems with adherence. However, because they offer some protection to older people in residential aged care, hip protectors can be considered in community settings as part of a strategy to minimise harm from falls, as long as they are worn properly and their use is monitored.

Chapter 17 Vitamin D and calcium supplementation

Recommendations

Assessment

- Consider adequacy of calcium and vitamin D as part of routine assessment of falls risk in older people living in the community.

Intervention

- Vitamin D and calcium supplementation should be recommended as an intervention strategy to prevent falls in older people who live in the community, particularly if they are not exposed to the minimum recommended levels of sunlight. Benefits from supplementation are most likely to be seen in people who have vitamin D insufficiency (25(OH)D <50 nmol/L) or deficiency (25(OH)D <25 nmol/L). (Level I-*)[49]

Good practice points

- Encourage older people to include high calcium foods in their diet, and exclude foods that limit calcium absorption.
- For older people with cognitive impairment who have problems with medication adherence, consider using an intermittent but high-dose preparation of vitamin D (that is, less frequent administration, but the same total dose as recommended for older people without cognitive impairment).

Recommendations

Assessment

- Older people with a history of recurrent falls should be considered for a bone health check. Also, older people who sustain a minimal-trauma fracture should be assessed for their risk of falls.

Intervention

- Older people with diagnosed osteoporosis or a history of low-trauma fractures should be offered treatment for which there is evidence of benefit. (Level I)[364]

Good practice point

- When using osteoporosis treatments, older people should be co-prescribed vitamin D with calcium.

Part E Responding to falls

Chapter 19 Post-fall management

Good practice points

- After the immediate follow-up of a fall, determine how and why a fall may have occurred and implement actions to reduce the risk of another fall.
- It is better to ask an older person whether they remember the sensation of falling or whether they think that they blacked out, because many older people who have syncope are unclear whether they blacked out.
- An in-depth analysis of the fall may be required if there has been a serious injury following a fall, or if a death from a fall has occurred in the presence of a member of the health care team.

Part A
Introduction

1 Background

1.1 About the guidelines

These guidelines aim to improve the safety and quality of care for older people. They are designed for health professionals providing care in Australian community settings and offer a nationally consistent approach to preventing falls based on best practice recommendations. The development of these guidelines was funded and managed by the Australian Commission on Safety and Quality in Health Care (ACSQHC).

The guidelines advocate autonomy, independence, enablement and rehabilitation in the context of an acceptable risk of falling. A degree of risk is inevitable in promoting autonomy in older people.

Any fall needs to be considered in the context of the care provided relative to best practice for the older person within the specific environment. Some falls may continue to occur even when best practice is followed. In such cases, there remains a need for vigilant monitoring, review of the care plan and implementation of actions to minimise injury risk.

1.2 Scope of the guidelines

1.2.1 Targeting older Australians

Falls can occur at all ages, but the frequency and severity of falls-related injury increases with age.[2] These guidelines have been developed with older people — defined as people aged 65 years and over — in mind. When considering Indigenous Australians, *older people* commonly refers to people aged over 50 years.[3] These guidelines may also apply to younger people at increased risk of falling, such as those with a history of falls, neurological conditions, cognitive problems, depression, visual impairment or other medical conditions that alter functional ability.[4]

1.2.2 Specific to the Australian community

These guidelines have been developed for health professionals and services providing care in Australian community settings. Primarily, community settings are private homes in which older people are receiving care, but may also include low-acuity community health centres. Recommendations have been tailored for the diversity of community settings.

Separate guidelines have been developed for the hospital and residential aged care facility settings.

1.2.3 Relevant to all members of the health care team

All members of the health care team (including general practitioners, allied health professionals, carers, etc) have a role to play in preventing falls in older people. These guidelines have been developed for all those who are involved in the care of older people. This includes support services as well as clinical, management and corporate staff.

1.3 Terminology

1.3.1 Definition of a fall

For a nationally consistent approach to falls prevention within Australia, it is important that a standard definition of a *fall* be used. For the purpose of these guidelines, the following definition applies:

> A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level.[5]

To date, no national data definition for a fall exists in the National Health Data Dictionary (compiled by the Australian Government's Australian Institute of Health and Welfare).

1.3.2 Definition of an injurious fall

These guidelines use the Prevention of Falls Network Europe (ProFaNE) definition of an *injurious fall*. According to this definition, the only injuries that could be confirmed accurately using existing data sources are peripheral fractures — defined as any fracture of the limb girdles and of the limbs. Head injuries, maxillo-facial injuries, abdominal, soft tissue and other injuries are not included in the recommendation for a core dataset.†

However, other definitions of an injurious fall include traumatic brain injuries (TBIs) as a falls-related injury, particularly as falls are the leading cause of TBIs in Australia (representing 42% of TBI-related hospitalisations in 2004–05).[6]

1.3.3 Definition of assessment and risk assessment

In these guidelines, *assessment* is defined as an objective evaluation of the older person's functional level by their ability to perform certain tasks and activities of daily living (eg dressing, feeding, grooming, mobilising).

Falls risk assessment is a detailed and systematic process used to identify a person's risk factors of falling. It is used to help identify which interventions to implement. Falls risk assessment tools should be validated prospectively in more than one group or study (see Chapter 5 for more detail).

† http://www.profane.eu.org

1.3.4 Definition of interventions

An *intervention* is a therapeutic procedure or treatment strategy designed to cure, alleviate or improve a certain condition. Interventions can be in the form of medication, surgery, early detection (screening), dietary supplements, education, or minimisation of risk factors.

In falls prevention, interventions can be:

- targeted at a single risk factor — *single interventions*
- targeted at more than one risk factor
  - *multiple interventions* — where everyone receives the same, fixed combination of interventions
  - *multifactorial interventions* — where people receive multiple interventions, but the combination of these interventions is tailored to the person, based on an individual assessment.

This classification of falls prevention interventions into three types is defined in the taxonomy used by the Cochrane Collaboration (developed by ProFaNE[†]).

In the community setting, some single, multiple and multifactorial interventions are effective for reducing falls.[7] Single interventions include exercise programs, vitamin D and calcium supplementation and home safety modifications. Multiple and multifactorial interventions may include any combination of these interventions, among others.

Chapter 4 contains more information about the effective interventions that are available for use in the community setting.

1.3.5 Definition of evidence

These guidelines use a *definition* of evidence based on Health-evidence.ca — a Canadian online resource funded by the Canadian Institutes of Health Research, and run by McMaster University. It defines evidence as:

> Knowledge from a variety of sources, including qualitative and quantitative research, program evaluations, client values and preferences, and professional experience.

Furthermore, these guidelines were developed using the principles of *evidence based practice*, which is the process of integrating clinical expertise and the preferences and values of the older person with the results from clinical trials and systematic reviews of the medical literature. This approach also involves avoiding interventions that are shown to be less effective or even harmful.

See Section 1.4 for more details on the development of the guidelines using an evidence based approach.

1.4 Development of the guidelines

1.4.1 Expert advisory group

To guide and provide advice to the project, a multidisciplinary expert panel (the Falls Guidelines Review Expert Advisory Group) was established in 2008. This included specialists in the areas of falls prevention research, measurement and monitoring, quality improvement, change management and policy, as well as health care professionals from fields including geriatric medicine, allied health and nursing. When necessary, the expert panel accessed resources outside its membership. An additional external quality reviewer was appointed to review the guidelines from an Australian perspective. An internationally renowned, independent quality reviewer (with expertise in the community setting) also reviewed these guidelines.

† http://www.profane.eu.org

‡ http://health-evidence.ca

1.4.2 Review methods

These guidelines were developed drawing on the following sources:

- a search of the most recent literature for each risk factor or intervention
- the most recent Cochrane review of falls prevention interventions in the community setting
- feedback from health professionals and policy staff implementing the previous guidelines
- clinical advice from the expert advisory group
- guidance from external expert reviewers
- guidance from international external expert reviewers
- guidance from specialist groups (including the Royal Australian College of General Practitioners and the Australian Association of Gerontology and Continence Foundation of Australia).

A systematic review of each aspect of falls prevention, for each setting (community, hospital and residential aged care facility) was beyond the capacity and timeframe of this update of the guidelines.

Due to these constraints, it was not possible to follow the National Health and Medical Research Council's (NHMRC's) detailed requirements for developing and grading clinical practice guidelines.[8] In particular, search terms and details of study inclusion and exclusion criteria were not recorded, data extraction tables were not compiled for included studies, quality appraisal criteria were not systematically applied, and the body of evidence was not graded in the way set out by the NHMRC.

However, the expert group was mindful of the need for a thorough review of the evidence supporting each recommendation. The methods used to review assessment and intervention recommendations are described briefly below.

Assessment

Assessment recommendations were based on information supplied by the clinical experts, supplemented by general literature reviews, where relevant. The text of each section describes the supporting information and provides a rationale for each recommendation. As NHMRC methods for reviewing diagnostic questions have not been followed, no attempt has been made to apply levels of evidence or to grade these recommendations.

Interventions

Literature searches were carried out with the aim of identifying the highest quality information for each intervention (systematic reviews — particularly Cochrane reviews — meta-analyses, and randomised controlled trials). This is in line with recommended methods for evidence based practice, where answers to clinical questions are needed quickly based on rapid identification of the best quality literature.[9] The information retrieved in this way was checked and supplemented by information from the extensive personal research databases of the clinical experts. Each chapter was reviewed by an external expert reviewer, then the entire guidelines were reviewed by an expert for each setting.

Economic evaluation

A systematic review of published economic evaluations was undertaken. Literature searches were carried out in Medline (1950 to end July 2008), CINAHL (1982 to end July 2008) and EMBASE (1980 to end July 2008). MeSH terms (Economics/; or Economics, Medical/; or Economics, Hospital/; or Technology Assessment, Biomedical/; or Models, Economic/) and text words for economic evaluations (cost effectiveness, cost utility, cost benefit, etc) were combined with MeSH and text words relating to falls or to hip protectors. Reference lists of relevant studies and reviews were also searched, and Australian researchers were contacted.

The search identified 388 abstracts. All abstracts were reviewed and excluded if they did not appear to be economic evaluations of either falls prevention interventions or hip protectors. Studies that included relevant data or information were retrieved and their full-text versions were analysed and examined for study eligibility. Across all interventions, 27 papers were identified that considered the costs or economic benefits of falls prevention interventions or hip protectors. The methods, results and limitations of these papers are discussed in the relevant intervention sections.

1.4.3 Levels of evidence

The NHMRC's six-point rating system for intervention research was used to classify each paper according to the strength of evidence that can be derived given the specific methods used in the paper. Table 1.1 lists the six levels of evidence.

Table 1.1 National Health and Medical Research Council levels of evidence

Level	Description
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial
III-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies with concurrent controls and allocation not randomised (cohort studies), case–control studies, or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single-arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test, or pretest and post-test

Source: NHMRC[10]

It is possible to have methodologically sound (Level I) evidence about an area of practice that is clinically irrelevant or has such a small effect that it is of little practical importance. These issues were not formally reviewed during this update of the guidelines, but relevant issues are described in the text of each section and were taken into account by the expert group in developing the recommendations.

Caution is needed when using the evidence from a particular community subgroup or setting to apply to an individual or to a different community subgroup or setting. In these guidelines, the highest level of evidence for an intervention is reported regardless of the setting; however, when the research setting is not the community, an asterisk (*) is added to the level (eg Level I-*). This shows that caution is needed when applying economic implications for that recommendation to a community setting.

The guidelines will be reviewed in 2014.

1.5 Consultation

The consultation process involved a call for submissions, an online survey, multiple nationwide workshops (in all state and territory capitals and a number of regional centres), teleconferences, and targeted interviews with key stakeholders. A wide range of useful, high-quality responses from these processes helped in the development of the guidelines (and subsequent implementation process), as well as in identifying other areas of action.

In addition, specialist groups provided invaluable feedback on previous guidelines and draft versions of these guidelines. They included the National Injury Prevention Working Group, the Australian Association of Gerontology, the Royal Australian College of General Practitioners and the Continence Foundation of Australia.

Development of the 2005 guidelines was underpinned by a large consultative process, from which these (2009) guidelines benefit.

1.6 Governance of the review of the Australian Falls Guidelines

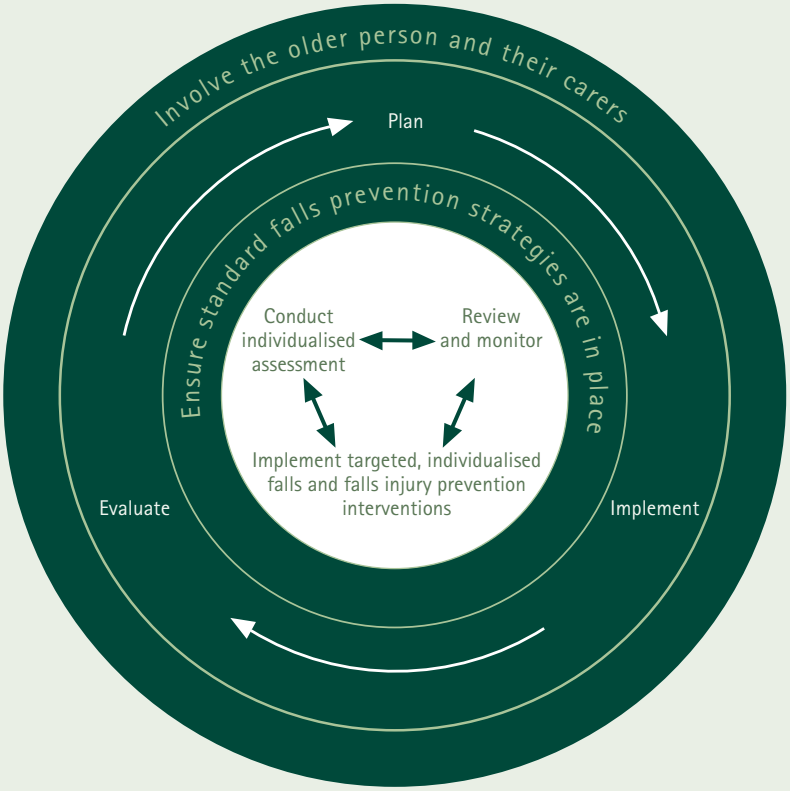
The Falls Guidelines development project was directed by ACSQHC in conjunction with its Inter-Jurisdictional, Private Hospital Sector and the Primary Care Committees. It was managed by the Office of the Australian Commission on Safety and Quality in Health Care on the advice of the Falls Guidelines Review Expert Advisory Group, which recommended the final guidelines for endorsement to ACSQHC.

1.7 How to use the guidelines

1.7.1 Overview

Figure 1.1 provides a step-by-step overview of how to use the guidelines to prevent falls and falls injuries in older people in the Australian community, in the context of consumer involvement. It is split into two linked sections:

- The bold arrows in the outer circle represent the strategic level. This is a 15-step approach in three sections:
  - plan a falls and falls injury prevention program
  - implement a falls and falls injury prevention program
  - evaluate a falls and falls injury prevention program.
- The inner circle represents interventions that can be applied at the point of care (ie the site where the older person receives the intervention). A best practice approach of individualised assessment followed by targeted individualised interventions is presented in Parts B to D of the guidelines *(Standard falls prevention strategies, Management strategies for common falls risk factors and Minimising injuries from falls).*



Plan

Plan for implementation

Step 1: Identify teams
Step 2: Identify, consult, analyse and engage key stakeholders
Step 3: Assess organisational readiness
Step 4: Analyse falls

Plan for evaluation

Step 5: Establish a baseline

Plan for quality improvement

Step 6: Review current clinical practice

Implement

Step 7: Decide on implementation approaches
Step 8: Determine process for implementation
Step 9: Conduct trial
Step 10: Learn from trial
Step 11: Proceed to widespread implementation for improvement
Step 12: Sustain implementation

Evaluate

Step 13: Measure process
Step 14: Measure outcomes
Step 15: Report and respond to results

Figure 1.1 Using the guidelines to prevent falls in Australia

1.7.2 How the guidelines are presented

The guidelines are presented in five parts:

- Part A — *Introduction*
- Part B — *Standard falls prevention strategies*
  - single, multiple and multifactorial falls prevention interventions
- Part C — *Management strategies for common falls risk factors*
  - falls risk screening and assessment
  - 10 specific risk factors and corresponding interventions
- Part D — *Minimising injuries from falls*
  - hip protectors
  - vitamin D and calcium supplementation
  - osteoporosis management
- Part E — *Responding to falls.*

For ease of reference, Parts C and D consider each falls risk factor and corresponding intervention in separate chapters. However, these interventions can be successful when used in combination (with some exceptions; see Chapter 4). Assessment of falls risk factors are discussed first (Part C), followed by interventions to minimise falls and harm from falls (Part D). This does not imply importance of one chapter over another.

Health care professionals and carers should consider the advantages and risks of using injury prevention strategies, as outlined in Part D, to give older people in the community extra protection from falls and related injuries. These strategies can be used after a fall or applied systematically to the population at risk.

Chapters on intrinsic and extrinsic risk factors in Parts C and D begin with a set of evidence based recommendations (assessment or intervention, or both, as appropriate). The supporting information for these recommendations is presented in the remainder of the chapter, which is organised into:

- background information and evidence — contains an overview of the risk factor or intervention, and a summary of the relevant literature on clinical trials
- principles of care — explains how to implement the intervention of interest
- special considerations — provides information relevant to specific groups (eg older people with cognitive impairment, rural and remote populations, and Indigenous and culturally and linguistically diverse groups)
- economic evaluation — summarises the relevant literature on health economics.

The guidelines contain text boxes for important information, as outlined below:

Evidence based recommendations

- Evidence based recommendations are presented in boxes at the start of each chapter, accompanied by references. They were selected based on the best evidence and accepted by the expert advisory group and external quality reviewers.
- Where possible, separate recommendations for assessment and interventions are given. Assessment recommendations have been developed by the expert advisory group based on current practice and a review of the literature discussed in the text of each section.
- Intervention recommendations are based on a review of the research on the use of the intervention. Each recommendation is accompanied by a reference to the highest quality study upon which it is based, as well as a level of evidence (see Section 1.4.3 for an explanation of levels of evidence).

Recommendations based on evidence nearer the I end of the scale should be implemented, whereas recommendations based on evidence nearer the IV end of the scale should be considered for implementation on a case-by-case basis, taking into account the individual circumstances of the older person.

Good practice points

- Good practice points have been developed for practice where there have not been any studies; for example, where there are no studies assessing a particular intervention, or where there are no studies specific to a particular setting. In these cases, good practice is based on clinical experience or expert consensus.

Point of interest

These boxes indicate points of interest. Most points of interest were revealed by the Australia-wide consultation process or from grey literature (conference proceedings, etc).

Case study

These boxes indicate case studies. These case studies provide information on likely scenarios, which are used as illustrative examples.

Boxes containing additional information, such as useful websites, organisations or resources, are also provided. References are listed at the end of the guidelines.

2 Falls and falls injuries in Australia

The following is a brief summary of the background information derived from the literature in relation to falls. Noninjurious falls in the home tend to be under-reported, resulting in a reporting bias — of the people who fall in the community, fewer than half report the fall to a health care professional.[11] Despite this, older people receiving community services are at increased risk of falling; therefore, health professionals delivering community-based services are ideally placed to have a role in falls prevention.

Specific literature related to risk factors for falling is outlined in the relevant sections.

2.1 Incidence of falls

Prospective studies undertaken in community settings around the world have found fall rates in older people who live in the community to be approximately 30–40% each year. In the Randwick Falls and Fractures Study conducted in Australia, 39% of 341 women aged 65 years and older (and living in the community) reported one or more falls in a one-year follow-up period.[12] In a large New Zealand study of 761 people aged 70 years and older, 40% of the 465 women and 28% of the 296 men fell at least once in the study period of one year — an overall incidence rate of 35%.[13] A study from the United States found a 32% incidence rate (of one or more falls) in 336 people aged 75 years and older.[14] Similar rates have been reported in Canada in a 48-week prospective study of a random sample of 409 people (65 years and older), living in the community (29%),[15] and in Finland in 833 people (70 years and older), living in the community in five rural districts (30%).[16]

2.2 Location of falls

In older people who live in the community, about 50% of falls occur within their homes and immediate home surroundings.[16,17] Most falls occur on level surfaces within commonly used rooms, such as the bedroom, lounge room and kitchen. Comparatively few falls occur in the bathroom, on stairs, or from ladders and stools. While a proportion of falls involve a hazard such as a loose rug or a slippery floor, many do not involve obvious environmental hazards.[17] The remaining falls occur in public places and in other people's homes. Commonly reported environmental factors involved in falls in public places include pavement cracks and misalignments, gutters, steps, construction works, uneven ground and slippery surfaces.

The location of falls is related to age, sex and frailty. In older women who live in the community, the number of falls occurring outside the home decreases with age, with a corresponding increase in the number of falls occurring inside the home on a level surface.[18] Campbell et al[17] found that fewer men than women fell inside the home (44% versus 65%) and more men fell in the garden (25% versus 11%). Frailer groups with limited mobility suffer most falls within the home. These findings indicate that the occurrence of falls is strongly related to exposure — that is, they occur in situations where older people are undertaking their usual daily activities. Furthermore, most falls occur during periods of maximum activity in the morning or afternoon, and only about 20% occur between 9 pm and 7 am.[17]

2.3 Consequences of falls

Falls are the leading cause of injury-related hospitalisation in people aged 65 years and over, and account for 14% of emergency admissions[19] and 4% of all hospital admissions in this age group.[20] Hospital admissions resulting from falls are uncommon in young adulthood but with advancing age, the incidence of falls related admissions increases at an exponential rate. Beyond 65 years, the admission rate due to falls increases exponentially for both sexes, with a ninefold increase in the rate in males and females between the ages of 65 and 85 years.[21] Falls also account for 40% of injury-related deaths and 1% of total deaths in this age group.[22]

Depending on the population studied, anywhere between 22% and 60% of older people suffer injuries from falls: 10–15% suffer serious injuries, 2–6% suffer fractures and 0.2–1.5% suffer hip fractures. The most commonly self-reported injuries include superficial cuts and abrasions, bruises and sprains. The most common injuries that require hospitalisation are hip fractures, pelvic fractures, fractures of the leg, fractures of the radius, ulna and humerus, and fractures of the neck and trunk.[21-23]

In terms of morbidity and mortality, one of the most serious falls-related injury is fracture of the hip. Elderly people often recover slowly from hip fractures and are vulnerable to postoperative complications. In many cases, hip fractures result in death, and of those who survive, many never regain complete mobility. Marottoli et al[24] analysed the outcomes of 120 people from a cohort study who suffered a hip fracture over a six-year period. Before their fractures, 86% of participants could dress independently, 75% could walk independently and 63% could climb a flight of stairs. Six months after their injuries, these percentages had fallen to 49%, 15% and 8%, respectively.

Another consequence of falling is the 'long lie' — that is, remaining on the ground or floor for more than one hour after a fall. The long lie is a marker of weakness, illness and social isolation, and is associated with high mortality rates among older people. Time spent on the floor is associated with fear of falling, muscle damage, pneumonia, pressure sores, dehydration and hypothermia.[25-27] Wild et al[28] found that half of those who lie on the floor for one hour or longer die within six months, even if there is no direct injury from the fall. Vellas[29] found that more than 20% of people admitted to hospital as a result of a fall had been on the ground for one hour or more. Tinetti et al[30] found that up to 47% of noninjured fallers are unable to get up off the floor without assistance.

Falls can result in restriction of activity, increased fear of falling, reduced quality of life and loss of independence. In a study of 5093 older people, Kiel et al[31] found that fallers (particularly recurrent fallers) were at greater risk of reporting subsequent difficulties with activities of daily living and more physically demanding activities, after controlling for age, sex, self-perceived health status and pre-existing difficulties with activities of daily living. Tinetti et al[32] found similar associations in a study involving 957 people older than 71 years, living in the community. After adjusting for potential confounding factors, both noninjurious and injurious falls were associated with declines in basic and instrumental activities of daily living over a three-year prospective period. Furthermore, those who suffered two or more noninjurious falls reported declines in social activities and those who suffered one or more injurious falls reported reduced physical activity levels.

Falls can lead to an excessive fear of falling, sometimes referred to as the 'post-fall syndrome', which is manifest as a loss of confidence, hesitancy and tentativeness, with resultant loss of mobility and independence. After falling, many older people report a fear of falling[32,33] and curtailing activities due to a fear of further falls.[25,29]

Finally, falls can also lead to disability and decreased mobility, which often results in dependency on others and therefore an increased probability of requiring residential care.[34,35]

2.4 Cost of falls

In addition to injuries, the effects of falls are costly to the older person (in terms of function and quality of life[2]) and also to the community. Research across all settings has shown that, in the face of an ageing population, if nothing more is done to prevent falls by 2051:

- the total estimated health cost attributable to falls related injury will increase almost threefold from A$498.2 million in 2001 to A$1375 million in 2051
- in hospitals, there will be 886 000 additional bed days per year or the equivalent of 2500 additional beds permanently allocated to treating injuries from falls
- 3320 additional residential aged care facility places will be required.

To maintain the current health costs, there will need to be a 66% reduction in the incidence of falls by 2051.[36]

2.5 Economic considerations in falls prevention programs

In health care, resources are limited — there are insufficient resources to provide all programs to all people. Therefore, health care providers and funders need to choose programs that ensure good value for money. It is no longer enough to demonstrate that an intervention is effective — it should also be a good use of scarce health care resources. Individual and organisational components of programs for preventing falls should be selected by weighing up the costs and the benefits (health outcomes). Health care providers must decide how they can facilitate improvements in health outcomes with finite resources, choosing the most effective intervention they can afford.

Economic evaluation of falls prevention programs is an important element of the overall decision-making process when comparing different options for falls prevention. An economic evaluation (often called a cost-effectiveness analysis) compares both costs and health outcomes of alternative health care programs. Health outcomes from a falls prevention intervention can be counted in 'natural units', such as falls prevented, fractures prevented, deaths prevented and survival — often expressed as 'life years saved' (LYS) or as multidimensional health outcomes, which include both survival and quality of life in a single composite measure (such as a 'quality-adjusted life years' — QALYs).

The cost effectiveness of a new program is assessed by comparing the costs and health outcomes of the program with the costs and health outcomes of an alternative program (often current clinical practice or usual care) by calculating an 'incremental cost-effectiveness ratio' (ICER). The ICER represents the extra cost for each additional unit of health outcome, and is a measure of value for money. Programs with lower ICERs offer better value for money (they are most cost effective) than programs with higher ICERs.

2.6 Risk factors for falling

There are a number of common risk factors for falling among older people. A person's risk of falling increases as the number of risk factors accumulates.[2]

Risk factors may be intrinsic (related to a person's behaviour or condition) or extrinsic (related to a person's environment or their interaction with the environment). Table 2.1 summarises the risk factors for falling in the community.

Table 2.1 Risk factors for falling in the community

Intrinsic factors	Extrinsic factors
Increased age	Inappropriate footwear (high heels and slippers
History of falls	Inappropriate spectacles
Chronic medical conditions (eg stroke, Parkinson's disease, arthritis)	Inappropriate spectacles
Multiple medications and specific types (eg psychoactive medications)	
Impaired balance and mobility	
Reduced muscle strength	
Sensory problems (eg impaired vision, peripheral neuropathy	
Dizziness	
Impaired cognition	
Incontinence	
Low levels of physical activity	
Slow reaction time	
Fear of falling	
Being female	

Some risk factors are associated with an increased risk of recurrent falls in the community setting, including confusion, unsafe gait and antidepressant medications.[7] Those people whose medical condition impacts directly on one or more falls risk factors, such as stroke, have high fall rates in the community setting.[7]

Best practice for preventing falls in the community includes four components:

- the implementation of standard falls prevention strategies
- the identification of falls risk factors
- the implementation of interventions targeting these risks so as to prevent falls
- the prevention of injury to those people who do fall.

3 Involving older people in falls prevention

The participation of the older person in their own health care is central to high-quality and accountable health services. It also encourages shared responsibility in health care. The older person can help facilitate change in health care practices.

Health care professionals should consider the following issues to encourage older people to participate in falls prevention:

- Make sure the falls prevention message is presented within the context of staying independent for longer.[37]
- Be aware that the term 'falls prevention' could be unfamiliar and the concept difficult to understand for many people in this age group.[37]
- Provide relevant and user-friendly information to allow older people and their carers to take part in discussions and decisions about preventing falls[38] (see the fact sheets on preventing falls).
- Find out what changes an older person is willing to make to prevent falls, so that appropriate and acceptable recommendations can be made.[38]
- Offer information in languages other than English, where required[38]; however, do not assume literacy in their own language.
- Explore the potential barriers that may stop older people from taking action to reduce falls (such as low self-efficacy and fear of falling) and support older people to overcome these barriers.[38]
- Develop falls prevention programs that are flexible enough to accommodate the older person's needs, circumstances and interests.[38]
- Ask the older person's family to help in falls prevention strategies.
- Trial a range of interventions with the older person.[39]

Part B
Standard falls prevention strategies

4 Falls prevention interventions

Recommendations

Intervention

- Use effective interventions to reduce falls in the community, for example certain exercise programs, assessment followed by multifactorial treatment, home safety interventions in high-risk groups, and academic detailing for general practitioners by a pharmacist. (Level I)[7]

Single interventions

- Older people should be encouraged to exercise to prevent falls. Certain programs have been shown to be effective and largely focus on balance training. (Level I)[7,40]
- Older people with visual impairment primarily related to cataracts should undergo cataract surgery as soon as practicable. (Level II)[41,42]
- When conducted as a single intervention, home environment interventions are effective for reducing falls in high-risk older people. (Level I)[43]
- For individual older people, gradual and supervised withdrawal of psychoactive medications should be considered to prevent falls. (Level II)[44]
- People with severe visual impairment should receive a home safety assessment and modification program specifically designed to prevent falls. (Level II)[45,46]
- Use cardiac pacing in older people who live in the community, and who have carotid sinus hypersensitivity and a history of syncope or falls, to reduce the rate of falls. (Level II)[47]
- Collaborative review and modification of medication by general practitioners and pharmacists, in conjunction with individual patients, is recommended to prevent falls. (Level II)[48]
- Vitamin D and calcium supplementation should be recommended as an intervention strategy to prevent falls in older people who live in the community, particularly if they are not exposed to the minimum recommended levels of sunlight. Benefits from supplementation are most likely to be seen in people who have vitamin D insufficiency (25(OH)D <50 nmol/L) or deficiency (25(OH)D <25 nmol/L). (Level I)[7] (Level I-*)[49]

Multiple interventions

- The combination of exercise targeting strength and balance, education and home safety intervention (the Stepping On Program) is recommended to reduce the rate of falls in older people who live in the community. (Level I)[43]

Multifactorial interventions

- In older people at risk of falls, individualised assessment leading directly to tailored interventions is recommended. (Level I)[7]

Good practice points

- The general practitioner can 'prescribe' verbal or written instructions for falls prevention interventions (eg exercise programs) for the older person to improve or maintain independence, and encourage adherence.
- Managing many of the risk factors for falls (eg balance problems, medication) will have wider benefits beyond falls prevention.

4.1 Background and evidence

In these guidelines, the term *standard falls prevention strategies* refers to strategies that are used when a person is identified as being at risk of falling. This section outlines evidence, recommended actions and resources to address specific falls risk factors and interventions.

A number of effective falls prevention interventions are available for older people living in the community.[7] These include strategies for:

- an individual older person
- subgroups of older people who are at risk of falls
- the older population living in the community as a whole.

The Prevention of Falls Network Europe (ProFaNE) has classified falls prevention interventions into three categories: single, multiple and multifactorial (see also Section 1.3.4 for definitions of interventions).

Single interventions that are effective in reducing falls include exercise (particularly exercise programs that include balance training), vitamin D supplementation (although only in people with low vitamin D levels) and home safety interventions (again, only in high-risk subgroups of older people).

Multiple interventions tested in Australia that were effective in reducing the *rate* of falls (eg the Stepping On Program) included:[39]

- exercise
- participant education
- home safety.

Multiple interventions with three combinations of components that were all effective in reducing the *risk* of falling included:[50]

- exercise and home safety
- exercise and vision assessment
- exercise, vision assessment and home safety.

A Cochrane systematic review of controlled (not randomised) trials concluded that a multiple intervention as a population-based approach to preventing falls-related injury is effective and can form the basis of public health practice.[51]

Assessing older people for their risk of falling, and then implementing multifactorial interventions based on these risk factors, reduces the rate of falls, although it does not appear to have a significant effect on the risk of falling.[7] After a falls risk assessment has been done, those factors identified as contributing to a person's risk of falling can be addressed in an individualised plan focused on preventing falls.

For older people who live in the community, the success of interventions can be limited by adherence.[2] Education and involvement in decision making is essential for encouraging older people (and their carers) to adopt and adhere to falls prevention interventions.[2]

4.1.1 Use of economic evaluation

An economic evaluation compares the costs and health outcomes of a falls prevention program with the costs and health outcomes of an alternative (often current clinical practice or usual care). Cost-effectiveness analyses have been reported as part of eight randomised controlled trials testing falls prevention interventions.[7] There are also economic evaluations of falls prevention interventions reported from controlled trials and using analytic models. The evidence from testing the effectiveness and investigating the cost effectiveness of falls prevention programs is summarised in the relevant chapters.

4.2 Exercise interventions

Evidence shows that several different types of exercise programs reduce both the rate of falls and the risk of falling in older people living in the community (see also Chapter 6 on balance and mobility limitations for more information).[7] This evidence comes from 50 randomised controlled trials testing an exercise program as a single intervention with the aim of preventing falls. Currently, no exercise program used alone has reduced falls in hospital patients or residential aged care facility residents.

The following types of exercise tested in randomised controlled trials have been found to prevent falls in older people living in the community:[7]

- *home-based balance and strength training* (eg the Otago Exercise Programme):[52,53] the pooled rate ratio was 0.66, 95%CI 0.53 to 0.82 (indicating a 34% reduction in falls)
- *group-based tai chi*:[54-57] the pooled rate ratio was 0.63, 95%CI 0.52 to 0.78 (indicating a 37% reduction in falls)
- *other group exercise programs*:[58-63] the pooled rate ratio was 0.78, 95%CI 0.71 to 0.86 (indicating a 12% reduction in falls).

The Otago Exercise Programme is an individually prescribed home exercise program comprising balance retraining, lower limb muscle strengthening and walking components. Randomised controlled trials have shown that it is effective in reducing falls in older people recruited from general practitioners' (GPs') registers when delivered for one year by an experienced physiotherapist, or by a trained nurse closely supervised by a physiotherapist.[52,53] Participants were recruited on the basis of age alone. Overall in four trials, the Otago Exercise Programme reduced the rate of falls by 35% and the rate of injuries by 35%.[64] The program was found to be more effective (and therefore more cost effective) in those people aged 80 years and older, and in those people who had fallen previously.

Group exercise in the form of tai chi was initially shown to significantly reduce falls in a trial of people aged 70 years and older living in an independent care facility.[56,65] However, the same intervention in a group of transitionally frail older people was not effective, indicating that this intervention is likely to be more beneficial in the less frail population.[66] A program of tai chi classes for one hour per week for 16 weeks was effective in reducing falls by 33% at six months in older people in Sydney, recruited through newspaper advertisements (with an age range of 60–96 years).[55,67]

More recently, other group exercise interventions have been shown to reduce falls.[58,68] In addition, a meta-analysis found that exercise programs that challenge balance and include frequent exercise reduce fall rates more than programs without these features.[40] Pooled results from 44 trials of exercise programs to prevent falls indicated that people allocated to exercise programs had 17% fewer falls than those allocated to control programs (pooled rate ratio 0.83, 95%CI 0.75 to 0.91). Programs that included a higher challenge to balance and a higher dose of exercise, but did not include a walking program, had the greatest effect on falls. These programs reduced fall rates by 42% (pooled rate ratio 0.58, 95%CI 0.48 to 0.69). The fact that programs without a walking component were more effective possibly indicates that time spent walking in programs of limited duration reduces time spent undertaking more intensive balance training.

In summary, both group and individual exercise programs can prevent falls. It is likely that some people will be more willing and able to exercise with others at a community centre and other people would prefer a home setting. A strategy to achieve ongoing exercise may be combining supervised group exercise with initial, interspersed or follow-on home exercise programs.

To be effective, exercise programs need to have a component that challenges balance and have a higher total dose of exercise.[40] There is also evidence that detraining occurs and benefits are lost when exercise programs finish, so a maintenance component is important when planning an exercise program.[69]

4.2.1 Targeting falls prevention exercise programs

Exercise programs can prevent falls when they are aimed at the general community, as well as when targeted at people who have an increased risk of falls. Greater relative reductions in fall rates have occurred in studies with broader inclusion criteria than in studies that only included people at high risk of falls.[7] This provides support for a population-based approach to falls prevention with appropriate exercise programs.

However, the consequences of falls (such as injuries and reduced activity levels) may have a greater impact in higher risk populations. For example, the Otago Exercise Programme reduced falls by 66% in the subgroup aged ≥80 years,[53] whereas falls were reduced by 35% overall in all participants in four clinical trials (aged ≥65 years).[64] For this particular program, the absolute numbers of falls prevented were greater in the older age group.

Conversely, this program was not effective in a younger group currently taking psychoactive medication,[44] or those with a severe visual impairment.[45] For these reasons, appropriate exercise programs for falls prevention should be carefully targeted at subgroups at high risk and also offered to the general, older community.

4.3 Other single interventions

The following sections describe interventions, other than exercise programs, that have been evaluated as a single intervention in randomised controlled trials and found to be effective in reducing the rate or the risk of falling.

4.3.1 Vitamin D supplementation

One intervention that has been studied in some detail is the use of vitamin D for preventing falls. Several meta-analyses with different inclusion criteria examining the effect of vitamin D on falls in older people have reported conflicting results.[7,70,71]

A Cochrane systematic review included 13 randomised controlled trials that assessed vitamin D supplementation with or without calcium supplementation as a single intervention to prevent falls in older people living in the community.[7] The review found no evidence for an effect of vitamin D (with or without calcium supplementation) on the rate of falls or risk of falling. However, a subgroup analysis of people with low vitamin D levels showed a significant reduction in both the rate of falls and risk of falling (but, this was based on a small number of trials). Vitamin D analogues (eg calcitriol) may be useful for preventing falls, but are also associated with adverse effects, such as hypercalcaemia. No economic evaluations have been included in the randomised controlled trials of vitamin D for the prevention of falls.

There is clear evidence for the benefits of vitamin D in preventing fractures,[72] as well as a strong association between vitamin D deficiency and neuromuscular function.[73] Therefore, the use of vitamin D has been well supported in the older population due to the high rate of vitamin D deficiency, particularly in those in long-term care. See Chapter 17 for more details on prescribing vitamin D and calcium to older people.

4.3.2 Medication review and withdrawal

Withdrawal of medications

Gradual withdrawal of psychoactive medications resulted in a large reduction in falls in a trial of 93 people aged ≥65 years living in the community and regularly taking these medications.[44] At the end of the 44-week follow-up period, there was a statistically significant (66%) reduction in falls in the medication withdrawal group compared with those continuing to take their active medication. However, one month after the trial was completed, 8 of the 17 participants (47%) in the intervention group who had successfully withdrawn from medications, resumed their medications. This highlights the difficulty in maintaining older people without psychoactive medications once these medications have been prescribed.

The preferred approach would therefore be to avoid prescribing psychoactive drugs if possible; that is, if appropriate for the older person, their medical condition and their social situation. Due to the small sample size, the results from this trial should be interpreted with caution — particularly because withdrawal from psychoactive drugs is difficult. There were no adverse effects from medication withdrawal noted in the trial.

A prospective cohort study investigated the impact of withdrawing drugs that increase the risk of falls, which included anxiolytics or hypnotics, neuroleptics, antidepressants, antihypertensives, antiarrhythmics, nitrates and other vasodilators, analgesics and hypoglycaemics.[74] Participants were 139 older outpatients with a history of falling and attending a geriatric outpatient clinic. Dose withdrawal or reduction was possible in 75 participants (54%). The remaining 64 participants (46%) either did not take a drug that increases the risk of falling or withdrawal was not possible. After a month of medication withdrawal and two months of follow-up, the risk of a fall in the drug withdrawal/reduction group had halved. Withdrawal of both cardiovascular and psychoactive medications was associated with a reduction in falls.

Academic detailing for general practitioners

An Australian cluster randomised controlled trial studied the effectiveness of a three-part quality use of medicines program for GPs.[48] The intervention consisted of education (academic detailing, prescribing information and feedback), medication risk assessment, a medical review checklist and financial incentives. Pharmacists instructed GPs on how to conduct medication reviews, particularly the use of benzodiazepines, traditional and nontraditional NSAIDs (nonsteroidal anti-inflammatory drugs), and antihypertensives. Participants completed a medication risk assessment containing questions such as whether they had three or more health problems, were taking four or more medications, and whether they had experienced any side effects such as sleep deprivation (see Figure 12.1 in Chapter 12). Intervention GPs decided whether their

participants would benefit from a medication review and, if so, completed a medication review checklist. Although there was no significant difference in the use of the target medications at the 12-month follow-up, the adjusted odds of falling, sustaining an injury as a result of a fall, and seeking medical attention as a result of a fall were lower for participants in the intervention group.

4.3.3 Cardiac pacemaker insertion

A randomised controlled trial showed that treating cardioinhibitory carotid sinus sensitivity with a pacemaker in people aged 50 years or older reduced the rate of falls.[47] However, cardioinhibitory carotid sinus sensitivity is not a common cause of falls. Carotid sinus massage was performed on 1624 people with an unexplained fall of the 24 251 people attending an accident and emergency department with a fall, and 175 people were recruited for the study. Carotid sinus syndrome should be considered in the presence of syncope associated with a fall, or when the cause of the fall is unexplained.[69] See Chapter 10 for more details about assessing and treating syncope in older people. No economic evaluations were found that examined the cost effectiveness of pacemaker insertion in the community setting.

4.3.4 Home safety programs

Systematic reviews show that home safety assessment and modification can reduce falls in older people at high risk.[7,43]

In the Australian trial by Cumming et al, where most participants were recruited on discharge from hospital, delivery of a home safety assessment and modification program by an experienced occupational therapist significantly reduced falls in the subgroup of older people who reported a fall in the previous year.[75] In this subgroup, falls were significantly reduced by 36% in those older people randomised to the home safety program. The home visit used a comprehensive and validated approach outlined in the Westmead Home Safety Manual.[76] The therapist assessed the older person's abilities and patterns of use of the home and reviewed the home with the older person. The review identified hazards, such as slippery floors and poor lighting, and specific unsafe behaviours, such as wearing loose shoes or leaving clutter in high traffic areas. A follow-up phone call was made two weeks later to check the modifications and encourage the older person to adopt the recommended behavioural changes.

Some older people will have impaired vision that cannot be corrected. A home safety assessment and modification program designed for older people with low vision can significantly reduce the rate of falls in people with severe visual impairment.[45] A randomised controlled trial showed that older people with severe visual impairment (6/24 or worse) benefited from a targeted home safety assessment and modification program.[45,46] In this trial (the VIP trial), 391 people aged 75 years and over, who were living in the community and who had severely impaired vision, were assigned to one of the following:

- a home safety program (*N*=100)
- an exercise program with vitamin D supplementation (*N*=97)
- both the home safety and the exercise program with vitamin D supplementation (*N*=98)
- a control group (who received a social visit) (*N*=96).

Falls were significantly reduced by 41% in those randomised to the home safety program but there was no reduction in the rate of falls in those receiving the exercise program, possibly due to low levels of adherence.[45]

Further information on home safety programs and environmental modification is provided in Chapter 14.

4.3.5 Improving vision

Four randomised controlled trials have evaluated the efficacy of interventions to improve vision as a falls prevention strategy. Expedited cataract surgery was effective in reducing the rate of falls when compared with remaining on a standard 12-month waiting list.[42]

Cataract surgery

Two related trials examined the effects of expedited cataract surgery in reducing falls. The first study involving 306 women aged >70 years examined the efficacy of cataract surgery in the first eye.[42] Participants were randomised to either expedited (approximately four weeks) or routine (12-month wait) surgery. Vision, visual disability, physical activity levels, anxiety, depression and balance confidence improved significantly in the operated group at the retest after six months. At one year follow-up, the rate of falls in the operated group was significantly reduced by 34% compared with the controls. This trial also

demonstrated that cataract extraction significantly reduced the risk of fractures in these older women, although the number of fractures was low (four participants in the operated group [3%] and 12 participants [8%] in the control group).

A second trial aimed to determine whether cataract surgery for the second eye further reduced falls; the trial also measured associated health gains.[41] In this study, 239 women aged over 70 years who had been referred to a hospital ophthalmology department with one unoperated cataract (the cataract in the other eye having been previously removed), were again randomised to either expedited (approximately four weeks) or routine (12-month wait) surgery. Visual function (especially stereopsis), confidence, visual disability and handicap all improved in the operated group compared with the control group. Over 12 months follow-up, the rate of falls was reduced by 32% in the operated group, but this did not reach statistical significance.

Vision assessment and eye examination

A trial with a multifactorial design recruited 1090 people aged 70 years and older who lived in the community.[50] The trial assessed the independent and combined effects of interventions aimed at vision improvement, home hazard management and group exercise. The vision improvement intervention involved referral to the participant's usual eye care provider if the participant had impaired vision (poor visual acuity, decreased stereopsis or reduced field of view) and was not already receiving treatment for this problem. The eye care provider was given the screening assessment results. Participants randomised to the vision improvement intervention had a nonsignificant 4% reduction in the risk of falling during the 18-month trial. However, there was a significant 14% reduction in the risk of falling when the vision intervention was combined with the exercise and home hazard management interventions, supporting the use of vision assessment and referral as part of a multifactorial approach to falls prevention.

A randomised controlled trial evaluated an intervention to improve vision that included comprehensive vision assessment and subsequent treatment for identified eye problems.[77] A group of 616 people aged 70 years and older who lived in the community were randomised to either a control group or the intervention group and followed for falls and fractures for 12 months. Just under half (44%) of the intervention group received some form of vision-related treatment, most often a new pair of spectacles. During the 12 months of follow-up, there was a 57% increase in falls in the intervention group compared with the control group. The authors speculated that large changes in visual correction (ie >0.75 diopter) may have increased the risk of falls, that the intervention participants might have needed more time to adapt to their updated prescriptions, or that they adopted more risk-taking activities (thus increasing their exposure to falls) after their vision improvement. An important limitation of this study was that many people in the control group reported that they did see an eye care professional during the follow-up period and demonstrated improvements in visual acuity similar to that of the intervention group.

The message from these trials suggests that frail, older people may need a considerable period of time to adjust to new spectacles. Eye care professionals should prescribe conservatively and give appropriate advice to older people about the need for caution during adaptation to changes in their spectacles.

See Chapter 13 for more information on vision interventions.

4.4 Multiple interventions

There are effective multiple interventions available and the evidence can be used for both an individual and a public health approach to falls prevention.[7,51]

In a 14-month randomised controlled trial in Sydney, small-group learning (two-hour weekly sessions for seven weeks) led to a significant 31% reduction in the rate of falls in people living in the community who had reported a fall in the previous 12 months. Falls prevention programs often take the form of group learning sessions run by community organisations. An ad hoc approach may not be effective, and therefore not cost effective in preventing falls, so these community organisations should consider using the Stepping On Program instead.

The Stepping On Program emphasises behaviour change to avoid falls. The program includes sessions on falls risk appraisal, exercise, home hazards, strategies to move around the local community, safe footwear, vision as a risk factor for falls, vitamin D, hip protectors, medication management, mastering safe mobility, and a home visit to follow through the falls prevention strategies and activities, and to assist with home adaptations and modifications if required. A booster session is held after three months.

Despite methodological limitations of the studies reviewed (five controlled but not randomised trials), the consistency of findings in a Cochrane systematic review led to the conclusion that a population-based approach to the prevention of falls-related injury is effective and can form the basis of public health practice.[51]

Two controlled trials also provide evidence that a concerted population approach to falls prevention will result in lower use of health care and reduced costs.[78,79] The cost-benefit evaluation of the Stay On Your Feet program in Queensland compared hospital records (admissions) between a matched sample and the intervention areas (see below).[80]

The program activities were based in the community and aimed at older people (aged ≥55 years).[78] They included selective advertising using specialty products, mass media campaigns, distribution of educational material (pamphlets, manuals, booklets), partnerships with GPs and other health professionals and workers, partnerships with local government, workshops, and training sessions regarding home modifications and appropriate exercises. The risk factors addressed were balance and gait problems, insufficient exercise, inappropriate footwear, poor vision, medication use, underlying medical conditions and environmental hazards.

A nonrandomised study from the United States compared rates of injuries from falls in a region that was exposed to interventions to change clinical practice (522 primary care clinicians, 133 outpatient rehabilitation facilities, 26 home care agencies, 7 acute care hospitals with emergency departments and 41 senior centres) with a region that had not been exposed to such interventions (460 primary care clinicians, 146 outpatient rehabilitation facilities, 7 acute hospitals and emergency departments, and 43 senior centres).[79] A multidisciplinary team used the media, websites, posters, brochures, educational materials, opinion leaders, advertising and outreach visits to everyone in the main group of clinicians and facilities being targeted. Results showed that between the pre-intervention period and the evaluation period, the falls-related use of medical services increased in the usual care region compared with the intervention region (adjusted rate ratio 0.89; 95%CI 0.86 to 0.92). The authors concluded that dissemination of evidence about falls prevention, coupled with interventions to change clinical practice, may reduce falls-related injuries in older people.

4.4.1 Economic evaluation

The Stay On Your Feet program (a community-based program of footwear, vision, medication, environment and physical activity assessments) was conducted in northern New South Wales resulting in cost savings associated with reduced hospitalisations.[80] The total cost for 950 participants of implementation was 1996A$805 579 over the four years from 1992–93 to 1995–96, including A$23 750 out-of-pocket participant costs. The analysis estimated savings from reduced hospitalisations, but did not calculate a cost per fall prevented.

A nonrandomised comparison of intervention and control regions in the United States showed an 11% relative reduction in the use of falls-related medical services in intervention regions.[79] The authors estimated that this may have led to potential savings of US$21 million in health care costs (based on an average acute care cost of US$12 000 per event); however, the authors did not report the total cost of implementing the intervention and did not calculate an incremental cost-effectiveness ratio.

Johansson et al conducted a modelled economic evaluation of a community-based nonpharmaceutical program for preventing hip fractures in older people in Sweden.[81] The community safety program consisted of structural environment changes (including local neighbourhoods and individual home assessments) and individual measures, such as safety promotion lectures and group-based balance exercises. Effectiveness was assessed using a quasi-experimental time series analysis before the intervention (1990–1995) and after the intervention (1996–2001). Results were modelled over a lifetime and indicated improved health outcomes, both in terms of life years and QALYs (quality-adjusted life years). The authors reported a Swedish krona (SEK) 71 000 cost saving when only the program-related costs (2004SEK 6.45 million) and the costs of hip fractures averted (2004SEK 6.52 million) were considered. No incremental cost-effectiveness ratio was reported.

4.5 Multifactorial interventions

Multifactorial interventions include assessing an individual's risk of falling, and then arranging referral or providing direct treatment to reduce the risks. To date, 31 randomised controlled trials of multifactorial interventions aimed at preventing falls have been reported.[7] A Cochrane review concluded that multifactorial interventions are effective in reducing the rate of falls but do not, overall, have a significant effect on the risk of falling in older people living in the community. The meta-analyses showed a high level of heterogeneity between studies, indicating that the interventions varied significantly in terms of their effectiveness. Subgroup analyses could not resolve whether including higher risk participants or increasing the intensity of interventions were factors in determining the effectiveness of interventions.

Another systematic review did not find an overall effect of multifactorial programs on the risk of falling.[82] The authors suggested that this may have been because the low intensity of some of the included programs lessened the pooled effect. This second systematic review also found bigger effects on the risk of falling in trials of interventions that were delivered as part of the trial compared with interventions that involved only referrals to programs.[82]

Some studies have tested a multifactorial intervention in a specific population, such as people presenting to the emergency department with a fall,[83,84] or people admitted to hospital and showing a functional decline.[85] Other studies have included people selected randomly from the community[50,86,87] or people with specified falls risk factors.[39,88]

Tinetti et al evaluated a multifactorial intervention program that reduced falls in older people in the community.[88] This program was tested at the Yale site of the multicentre FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) trials. Interventions targeting eight specific risk factors identified at baseline assessment were compared with social visits. Interventions included medication review, behavioural change recommendations, education and training, and home exercise programs. During one year of follow-up, 47% of the control group fell compared with only 35% of the intervention group and there was a significant 31% reduction in falls.

Another trial found that a medical and occupational therapy assessment and subsequent tailored intervention resulted in a significant decrease in fall rates over a one-year period.[19] Participants in this trial were people who had been attended to in an emergency department following a fall. The trial reported a substantial and significant reduction in the risk of falling (61%) and the risk of recurrent falls (67%).

The effectiveness of multifactorial interventions may be sensitive to differences between health care systems and networks at both local and national levels. For example, a trial by Hendriks et al[89] in The Netherlands aimed to reproduce the successful multifactorial intervention reported by Close from the United Kingdom.[19] However, their intervention did not prevent falls significantly. Major differences in the health system in The Netherlands compared with that in the United Kingdom made it difficult to make timely contact with the appropriate health professionals and implement the interventions when needed. The fact that the risk of falling was not reduced in the trial may be due to these health care differences, rather than to sample variation, because ineffective falls prevention interventions have also been reported from The Netherlands in other trials.[67,90]

Multifactorial interventions form the basis of many falls prevention services, but the interventions examined in randomised controlled trials are complex, and their effectiveness may depend on factors yet to be determined.

4.5.1 Multifactorial versus single interventions

Since most falls occur as a result of a combination of factors, in theory, the benefits of multifactorial interventions should be greater than single interventions. However, a meta-analysis found that single intervention approaches were just as effective in reducing falls as multifactorial prevention programs.[91]

There is a risk that older people may become confused or be offered conflicting advice when several interventions are attempted. In a trial of older people with severe visual impairment, participants who received a home safety program benefited more than those receiving the home safety program plus the Otago Exercise Programme.[45] A study in New Zealand found that multifactorial interventions containing this exercise program did not prevent falls when offered within a usual health care setting.[92] Therefore, when multifactorial interventions are delivered, they should be done so in a staged and integrated manner.

4.5.2 Economic evaluation

Rizzo et al conducted an economic evaluation in a cluster randomised controlled trial of Tinetti's home-based multifactorial intervention.[93] This intervention consisted of medication adjustments, environmental modifications and individualised exercise.[88] The authors reported a mean intervention cost of 1993US$925 ($588–1346), and lower mean total health care costs in the intervention group overall (intervention US$8310 compared with usual care US$10 439). The differences in these costs varied with falls risk (high risk, defined as four or more of the eight specified risk factors: intervention US$10 537 compared with usual care US$14 232; low risk [three or fewer risk factors]: intervention US$6026 compared with usual care US$5232). For the mixed high and low-risk population, and in the high-risk subgroup, the intervention was more effective and less costly than usual care. In the low-risk subgroup, the intervention had a cost-effectiveness ratio of US$2771 per fall prevented, and US$11 417 for preventing a fall that would require medical care.

In an Australian analysis of a multidisciplinary assessment and referral over 12 months, Day et al reported an intervention cost of 2008A$1196.97–1342.28 per person.[138] Over 12 months, the cost per fall prevented ranged from A$796.24 to A$892.20 (with the higher cost program) per fall prevented, and the cost per hospital admission averted ranged from A$39 812 to A$44 645 (with the higher cost program).

Hendriks et al undertook an economic evaluation of a randomised controlled trial of a multidisciplinary intervention in The Netherlands.[94] The authors reported a mean intervention cost of 2004€385, slightly lower mean total costs in the intervention (€4857) compared with control groups (€4991), and no significant differences in falls or in QALYs, concluding that, compared with usual care, the program was not cost effective in their setting.

4.6 Special considerations

4.6.1 Cognitive impairment

The interventions studied that have successfully reduced fall rates in the community have all excluded people with a significant degree of cognitive impairment or dementia. However, one randomised controlled trial investigated the effect of a multidisciplinary, multifactorial intervention on falls, specifically for people with cognitive impairment.[95] Unfortunately, this intervention did not significantly reduce falls.

Although most community-based trials of falls prevention list cognitive impairment as an exclusion criterion, the trials use different definitions of cognitive impairment. The Mini-Mental State Examination (MMSE) is the most commonly described tool used in trials, with different cut-off points used to define impaired cognition. A score of 20 and above has been used in a number of trials[68,88] and, as this score is relatively high, community studies include people who do have some cognitive impairment. Therefore, this group of people may be included in the study populations.

While there is limited evidence to support any specific strategy to prevent falls in older people with cognitive impairment, this group of people can often comply with falls prevention programs.[95,96] More research is required to define the relative contribution of risk factors to falls in older people with cognitive impairment, as well as to identify interventions specifically targeted to people with impaired cognition.

4.6.2 Indigenous and culturally and linguistically diverse groups

The risk of falls may be greater if people from Indigenous and culturally and linguistically diverse groups cannot read signs or understand information given by staff,[2] or are assessed inadequately due to language difficulties.

There is some evidence that falls prevention strategies may work differently among culturally and linguistically diverse groups (eg due to cultural differences in exercise preferences and dietary intake of calcium from dairy products).[97]

General points to consider when conveying falls prevention messages to Indigenous and culturally and linguistically diverse groups include:

- the importance of interpreters in the first instance
- the use of communication and translation boards
- seeking and using written information in the appropriate language and cultural context
- learning some basic words from the person's first language.

4.6.3 Rural and remote settings

A common problem in rural and remote settings is a shortage of some types of health professional. Where this is the case, options to support available expertise include telephone and video conferencing with experts or facilities with advanced programs in other areas or regions.[98] In instances where this approach is used, local staff should:

- ensure they have standard strategies in place before calling for support from external specialist staff
- carry out necessary screening, assessments and identification of appropriate interventions so that the basic assessment and interventions are in place by the time they are linked with the external support.

Part C
Management strategies for common falls risk factors

5 Falls risk screening and assessment

Recommendations

Screening and assessment

- Older people should be asked about falls at least once every year by their general practitioner or other health care provider.
- Older people with a history of one or more falls in the past year should be assessed using a simple, validated balance test or falls risk screen.
- Older people who perform poorly on a simple test of balance or gait, or on a falls risk screening tool, should undergo a detailed assessment to identify contributory risk factors.
- Falls risk screening and assessment tools used should be evidence based (meaning that they have demonstrated good predictive accuracy, and have been evaluated in the relevant setting in more than one site).
- Falls prevention interventions may need to be modified to make sure they are suitable for the individual, and often the carer(s) and family members will also play important roles in implementing falls prevention actions.

Good practice points

Falls risk screening

- Falls risk screening should be used to guide more detailed assessment and intervention, and the outcomes of the screen should be documented and discussed with the older person and their carer(s).
- When the threshold score of a screening tool is exceeded, a falls risk assessment should be conducted as soon as practicable. If the score is not exceeded, standard falls prevention strategies apply.

Falls risk assessment

- To develop an individualised plan for preventing falls, health care professionals need to identify systematically and comprehensively the factors contributing to the older person's increased risk of falling.
- Interventions delivered as a result of the assessment provide benefit rather than the assessment itself; therefore, it is essential that interventions systematically address the risk factors identified.
- Identifying the presence of cognitive impairment should form part of the falls risk assessment process.

5.1 Background and evidence

The terms *falls risk screening* and *falls risk assessment* are sometimes used interchangeably; but there are some clear differences. In these guidelines, they are considered separate but related processes. Screening is a process that primarily aims to identify people at increased risk. In the community setting, a falls risk screen can be used to identify older people who require a more detailed falls risk assessment.[99] Falls risk assessments aim to identify factors that increase the risk of falling and that may be amenable to intervention. Even where risk factors for falling cannot be reversed, alternative strategies can be implemented to minimise the risk of falling, or to prevent injury if an increased risk is identified.

Many falls risk screening and assessment tools have been developed for use in the community setting. However, only some of these have been evaluated for reliability and predictive validity in prospective studies and have an acceptable level of sensitivity and specificity — that is, they are sufficiently accurate in predicting both fallers (who do fall in the follow-up period) and nonfallers (who do not fall in the follow-up period).

Screening and assessment are not stand-alone actions in falls prevention. Screening and assessment need to be linked to an action plan to address any modifiable falls risk factors they identify. In some randomised controlled trials, falls have been prevented by using age alone as an entry criterion (ie participants were recruited according to their age, which may have influenced the successful outcome for falls prevention interventions).[48,52,53,55]

Factors such as low bone mineral density, low body mass index and fragile skin increase the risk of injury if a fall occurs.

5.2 Principles of care

5.2.1 Falls risk screening

Falls risk screening is a brief process of estimating a person's risk of falling, classifying people as being at either low or increased risk. Falls risk screening usually involves only reviewing up to five brief items. Although not designed as comprehensive assessments, positive screening on certain screen items can also provide information about intervention strategies. When a falls risk screen is introduced, it needs to be supported with education for staff and intermittent reviews to ensure appropriate and consistent use.

The simplest falls risk screens that can be easily incorporated into routine care should record the older person's history of falls in the past 12 months and their balance and mobility status. Alternatively, a multiple-item screening tool can be used.[100] These tests and screens are summarised in the following sections.

History of falls in past 12 months

At least once a year, the general practitioner (GP) should ask all older people (or their carers) about any falls they have experienced.[100] The GP should also take a detailed history of the events surrounding the fall(s). This role could also be undertaken by other health professionals who provide care to older people living at home.

Balance and mobility performance

The American and British geriatrics societies recommend that all older people who report one or more falls in the preceding year should be assessed on the Timed Up and Go Test as a simple screening test to identify whether more detailed assessment of gait and balance is warranted.[100] The Timed Up and Go Test, which gives a global indication of steadiness, measures the time taken for a person to rise from a chair, walk three metres at normal pace with their usual assistive device, turn, return to the chair and sit down. While the results from studies have varied, taking 12 or more seconds to complete the test is an indicator of impaired functioning and increased falls risk (for people who live in the community).[101-103]

The Sit-to-Stand Test and Alternate Step Test have demonstrated validity, reliability and feasibility as falls risk screens in the community setting.[104] The Sit-to-Stand Test is a measure of lower limb strength, speed and coordination. The test involves asking the older person to rise from a chair of standard height without armrests, five times, as quickly as possible with their arms folded. The Alternate Step Test provides a measure of lateral stability and involves the time taken to complete eight steps, alternating between left and right foot, as fast as possible up onto a step.

Multiple-item screening tools

Other validated falls risk screening tools contain multiple items. For example, the FROP-Com (Falls Risk for Older People (community version)) fall screening test[105,106] contains three to five common risk factors that, in combination, can identify with reasonable accuracy those older people with an increased risk of falling.

If any item on a multiple risk factor screen is identified as being 'at risk', interventions should be considered for that risk factor — even if the person has a low falls risk score overall. For example, if a person scores an overall score of two on the FROP-Com screen (consisting of a score of zero for a previous fall, two for balance and mobility, and zero for a change in activities of daily living), they would have a low risk of falling overall. However, a preventive approach would use an intervention to address their mild balance impairment at this time.

Table 5.1 lists validated tests and tools that are available for screening falls risk.

Table 5.1 Screening tools

Timed Up and Go Test (TUG)[101-103]	
Description	TUG measures the time taken for a person to rise from a chair, walk three metres at normal pace with their usual assistive device, turn, return to the chair and sit down.
Time needed	1–2 minutes
Criterion	A time of ≥12 seconds indicates increased risk of falling

Sit-to-Stand Test (STS)[104]	
Description	STS provides a measure of lower limb strength, speed and coordination. It involves the time taken to complete five STS sequences as fast as possible from a chair of standard height (43 cm).
Time needed	1–2 minutes
Criterion	A time of ≥12 seconds indicates increased risk of falling

Alternate Step Test (AST)[104]	
Description	AST provides a measure of lateral stability and involves the time taken to complete eight steps, alternating between left and right foot, as fast as possible up onto a step that is 19 cm high and 40 cm deep.
Time needed	1–2 minutes
Criterion	A time of ≥10 seconds indicates increased risk of falling

FROP-Com Screen[107]	
Description	A three-item falls risk screening tool, developed from the FROP-Com assessment tool. The three items are a history of falls in the past 12 months; observations of steadiness while standing up, walking three metres, turning returning to the chair and sitting down; and self-reporting the need for assistance in performing domestic activities of daily living.
Time needed	1–2 minutes
Criterion	A score of >3 indicates increased risk of falling

5.2.2 Falls risk assessment

Assessing falls risk typically involves either the use of multifactorial assessment tools that cover a wide range of falls risk factors, or functional mobility assessments that focus on the physiological and functional domains of postural stability, including vision, strength, coordination, balance and gait. When identifying the cause of a fall, it is also important to remember that most falls occur as a result of an interaction between intrinsic and extrinsic factors, and that multiple factors increase the risk of falls.[108] Many disease processes that are more common in older people increase the risk of falls, mainly through impairing postural stability. Assessment tools provide detailed information on the underlying deficits contributing to overall risk and should be linked to intervention and management. Most falls risk assessments also classify people into low and high falls risk groups.

Several falls risk assessment tools are now available for use in community settings. However, when selecting a tool, it is important to check whether it has been validated prospectively, preferably in more than one site.[109,110] Table 5.2 lists some recommended falls risk assessment tools that have demonstrated applicability to Australian community care. Where publicly available, copies of these tools are provided in Appendix 2.

Table 5.2 Falls risk assessment tools

QuickScreen[104]	
Description	QuickScreen is a risk assessment tool designed for use by practice and rural nurses, allied health workers and GPs. It is based on the sensorimotor functional model for falls prediction. It allows the clinician to estimate the level of increased falls risk, and to determine which sensorimotor systems are impaired. This provides an opportunity to link assessment with evidence based tailored interventions. QuickScreen consists of the following measures: previous falls, medication use, vision, peripheral sensation, lower limb strength, balance and coordination. The falls assessment requires minimal equipment: a low-contrast eye chart, a filament for measuring touch sensation, and a small step. There is a cost associated with the purchase of QuickScreen; for details, see http://www.powmri.edu.au/research/facilities/falls-and-balance-research-group/quickscreen
Time needed	10 minutes
Criterion	A score of four or more indicates an increased risk of falling

FallScreen — Physiological Profile Assessment[111]	
Description	FallScreen is a validated risk assessment tool that can be linked to evidence based approaches to interventions. It provides detailed quantitative information on the physiological domains contributing to postural stability. FallScreen contains five assessment items: vision, peripheral sensation, lower limb strength, reaction time and body sway (short version); and more detailed assessments in the long version. There is a cost associated with the purchase of FallScreen; for details, see http://www.powmri.edu.au/health/falls-balance
Time needed	15–20 minutes (short version)
Criterion	A score of one or more indicates an increased risk of falling

FROP-Com (Falls Risk for Older People – community version)[106]	
Description	FROP-Com is a detailed falls risk factor assessment tool. It includes 13 risk factors in 26 questions with either dichotomous (0–1) or ordinal (0–3) scoring. A total of these individual scores provides an overall score of falls risk (range 0–60), with higher scores indicative of greater risk. The tool includes guidelines on scoring each risk factor, and evidence based referrals or interventions. No special equipment is required. The full FROP-Com and its guidelines are available at: http://www.mednwh.unimelb.edu.au/research/research_falls_service.htm
Time needed	10–15 minutes
Criterion	A score >18 indicates a high risk of falls

Falls risk assessments can be performed by a GP or other health professional. Based on the assessment outcome, these assessors might refer to other health professionals for more detailed assessment and management of identified risk factors; for example, a referral to an ophthalmologist for a detailed vision assessment for people with impaired vision, or a referral to a physiotherapist or exercise physiologist for a more detailed assessment of balance and mobility if the older person scores poorly in these areas. Most risk-assessment tools focus on intrinsic falls risk factors only, so a separate environmental assessment may be indicated to identify extrinsic falls risk factors (see Chapter 14 for more information on environmental assessment and modification).

The outcomes of the falls risk assessment, together with the recommended strategies to address identified risk factors, need to be documented and reported to other health care staff, and discussed with the older person and where applicable their carer(s). More specific assessments may be indicated for some risk factors (see Table 5.3). Descriptions of these assessments are provided in the respective chapters, as indicated in Table 5.3.

Table 5.3 Specific assessments of risk factors

Characteristic or feature	Measure	Assessment	Description
Impaired balance and mobility	Impaired balance	Postural sway and leaning balance tests, functional reach, Alternate Step Test	Chapter 6
	Reduced mobility	Six-Metre Walk Test, Timed Up and Go Test	
	Muscle weakness	Sit-to-Stand Test, spring balance	
Cognitive impairment	Dementia or delirium	Folstein Mini-Mental State Examination, Rowland Universal Dementia Scale, Confusion Assessment Method	Chapter 7 Appendix 3
Incontinence	Urinary and fecal	Questionnaires, assessment, physical examination	Chapter 8
Feet and footwear	Footwear analysis	Safe-shoe checklist, footwear assessment form	Chapter 9 and Appendix 4
	Foot pain (ie from bunions and corns) and deformities	Podiatrist assessment	
Syncope	Postural hypotension	Lying and standing blood pressure measurements, head-up tilt-table test	Chapter 10

Characteristic or feature	Measure	Assessment	Description
	Carotid sinus hypersensitivity	Carotid sinus massage by a medical specialist	
	Vestibular function	Head-thrust test, audiology testing, Dix–Hallpike test	
Dizziness	Benign paroxysmal positional vertigo	Dix–Hallpike test	Chapter 11
	Peripheral vestibular function	Halmagyi head-thrust test	
Medications	Benzodiazepines	Medication review	Chapter 12
	Specific serotonin reuptake inhibitors and tricyclic antidepressants	Medication review	
	Antiepileptic drugs and drugs that lower blood pressure	Medication review	
Vision	Visual acuity	Snellen eye chart, Pelli–Robson test chart	Chapter 13
	Contrast sensitivity	Melbourne Edge Test	
	Visual fields	Humphrey Field Analyser	
Environment	Impaired mobility, visual impairment	Home safety assessment by an occupational therapist	Chapter 14 Appendix 5
Individual surveillance and observation	Impaired mobility, high falls risk	Response systems, review and monitoring	Chapter 15

Case study

Mrs D went to her general practitioner (GP) after a fall. She had bruised her hip and was concerned it was broken. The GP asked whether she had fallen on other occasions in the past year, which Mrs D confirmed. The GP discussed the circumstances of her falls, which she reported included several trips both inside and outside the home, and a sense that her balance had progressively worsened. The GP assessed Mrs D using the Timed Up and Go Test, which she completed in 16 seconds. The practice nurse administered the QuickScreen assessment, which discovered that Mrs D was taking a benzodiazepine, and performed poorly in the Sit-to-Stand Test and Alternate Step Test. The GP reviewed and modified Mrs D's medications (including weaning her off the use of the benzodiazepine medication), and referred her for a physiotherapy assessment to prescribe an exercise program. An occupational therapy assessment was also organised to review home safety and consider functional needs at home. Six months later, Mrs D was taking part in a community strength and balance exercise program and had resumed her previous activities. She had regained confidence in her outdoors mobility, and had experienced no further falls.

5.3 Special considerations

5.3.1 Cognitive impairment

Cognitive impairment is an independent risk factor for falls (see Chapter 7). Up to 80% of older people who live in the community and have cognitive impairment fall in a 12-month period.[95] Identifying the presence of cognitive impairment should form part of the falls risk assessment process.[106] Identified falls risk factors should be incorporated into a management plan in the same way as for people who do not have cognitive impairment. However, interventions may need to be modified or provided in a different format for people with cognitive impairment.[112] For example, the carer(s) and family members may take on greater roles in supporting intervention implementation. Strategies to minimise risk of injuries from falls (for example, hip protectors, vitamin D with calcium supplementation, other osteoporosis management — see Part D) and environmental modification (see Chapter 14) also remain important.

5.3.2 Rural and remote settings

Falls risk factor assessments can usually be done by a health professional. For example, the FROP-Com and QuickScreen assessments were validated with assessments by GPs, physiotherapists, occupational therapists and nurses (practice, regional and remote).[106] Therefore, these assessments can be done by any trained member of the health professional team. With medical, nursing and health professional shortages in some rural and remote settings, flexibility and upskilling of team members may be required for successful assessment and interventions to be implemented.

5.3.3 Indigenous and culturally and linguistically diverse groups

To adequately assess the falls risk of people from Indigenous and culturally and linguistically diverse groups, the health care team needs to consider assessing the older person in the person's primary language and in a culturally appropriate manner. This may require using a translation and interpretation service.

6 Balance and mobility limitations

Recommendations

Assessment

- Use assessment tools to:
  - quantify the extent of balance and mobility limitations and muscle weaknesses
  - guide exercise prescription
  - measure improvements in balance, mobility and strength
  - assess whether the older person has a high risk of falling.

Intervention

- Deliver exercise programs to prevent falls in older people who live in the community (eg group exercise classes, strength and balance retraining at home, tai chi classes). (Level I)[7]
- Improve the effectiveness of exercise programs for preventing falls by including challenging balance training and frequent exercise. (Level I)[7,40]
- Encourage exercise for falls prevention in all older people in the community, not only those who have an increased risk. (Level I)[7,40]

6.1 Background and evidence

Balance is a highly complex skill in which the body's centre of mass is controlled within the limits of stability. This requires integration of accurate sensory information (such as vision and proprioception) and a well-functioning musculoskeletal system (not adversely affected by muscle weakness, pain or contracture) to execute appropriate movements. Different combinations of muscle actions are required to maintain balance (ie prevent falling) during the wide range of everyday motor tasks (eg standing, reaching, walking, climbing stairs). Increasing age, inactivity, disease processes and muscle weakness can impair balance abilities.[18]

Exercise is an effective single intervention for preventing falls in older people;[7] and is recommended by other guidelines.[113-115] See Section 4.2 for more information on exercise interventions.

Regular physical activity has many benefits, reducing the risk of cardiovascular disease, thromboembolic stroke, hypertension, type 2 diabetes mellitus, osteoporosis, obesity, colon cancer, breast cancer, anxiety and depression.[116] In addition, active older people are less likely to develop physical disability.[117] Studies have shown that it is possible to encourage older people to increase physical activity levels, particularly when cognitive behavioural approaches, such as self-monitoring and goal setting, are used.[118]

Observational studies have shown that older people who are more active have fewer falls.[119] However, simply encouraging older people to be more active does not seem to reduce the rate of falls. There is even some indication that increasing physical activity through walking programs may increase fall rates.[40,120,121]

In contrast, exercise programs can help to prevent falls[7,40] and falls-related injury[64] in older people. Exercise programs shown to be effective in preventing falls are available and should be used, because some types of exercise programs reduce falls and others do not.[7]

6.1.1 Impaired physical functioning increases the risk of falling

Impairments in various aspects of physical functioning increase a person's risk of falling. A systematic review found that gait or balance limitations are the most consistent predictors of future falls.[122]

Between 50% and 70% of falls in older people occur when walking. To avoid a fall while walking, an individual needs to be able to control the body's position as it moves forward in space, while safely negotiating obstacles, different terrains and unexpected events. Consequently, fallers walk more slowly and adopt a conservative gait pattern.[123]

Balance is the ability to complete a wide range of tasks safely, and is measured in many different ways (see Table 6.1 in Section 6.2.1, below; see also Chapter 5 for more information on assessment). Postural sway tests measure the amount of movement when a person attempts to stand still, whereas other tests (eg Alternate Step Test, Sit-to-Stand Test) measure the person's ability to complete different tasks. As Table 6.1 shows, poor performance on various balance tests has been associated with falls in older people who live in the community. The most appropriate test to use in different situations will depend on the purpose of testing (eg to predict falls, to measure improvement or to help with exercise prescription) and the nature of the population. Some tests are likely to have 'floor' or 'ceiling' effects in different populations. A floor effect occurs when the test is too hard, so many participants have low scores. For example, a single-leg stance test in a group of frequent fallers is likely to show a floor effect. A ceiling effect occurs when a test is relatively easy and many people achieve the maximum score. For example, measurements of an active population's ability to walk unaided may show a ceiling effect.

After controlling for balance, muscle weakness has been found to be an independent risk factor for falling — that is, muscle weakness makes a separate contribution to falls, over and above the effect of balance.[111] This is probably because muscle strength is required to safely perform tasks, such as getting up from a chair, climbing stairs and responding to unexpected events (eg tripping, being knocked off balance).

Other physiological abilities, such as vision, proprioception and reaction time, are also predictors of falls.[111] This is probably because these abilities are required to maintain an upright position during a range of tasks in a range of different environments.

Fortunately, impairment on several of the physical factors associated with falls can be reduced using exercise. Systematic reviews have shown that balance[124] and strength[125] can be improved by well-designed exercise programs.

6.1.2 Exercise as a single intervention

Evidence shows that certain exercise programs reduce the rate of falls and the risk of falling in older people living in the community (see Section 4.2).

6.2 Principles of care

6.2.1 Assessing balance, mobility and strength

Many different approaches can be used to assess balance, mobility and muscle strength in older people. Some of the clinical assessments that may be of use are outlined below in Table 6.1. The choice of tool depends on the time and equipment available and the level of ability of the older people being assessed.

An expanding field of research is evaluating different properties of measurement tools. These tools are evaluated according to their reliability (whether the tool is consistent when used by different people at different times), validity (whether the tool measures what it aims to measure) and responsiveness to change (how much change is required before it is certain that the change reflects improved performance rather than measurement variability, and how well the tool can detect meaningful changes). Several studies have evaluated these aspects of tools for use in the general older population,[126] and in people after hip fractures[127] and those undergoing rehabilitation.[126] Some preliminary work has developed methods for evaluating balance assessment tools in falls prevention programs.[128]

A full review of the properties of measurement tools is beyond the scope of these guidelines. More information is available from the database of outcome measures established by the United Kingdom Chartered Society of Physiotherapy[7] and the manual of outcome measures from the Victorian chapter of the National Neurology Group of the Australian Physiotherapy Association (Hill et al 2005; available from the Australian Physiotherapy Association (03) 9534 9400; national.office@physiotherapy.asn.au).

Table 6.1 Tools for assessing balance, mobility, strength and gait

Test	Description	Time to complete (minutes)	Level that is predictive of falling
Tools for assessing balance			
Postural sway and leaning balance tests[111]	As part of the Physiological Profile Assessment (PPA), sway is measured using a sway meter that measures displacement of the body at waist level. During standing balance tests, the person has to stand as still as possible for 30 seconds, with eyes open then closed; once on the floor then once on a piece of medium-density foam rubber (15 cm thick). During leaning balance tests, the person has to lean forward and backwards as far as possible, or follow a track.	5–10	Part of the PPA[111]
Functional reach (FR)[129]	FR is a measure of balance and is the difference between a person's arm length and maximal forward reach, using a fixed base of support. FR is a simple and easy-to-use clinical measure that has predictive validity in identifying recurrent falls.	1–2	≤10 inches
Alternate Step Test (AST)[104]	AST is a measure of lateral stability. It involves the time taken to complete eight steps, alternating between left and right foot, as fast as possible, onto a step 19 cm high and 40 cm deep.	1–2	10 seconds

Test	Description	Time to complete (minutes)	Level that is predictive of falling
Tools for assessing mobility			
Six-Metre Walk Test (SMW)[104]	SMW measures a person's gait speed along a corridor (over a distance of 6 metres) at normal walking speed.	1–2	6 seconds
Timed Up and Go Test (TUG)[130]	TUG measures the time taken for a person to rise from a chair, walk 3 metres at normal pace and with their usual assistive device, turn, return to the chair and sit down.	12	15 seconds
Tools for assessing strength			
Sit-to-Stand Test (STS)[131]	STS is a measure of lower limb strength, and is the time needed to perform five consecutive chair stands from a seated position.[131]	1–2	12 seconds
Spring balance[111]	As part of the PPA, the strength of three leg muscle groups (knee flexors and extensors and ankle dorsiflexors) is measured while participants are seated. In each test, there are three trials and the greatest force is recorded.	5	Part of the PPA[111]
Scales for assessing balance and gait			
Berg Balance Scale[132]	The Berg Balance Scale is a 14-item scale designed to measure balance of the older adult in a clinical setting with a maximum total score of 56 points (http://www.chcr.brown.edu/geriatric_assessment_tool_kit.pdf).	15–20	≤40
Tinetti Performance-Oriented Mobility Assessment Tool (POMA)[133]	The POMA measures a person's gait and balance. It is scored on the person's ability to perform specific tasks, with a maximum total score of 28 points.	10–15	≤24
Scale for assessing confidence and falls efficacy[134]			
Falls Efficacy Scale International (FESI)	The FESI provides information on level of concern on a four-point scale (1 = not at all concerned, 4 = very concerned) across all 16 activities of daily living (eg cleaning the house, simple shopping, walking on uneven surfaces).	5	Score ≥23 indicates high level of concern

6.2.2 Providing exercise interventions

Effective exercise programs for preventing falls mainly comprise challenging and progressive balance exercises. The exercise program should be tailored to the existing levels of fitness and targeted to the older person's particular deficits and lifestyle. For optimal benefit, exercises should be conducted while standing, if possible.

Challenging balance safely

To improve balance, an exercise program needs to be challenging yet safe. To ensure a sufficient challenge to balance, the program should aim to include:

- exercise in a standing position
- minimal upper limb support (minimise the use of rails or chairs for support while exercising; however, it is useful for older people to exercise near supportive objects so they can steady themselves when necessary)
- a minimal base of support (ie exercise that involves standing or walking with the feet closer together or standing on one leg)
- controlled movements of the body's centre of mass, such as stepping, reaching or dancing.

Exercises that challenge balance could lead to falls themselves; therefore, they need to be carefully prescribed, set up in a safe way (eg next to a wall or counter for hand support as required) and supervised, if necessary. This is particularly important for frailer older people.

Dose of exercise

The optimum duration and frequency of exercise programs to prevent falls is not yet known. A systematic review found that exercise programs prevented more falls if they included at least two hours of exercise each week over a 25-week period.[7] However, it is likely that effects of exercise are lost once exercise stops;[116] therefore, ongoing exercise is probably required for ongoing effects on fall rates. Research into other benefits of exercise has often found that there is a dose–response relationship — that is, greater effects are seen with more exercise.[116,117] This may also be the case for falls prevention.

Walking programs and falls prevention

Walking is a popular form of exercise and can provide the many health benefits associated with increased physical activity levels.[116] However, the role of walking programs in falls prevention is unclear, because there is some evidence that including walking is associated with reduced effects on falls prevention[7] and possibly an increase in fall rates.[120,121]

Table 6.2 lists the features that an exercise program should include to be effective for reducing falls.

Table 6.2 Features that should be included in exercise programs

Feature	Description
Program	The core of the exercise program should be balance training (preferably in weight-bearing positions) that aims to reduce the amount of support. Additionally, the exercise program can include components of: • moderate-intensity resistance training • endurance exercise to increase general fitness (not a walking program on its own).
Modalities	Exercise programs should be designed or delivered by a trained professional (eg physiotherapist or exercise physiologist) to ensure the exercises are challenging yet safe.
Intensity	Individually prescribed and progressive (the instructor must be sensitive to fatigue levels of individual participants and tailor the intensity of the program accordingly).
Setting	Individual or group.
Duration of program	Ongoing exercise.

6.2.3 Including all older people

Exercise is generally safe and beneficial for older people, even those with chronic health problems. However, exercise may be unsafe for a minority of people with particular medical conditions. Therefore, before starting an exercise program, older people should be screened to assess whether they need medical clearance before exercising.[135] Older people with health problems that affect their ability to exercise safely might be more likely to require guidance from a health professional or other qualified exercise leader when starting a new exercise program.

Case study

Mrs T is 83 years old and presented to her general practitioner (GP) with bruises after she tripped while walking down some steps. On further questioning, her GP discovered this was her third fall in the past year. The two earlier falls also happened when she tripped while outside. As a result, Mrs T goes outside far less frequently. The GP observed some unsteadiness in her walking and turning, and referred Mrs T to a physiotherapist for a balance assessment. The physiotherapist assessed Mrs T's performance using the Timed Up and Go Test and the functional reach test and saw she had a high risk of future falls. The physiotherapist explained how she would benefit from a well-designed exercise program to improve her balance and general wellbeing, but also to prevent future falls. The physiotherapist initially referred Mrs T to a supervised group balance and strength program. At a later stage, Mrs T could progress to self-directed exercise, although she may prefer to continue to exercise with other people to maintain motivation.

6.3 Special considerations

6.3.1 Cognitive impairment

Risk factors for falls (eg impairments of gait and balance) are more prevalent in older people with cognitive impairment compared with people without cognitive impairment.[136] People with cognitive impairment should therefore have their falls risk investigated as comprehensively as those without cognitive impairment.

Exercise may improve central executive functioning.[137] In a randomised controlled trial of the Otago Exercise Programme, response inhibition as measured by the Stroop Color–Word Test improved at the six-month follow-up in the exercise versus the control group.

Interventions shown to work in cognitively intact populations should not be withheld from cognitively impaired populations unless there is a problem with ability to follow or comply with instructions (see Chapter 7 on cognitive impairment). Simplifying instructions and using picture boards and demonstrations are strategies that may improve the quality of exercise for people with cognitive impairment. Family members, carers and other volunteers may be able to help in supervising and motivating older people who are undertaking exercise programs.

6.3.2 Rural and remote settings

Ideally, exercise interventions for high-risk older people in community settings would be prescribed by a physiotherapist after individualised assessment. However, in rural and remote settings, this may need to be done by other members of the health care team with appropriate guidance from a physiotherapist to ensure programs are challenging and safe.

6.3.3 Indigenous and culturally and linguistically diverse groups

When developing exercise programs for Indigenous and culturally and linguistically diverse groups, members of the health care team should ensure they are informed about requirements (specific to that cultural group) that may affect the intervention. For example, some cultural groups may require single-sex exercise classes. The health care team should also use interpreters and other communication strategies, as needed.

6.4 Economic evaluation

6.4.1 Tai chi

An Australian modelled analysis by Day et al considered the likely costs and health outcomes (falls prevented and hospital admissions averted) of tai chi in people older than 70 years, who lived in the community.[138] Costs and health outcomes were estimated over a 12-month period. Effectiveness estimates were based on a randomised controlled trial by Wolf et al.[56] Day et al reported an intervention cost of 2008A$469.80 per person for a 15-week tai chi course. Over 12 months, the cost per fall prevented was A$1079 and A$53 974 per hospital admission averted (base case). The cost per fall prevented ranged from A$391 (with A$10 in contribution per class by each participant) to A$1374, with effectiveness of the intervention set to the lower 95%CI limit. The cost per hospital admission avoided ranged from A$19 531 (with the $10 contribution) to A$77 106 with a low rate of hospitalisation.[138]

6.4.2 Otago Exercise Programme

Day et al also conducted a modelled analysis that considered the costs and health outcomes (falls prevented and hospital admissions averted) of a home-based program for muscle strengthening and balance retraining (the Otago Exercise Programme) in people older than 80 years, compared with usual care.[138] The intervention was based on randomised trials and a controlled trial in older people living in the community in New Zealand.[52,53,139,140] Although the four trials were conducted in people older than 65, 75 and 80 years, the modelled analysis was limited to the 80+ age group. Costs and health outcomes were modelled over both 12-month and 2-year periods (assuming similar benefit for the proportion who continued exercising in the second year). The authors reported a 12-month cost for a district nurse-delivered program of 2008A$1091, and A$1233 for a GP-based, nurse-delivered program (with an estimated additional A$219 per participant in the second year). Using the district nurse-delivered program costs, the cost per fall prevented over 12 months was A$4191, and cost per hospital admission avoided was A$64 542. Over two years, the cost per fall prevented was lower at A$2884, and the cost per hospital admission averted was A$44 409. In sensitivity analyses, the cost per fall prevented ranged from A$2867 to A$9045, and the cost per hospital admission avoided ranged from A$44 146 to A$139 297.

The values for incremental cost-effectiveness ratios (ICERs) for the Otago Exercise Programme from Day's models differed from those calculated within the actual clinical trials. Robertson et al conducted three trial-based economic evaluations of the Otago Exercise Programme in older people living in the community, compared with usual care, in New Zealand.[53,139,140] The first analysis was in a randomised controlled trial of the Otago Exercise Programme, in women aged ≥80 years.[139] The program was individually prescribed by a physiotherapist during four home visits. Costs from a societal perspective and outcomes (falls prevented and injurious falls prevented) were assessed over two years, with incremental cost-effectiveness ratios reported for both one and two years of follow-up. Using fall rates per 100 person years, the cost per fall prevented was 1995NZ$379 at one year and NZ$353 at two years; the cost per injurious fall prevented was NZ$535 at one year and NZ$509 at two years. Sensitivity analyses indicated these ICERs were robust over a range of plausible changes in costs and effects.

The second cost-effectiveness analysis by Robertson et al was in a randomised controlled trial where a district nurse delivered the Otago Exercise Programme to both men and women aged ≥75 years.[53] Costs and outcomes (falls prevented and injurious falls prevented) were assessed over one year. Using fall rates per 100 person years the incremental cost effectiveness ratio for delivery of the program only was 1998NZ$1629 per fall prevented and NZ$5685 per injurious fall prevented. When total costs (incorporating hospital admissions averted) were considered, the cost per fall prevented at one year was NZ$140, and the program was *cost saving* in people older than 80 years. The cost per injurious fall prevented at one year was NZ$487, and again was *cost saving* in people 80 years and older.

The third cost-effectiveness analysis by Robertson et al was in a controlled trial in multiple centres, delivered from general practices by practice nurses to men and women aged ≥80 years.[140] Costs and outcomes (falls prevented and injurious falls prevented) were assessed over one year. Using fall rates per 100 person years, and program costs only (ie excluding costs from falls-related admissions), the cost per fall prevented at one year was 1998NZ$1734 and the cost per injurious fall prevented at one year was NZ$3846.

Additional information

The Physiotherapy Evidence Database (PEDro) provides evidence based information from randomised controlled trials, systematic reviews and evidence based guidelines in physiotherapy:
http://www.pedro.org.au

The following organisations, manuals, exercise programs and resources are available:

- Otago Exercise Programme – this program is aimed at preventing falls in older people who live in the community, but it is also relevant for the residential aged care setting. The manual can be purchased for NZ$60:
  http://www.acc.co.nz/otagoexerciseprogramme
- Hill KD, Miller K, Denisenko S, Clements T and Batchelor F (2005). *Manual for Clinical Outcome Measurement in Adult Neurological Physiotherapy*, 3rd edition, APA Neurology Special Group (Vic). Available from the Australian Physiotherapy Association for A$30 for students, A$60 for group members and A$75 for others:
  http://www.physiotherapy.asn.au
- Chartered Society of Physiotherapy (United Kingdom) outcome measures online database:
  http://www.csp.org.uk/director/members/practice/clinicalresources/outcomemeasures/searchabledatabase.cfm
- Fitness Australia:
  http://www.fitnessaustralia.com.au

7 Cognitive impairment

Recommendations

Assessment

- Older people with cognitive impairment have an increased risk of falls and should have their falls risk factors assessed.

Intervention

- Identified falls risk factors should be addressed as part of a multifactorial falls prevention program, and strategies to minimise injuries (such as using hip protectors or vitamin D and calcium supplementation) should be considered. (Level I-*)[49]

Note: there is no evidence that falls can be reduced in older people with cognitive impairment living in the community.[7] See the residential aged care facilities guidelines for further information on providing treatment to older people with cognitive impairment.

Good practice points

- Older people presenting with an acute change in cognitive function should be assessed for delirium and the underlying cause of this change.
- Older people with gradual onset, progressive cognitive impairment should undergo detailed assessment to determine diagnosis, and where possible, reversible causes of the cognitive decline. Reversible causes of acute or progressive cognitive decline should be addressed and treated.
- If an older person with cognitive impairment does fall, reassess their cognitive status, including presence of delirium (eg using the Confusion Assessment Method tool).
- Interventions shown to work in cognitively intact populations should not be withheld from cognitively impaired populations; however, interventions for older people with cognitive impairment may need to be modified and supervised, as appropriate.

7.1 Background and evidence

Cognitive impairment affects approximately 6–10% of older people who live in the community.[141] Although cognitive impairment is most commonly associated with increasing age, it is a complex area that may exist in all age groups due to acquired brain injury, mental health conditions and other pre-existing conditions. Cognitive impairment implies a deficit in one or more cognitive domains (eg memory, visuospatial skills or executive function), but is not synonymous with dementia.

Dementia and delirium are the two most common forms of cognitive impairment in older people:

- Dementia is a syndrome of progressive decline in more than one cognitive domain that affects the person's ability to function. A report for Alzheimer's Australia showed that the number of people living in Australia with dementia in 2005 exceeded 200 000 (1% of the population) with 1000 new cases of dementia being diagnosed each week.[142] Dementia has a gradual onset and usually involves progressive decline in a range of cognitive abilities (eg memory, orientation, learning, judgment and comprehension). It is often accompanied by changes in personality and behaviour.[141]
- Delirium is a syndrome characterised by the rapid onset of variable and fluctuating changes in mental status. One epidemiological survey estimated the rate of delirium at approximately 1% among older people who live in the community and are older than 55 years.[143] Delirium is a medical emergency that frequently requires a period of hospitalisation to deal with both the underlying precipitant and the manifestations of the delirium. Delirium usually develops over hours or days and has a fluctuating course that can involve changes in a range of cognitive abilities, such as attention and concentration, orientation, mood, perceptions, psychomotor activity and the sleep–wake cycle.[144]

Differentiating between dementia and delirium can be difficult and they can coexist in many older people. Older people with existing cognitive impairment are more likely to develop a delirium from an acute event.[144] It is crucial that delirium is diagnosed rapidly and treated early; but overall, it appears that prevention of delirium might be more effective than early detection and treatment.[141]

7.1.1 Cognitive impairment associated with increased falls risk

Older people with cognitive impairment have an increased risk of falls.[145] The annual incidence of falls in this group is about 70–80%.[14,146] Older people with cognitive impairment also have an increased risk of sustaining a hip fracture as a result of a fall.[147] Additionally, fallers with cognitive impairment are five times more likely to be admitted to residential aged care facilities than older people with cognitive impairment who do not fall.[148]

Risk factors for falls are more prevalent in older people with cognitive impairment than in people without cognitive impairment. In this group, impairment of gait and balance are worse,[136] psychoactive medications are more commonly prescribed,[14,149] and orthostatic hypotension is more prevalent.[150]

Cognitive impairment may increase the risk of falling by directly influencing the older person's ability to understand and manage environmental hazards, through a tendency to increased wandering,[151] and through altered gait patterns and impaired postural stability.[152] Examples of the different behaviours that contribute to increased falls risk in older people with cognitive impairment include agitation, wandering, lack of awareness of environmental hazards, impaired ability to solve problems and impulsiveness.[147,153] Any changes in the environment can increase confusion and agitation, and may also increase the risk of falls.

Vascular dementia is characterised by significant alterations in gait, while Lewy body dementia may increase the risk of falls through an increased risk of symptomatic postural hypotension.[154]

7.2 Principles of care

In the absence of specific trial data to show that it is possible to prevent falls in people with cognitive impairment, the suggestions for care in the following sections reflect good clinical practice.

7.2.1 Assessing cognitive impairment

General practitioners can use the following steps to assess for the presence of cognitive impairment:

- Assess for the presence of dementia or delirium and treat possible medical conditions that may contribute to an alteration in cognitive status. Rapid diagnosis and treatment of delirium and its underlying precipitant (eg infection, dehydration, constipation, pain) are crucial.[141]

- Older people with a progressive decline in cognition should undergo detailed assessment to determine diagnosis, and where possible, treat reversible causes of the cognitive decline.[141] Referring the older person to a specialist memory service can be helpful for diagnosing their cognitive impairment accurately, and linking with appropriate community services.
- General practitioners should assess the falls risk factors for older people with cognitive impairment as discussed in other chapters, and offer interventions to modify risk.[96] Some interventions need the person to be able to follow instructions or comply with a program (eg exercise). Where there is doubt about an older person's ability to follow instructions safely, the general practitioner (or other member of the health care team) should conduct an individualised assessment and develop a falls prevention plan using the information from the assessment on their behalf.

Many tools can be used to assess cognitive status; some are summarised in Table 7.1.

Table 7.1 Tools for assessing cognitive status

Dementia screening	
Folstein Mini-Mental State Examination (MMSE)[155]	
Description	MMSE is a widely used method for assessing cognitive mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall and language. The maximum score is 30.
Time needed	5–10 minutes
Criterion	A score ≤23 indicates mild cognitive impairment. A score ≤18 indicates severe cognitive impairment.
Rowland Universal Dementia Scale (RUDAS)[156,157]	
Description	RUDAS is a simple method for detecting cognitive impairment. RUDAS is valid across cultures, portable and administered easily by primary health care professionals. The test uses six items to assess multiple cognitive domains: memory, praxis, language, judgment, drawing and body orientation (see Appendix 3).
Time needed	10 minutes
Criterion	A score >23 (out of a maximum score of 30)
Accuracy	89% sensitivity 98% specificity

Delirium screening	
Confusion Assessment Method (CAM)[158]	
Description	A comprehensive assessment instrument that screens for clinical features of delirium, CAM comprises four features, which are determined by the older person, nurse and family interview: • an onset of mental status changes or a fluctuating course • inattention • disorganised thinking • an altered level of consciousness (ie other than alert).
Time needed	5 minutes
Criterion	Older person is diagnosed as delirious if they have both the first two features, and either the third or fourth features.
Accuracy	94% sensitivity 90% specificity[159]

Point of interest: strategies for maintaining hydration in older people

Older people with cognitive impairment may become dehydrated easily, which can lead to delirium. An Australian study used strategies developed by the Joanna Briggs Institute Practical Application of Clinical Evidence System (JBI-PACES)[160] to maintain oral hydration in residents of residential aged care facilities.[161] Although adherence was problematic, the following strategies recommended by the JBI-PACES may be beneficial:

- Drinks (cordial, juice and water, but not caffeinated drinks) were offered by staff every 1.5 hours (as well as morning tea, afternoon tea and supper rounds).
- Residents with cognitive impairment were either helped or prompted to drink.
- An accessible water fountain was set up with a supply of cups.
- Filled jugs of water were placed on all tables, with cups.
- Drinks were always given with medication.
- Icy poles, jellies and ice-cream were offered throughout the day as snacks and enjoyable treats.
- Fruit with a high water content (eg grapes, peeled mandarins) was placed on kitchen tables for easy access and picking.
- Light soups were given with meals.
- Happy hour was introduced twice a week with nonalcoholic wines, mocktails, soft drinks and nibbles.
- Warm milk drinks were given to help people settle at night.

These strategies may also be applicable to older people with cognitive impairment living at home.

Case study

Mr F is a 72-year-old man living with his wife in the community. He has recently been diagnosed with Alzheimer's disease. In the afternoon, Mr F often wanders off to walk around in the garden. To go from the house into the garden, he has to walk up and down two steps. On more than one occasion, he has fallen down the steps. Since his wife cannot help him up again, she has to ask their neighbour for help. The community nurse suggested that an occupational therapist run a home environment assessment. As a result, the therapist recommended that they install an antislip ramp with a rail. Now Mr F can get in and out of the house without having to negotiate the steps.

7.3 Special considerations

7.3.1 Indigenous and culturally and linguistically diverse groups

The Folstein Mini-Mental State Examination (MMSE) is the most widely used screening tool for dementia in Australia. However, the MMSE has significant limitations in Indigenous and culturally and linguistically diverse populations. The Rowland Universal Dementia Scale (RUDAS) is designed to overcome these limitations, but with the added advantage of being simpler to use in a multicultural population.[155,156]

A study funded by the National Health and Medical Research Council investigated the validity of a new assessment of cognitive function developed specifically for Indigenous Australians. It is called the Kimberley Indigenous Cognitive Assessment.†

7.4 Economic evaluation

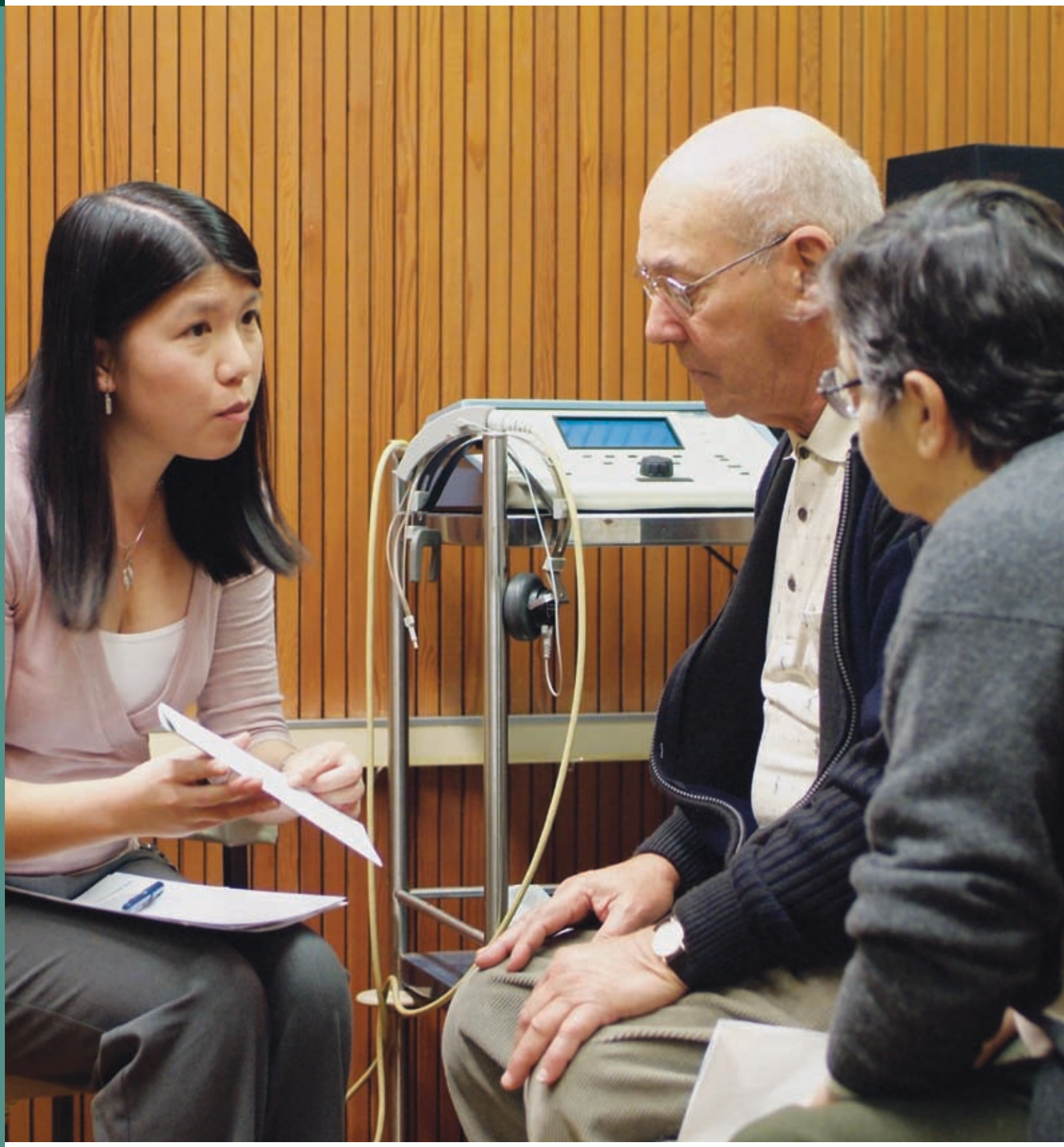
No economic evaluations were found that examined the cost effectiveness of a program related to identifying and managing cognitive impairment in the community setting.

Additional information

A range of resources are available from associations and websites:

- *Living with Dementia — A Guide for Veterans and their Families:* http://www.dva.gov.au/aboutDVA/publications/health/dementia/Pages/index.aspx
- Alzheimer's Australia can provide further information, counselling and support for people with dementia, and their families and carers: http://www.alzheimers.org.au

† http://www.nari.unimelb.edu.au/research/dementia.htm



8 Continence

Recommendations

Assessment

- Older people should be offered a continence assessment to check for problems that can be modified or prevented.

Intervention

- Manage problems associated with urinary tract function as part of a multifactorial approach to care. (Level I-*)[49]

Note: there is no evidence that assessing or treating incontinence will prevent falls in older people living in the community.[7]

Good practice point

- Check the height of the toilet(s) and the need for rails to assist the older person sitting and standing from the toilet(s) in the home.

8.1 Background and evidence

Incident urinary incontinence in people aged over 65 years is significantly associated with decreased measures of functional ability and has also been shown to be a predictor of the onset of frailty.[162] It seems reasonable, therefore, to suggest that the continence status of people over the age of 65 years should be assessed. Urinary incontinence in frail older people is always caused by multiple risk factors. Similarly, the relationship between incontinence and falls is likely to be confounded by impairments of mobility and cognition, and evidence shows that certain multifactorial approaches prevent falls.[7]

Although there is observational evidence of an association between incontinence and falls, there is no direct evidence that incontinence interventions affect the rate of falls.[163] Managing incontinence appropriately may improve overall care, but it is difficult to make strong recommendations because specific incontinence strategies have not been part of successful falls prevention programs in a community setting.

8.1.1 Incontinence associated with increased falls risk

Urinary and fecal incontinence affect both males and females but are not considered to be part of the normal ageing process.[164] However, age-related changes within the urinary tract do predispose older people toward urinary incontinence.[165] Approximately 34% of older men and 55% of older women in the community experience urinary incontinence.[164]

People will make extraordinary efforts to avoid an incontinent episode, including placing themselves at increased risk of falling. Incontinence, assisted toileting[166,167] and symptoms of overactive bladder[35,168] have been identified as risk factors for falls in older people who live in the community.[163,164]

Different types of bladder and bowel symptoms and their relationship with falls include the following:

- *Bladder dysfunction* is common in older women, as a result of deficiencies in the pelvic floor muscles and connective tissue supporting the urethra and the urethral sphincter mechanism.[173] A decline in oestrogen levels after menopause can lead to atrophic changes affecting the vagina and urethra, and also increases a woman's susceptibility to urinary tract infections. Symptoms include urinary frequency, stress and urge incontinence.[179]
- *Constipation* may cause delirium and agitation, which may in turn cause falls. Urinary incontinence is significantly associated with self-reporting of constipation in older Australian women who live in the community.[174] It is a common problem in older people and is related to decreased mobility, reduced fluid intake and the use of a number of high-risk medications. Straining during defecation may also shunt blood away from the cerebral circulation, leading to dizziness or syncope due to the vasovagal phenomenon.[176] Relieving constipation improves lower urinary tract symptoms, including urinary incontinence.[177]
- *Diarrhoea* may cause agitation as well as metabolic disturbance, which may in turn cause falls.
- *Frequency* is defined as the complaint by the person who considers that they void too often by day.[169]
- *Nocturia* is defined as being woken at night by the desire to void.[173] Nocturia is common, and is significantly associated with falls in ambulatory older men and women who live in the community.[175] Nocturia can be particularly problematic when lighting is poor and the older person not fully awake. Nocturia is one of the most common causes of poor sleep and carries with it a higher risk of falling and fractures in older person.[175]
- *Overactive bladder syndrome* is defined as 'urgency with or without urge incontinence, usually with frequency and nocturia'.[169] Overactive bladder syndrome is estimated to affect approximately 41% and 31% of older men and women respectively.[170,171]
- *Urge (urinary) incontinence* is defined as involuntary urine leakage accompanied or immediately preceded by urgency,[173] and has been suggested to increase the risk of an older person falling and fracturing bones.[170] This is presumably because urge incontinence (as opposed to stress incontinence) is associated with frequent rushed trips to the toilet to avoid incontinent episodes. Additionally, performing a secondary task, such as walking and concentrating on getting to the toilet, may be difficult.[172] Urinary incontinence is significantly associated with self report of constipation in older Australian women who live in the community.[174]
- *Urgency* is defined as the sudden compelling desire to void, which is difficult to defer.[169] The symptom of urgency may be suffered without any associated loss of urine.[172]
- *Urinary dysfunction in men* caused by benign prostatic hyperplasia (noncancerous enlargement of the prostate) is common in older men. It affects 50% of men at 60 years and 90% of men over 85 years of age. Symptoms include urinary frequency, nocturia, urgency, poor stream, hesitancy, straining to void and a sensation of incomplete bladder emptying and post-void dribbling.[178]

Definitions

Refer to Abrams et al for a comprehensive list of definitions of the symptoms, signs, urodynamics, observations and conditions associated with lower urinary tract dysfunction, and urodynamics studies for use in all age groups.[173] Also, refer to Abrams for revised explanations of recommended terminology.[180]

While numerous falls in institutional care occur when going to or returning from the toilet,[181] few falls in older people who live in the community involve toileting.[165] The close associations reported between incontinence, dementia, depression, falls and level of mobility suggests that these 'geriatric syndromes' may have shared risk factors rather than causal connections.[35,182]

Urinary and fecal incontinence can increase falls risk in a number of other ways:

- An incontinence episode increases the risk of a slip on the soiled or wet floor surface.[165]
- Urinary tract infections can cause delirium, drowsiness, hypotension and urinary frequency.
- Urinary or fecal urgency are associated with frequent and rushed trips to the toilet.
- Medications used to treat incontinence (eg anticholinergics or alpha blockers) can themselves cause postural hypotension and falls; anticholinergics can also cause acute confusion.
- Drugs such as diuretics, used predominantly to manage heart failure, can potentially increase the risk of falls through increased urinary frequency or through hypovolaemia (low blood volume).
- Deteriorating vision and impaired balance are common conditions in older people and are strongly associated with falls,[183] perhaps adding to the likelihood of falls associated with nocturia and getting out of bed at night.

8.1.2 Incontinence and falls intervention

Older people are often reluctant to discuss issues around continence. Health care staff and community service providers should be encouraged to enquire routinely about continence rather than rely on the older person to mention it during a consultation.

The most commonly recommended and most effective intervention for women with stress incontinence is pelvic floor muscle training. A Cochrane systematic review showed it is also used in the treatment of women with mixed incontinence, and less commonly for urge incontinence. However, limitations of the data make it difficult to judge whether pelvic floor muscle training is better or worse than other treatments in managing overactive bladder symptoms.[184] There is evidence from another systematic review to support conservative management of fecal incontinence.[185]

Toileting-assistance programs are an important and practical approach to maintaining continence for many people, and may also reduce the risk of falls in nursing home residents.[186] The three types of toileting-assistance programs (timed voiding, habit retraining, prompted voiding) are discussed in Section 8.2. Cochrane systematic reviews on these interventions found limited evidence for their effectiveness, and further investigation is needed.[187-189]

8.2 Principles of care

Although the following strategies for promoting continence have not been part of rigorously conducted, multifactorial falls prevention programs, appropriate management is good gerontological practice that may translate into a lower risk of falling.

8.2.1 Screening continence

The cause of incontinence should be established through a thorough assessment; ~~for example, using ward urinalysis. Older people may have more than one type of urinary incontinence, which can make assessment findings difficult to interpret.~~[190] The following strategies should be used to assess the older person's continence status:

- Obtain a continence history from the older person. This might include such things as a bladder chart (a frequency/volume chart or a continence diary). Continence history should be recorded for a minimum of two days[191] to help provide a valid assessment. Simple, validated questions to the older person can help differentiate the type of urinary incontinence they have.[192] Sometimes, a bowel assessment is required. The older person's normal bowel habits and any significant change must be determined, because constipation can affect bladder function.
- The suitability of diagnostic physical investigations should be addressed on an individual basis. Consent from the older person must be obtained before the physical examination, which should be done by a suitably qualified health professional.
- Post-void residuals should always be checked in incontinent older people.[183]
- Functional considerations, such as reduced dexterity or mobility, can affect toileting, and should be assessed and addressed.
- The toilet should be assessed for accessibility (especially if the older person uses a walking aid), proximity, height and the number of household members using the same toilet (see Chapter 14 on environmental considerations for more information).
- Risk factors for falling related to incontinence need to be considered along with the symptoms and signs of bladder dysfunction.

8.2.2 Strategies for promoting continence

Appropriate management of incontinence may improve overall care but it is difficult to make strong recommendations because specific incontinence strategies have not been part of successful falls prevention programs in a community setting.[165] However, studies from the hospital setting have shown that toileting protocols and practices for older people at risk of falling should be included in multifactorial falls prevention interventions.[193,194] Also, multifactorial falls prevention interventions in hospitals should include management of urinary tract function.[195]

The suggested strategies below are adapted from those recommended by the Third International Consultation on Incontinence 2005[183] and should be used to promote continence in the community setting:

- Make sure the older person has access to a comprehensive and individualised continence assessment that identifies and treats reversible causes, including constipation and side effects of medication.
- Use an adequate trial of conservative therapy as the first line of management.
- Establish treatment strategies as soon as incontinence has been diagnosed. The aim of managing urinary incontinence is to alter those factors causing incontinence and to improve the continence status of the person. Management of incontinence is a multidisciplinary task that ideally involves doctors, nurse continence advisers, physiotherapists, occupational therapists and other suitably qualified health professionals.
- Address all comorbidities that can be modified.
- Encourage habit training, prompted voiding or timed voiding programs to help improve the older person's control over their toileting regime, and reduce the likelihood of incontinence episodes
  - habit retraining is based on identifying a pattern of voiding and tailoring the toileting schedule to the older person
  - prompted voiding aims to increase continence by increasing the older person's ability to discriminate their continence status and to respond appropriately
  - timed voiding is characterised by a fixed schedule of toileting.
- Reducing an older person's caffeine and carbonated drinks intake may help decrease symptoms of urgency and frequency.

- Minimise environmental risk factors by
  - keeping the pathway to the toilet free of obstacles, and leaving a light on in the toilet at night
  - ensuring the older person is wearing suitable clothes that can be easily undone and removed
  - recommending appropriate footwear to reduce slipping in urine
  - placing a nonslip mat on the floor beside the bed, which may be useful for older people who experience incontinence on rising from the bed, particularly if the bedroom floor is not carpeted (care must be taken when using mats to ensure the older person does not trip on the mat)
  - checking the height of the toilet(s) and the need for rails to assist the older person sitting and standing from the toilet (reduced range of motion in hip joints is common after total hip replacement or surgery for fractured neck of femur, and might mean the height of the toilet seat needs to be raised).
- Where possible, consult with a continence adviser if usual continence management methods as described above are not working or the older person is keen to learn simple exercises to improve their bladder or bowel control. Some men are resistant to the idea of doing pelvic floor exercises. This should be recognised and the benefits explained.
- Consider the use of continence aids as a trial management strategy.

Case study

Mrs U is an 85-year-old lady who presented to her general practitioner (GP) with a bruised face after falling. When the GP asked why she fell, she said she was rushing to the toilet. The continence assessment revealed that she had reduced bladder capacity and detrusor instability from chronic constipation. The constipation was treated and Mrs U no longer needed to rush to the toilet. The GP was also careful to consider many of the other risk factors for falling that were identified from the falls risk assessment and ensure that targeted interventions were implemented accordingly.

8.3 Special considerations

8.3.1 Cognitive impairment

Acute delirium can be caused by both urinary and gastrointestinal problems. Cognitive impairment and dementia can also lead to problems with both urinary and fecal continence. Regular toileting is recommended in people with cognitive impairment. Older people with cognitive impairment may benefit from prompted voiding,[187] scheduled toileting and attention to behaviour signals indicating the desire to void. Aim to identify each older person's toileting times and prompt them to go around those times. Older people with severe dementia may need to be reminded of the location of the bathroom.

8.3.2 Rural and remote settings

It is important that the strategies outlined above are also in place in rural and remote locations. If access to specialist continence assessment and advice is difficult, additional strategies, such as teleconferencing, may help health practitioners to implement best practice. Resources (eg leaflets) providing advice on managing incontinence are available.

8.3.3 Indigenous and culturally and linguistically diverse groups

The health care team, including carers, need to be aware of cultural and religious requirements with respect to toileting. Generic signage for toileting facilities and requirements could be used. In some cultures, incontinence is a taboo topic. Specific information on dealing with these issues may be obtained from the person, their carers or from the Continence Foundation of Australia.

Incontinence is not a condition that is well understood by Indigenous Australians and it causes shame for many. When discussing incontinence, it is important to be aware that Indigenous men will frequently only discuss this matter with a male health worker and women only with a female health worker. Resources for Indigenous people are also available from the Continence Foundation of Australia.

8.4 Economic evaluation

No economic evaluations were found that examined the cost effectiveness of continence management in older people in the community.

Additional information

- The Continence Foundation of Australia and the National Continence Helpline have leaflets and booklets on different continence-related topics, Indigenous-specific resources and information leaflets translated into 14 community languages:
  http://www.continence.org.au
- The Continence Foundation of Australia manages the National Continence Helpline for the Australian Government. This free service, staffed by nurse continence advisers, provides confidential information on incontinence, continence products and local services:
  National Continence Helpline: 1800 33 00 66
- The National Public Toilet Map gives information on toilet facilities along travel routes throughout Australia. Access the map via the website, or by calling the National Continence Helpline; they will mail out copies of maps of toilets along planned journeys:
  http://www.toiletmap.gov.au
- The fact sheet, *Continence: Caring for Someone with Dementia*, can be found on the Alzheimer's Australia website:
  http://www.alzheimers.org.au/content.cfm?infopageid=83#co
- The National Institute for Health and Clinical Excellence (NICE), based in the United Kingdom, provides guidance on promoting good health and preventing and treating ill health. See their evidence based guidelines on managing urinary incontinence:
  http://www.nice.org.uk

9 Feet and footwear

Recommendations

Assessment

- Assessment should include screening for ill-fitting or inappropriate footwear and for foot pain and other foot problems, because these are risk factors for falls.

Interventions

- Include an assessment of footwear and foot problems as part of an individualised, multifactorial intervention for preventing falls in the community. (Level IV)[196,197]
- Health care providers should provide education and information about footwear features that may reduce falls risk. (Level III-2)[198]

Note: there is no evidence that assessing or addressing footwear and foot problems as a single intervention will prevent falls in older people living in the community.

Good practice points

- Health care providers should educate older people and provide information on foot problems and foot care, and refer them to a podiatrist when necessary.
- Safe footwear characteristics include:
  - *soles:* shoes with thinner, firmer soles appear to improve foot position sense; a tread sole may further prevent slips on slippery surfaces
  - *heels:* a low, square heel improves stability
  - *collar:* shoes with a supporting collar improve stability.

9.1 Background and evidence

9.1.1 Footwear associated with increased falls risk

Inappropriate footwear is a contributing factor to falls[199] and fractures in older people.[200] Studies (of differing design and quality, and conducted in different settings) have reported the following results:

- Poorly fitting footwear or footwear inappropriate for the environmental conditions impairs foot position sense in both younger and older men.[201]
- Wearing shoes with inadequate fixation (ie shoes without laces, buckles or velcro fastenings) is associated with an increased risk of tripping.[200]
- Wearing high-heeled shoes impairs balance, compared with low-heeled shoes[202,203] or being barefoot.[204]
- Medium or high-heeled shoes and shoes with a narrow heel significantly increase the likelihood of sustaining all types of fracture, while slip-on shoes and sandals increase the risk of foot fractures as a result of a fall.[205]
- Slippers are often the indoor footwear of choice for many older people, but are associated with an increased risk of injurious falls.[206]
- Walking barefoot or in socks is associated with a 10–13-fold increased risk of falling,[198,207] with athletic shoes being associated with the lowest risk.[198]

A retrospective, observational study showed that three-quarters of people who have suffered a fall-related hip fracture in the community were wearing footwear with at least one suboptimal feature at the time of the fall.[200] Older people should wear appropriately fitted shoes, both inside and outside the house. However, many older people wearing inappropriate footwear believe them to be adequate.[208] A review of the best footwear for preventing falls identified the following shoe characteristics as safe for older people:[196]

- *Soles:* shoes with thinner, firmer soles appear to improve foot position sense; a tread sole may further prevent slips on slippery surfaces.
- *Heels:* a low, square heel improves balance.
- *Collar:* shoes with a supporting collar improve balance.

Figure 9.1 represents an optimal 'safe' shoe, and a theoretical 'unsafe' shoe. However, the level of evidence for these recommendations is low, since there are no studies of footwear that have examined falls as an outcome.

A low-quality trial investigated the effect of a balance-enhancing insole (footwear insole with a raised ridge around the perimeter designed to facilitate sensation in the foot soles) on lateral gait stability. The study also evaluated its effectiveness in daily life. The authors concluded that this relatively simple change in insole design can help to counter effects of age-related (non-neuropathic) decline in foot-sole sensitivity, and is a viable intervention to improve balance control.[209]

9.1.2 Foot problems and increased falls risk

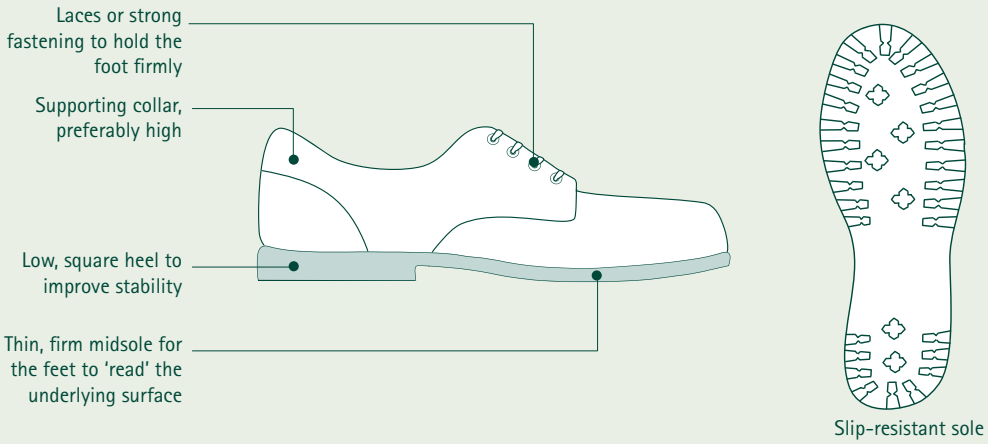
Foot problems are common in older people, affecting 60–80% of older people who live in the community.[210,211] Women report a higher prevalence of foot problems than men, which might be influenced by fashion footwear.[212] The most commonly reported foot problems are:[211,213,214]

- pain from corns, calluses and bunions
- foot deformities, such as hallux valgus, hammer toes and nail conditions.

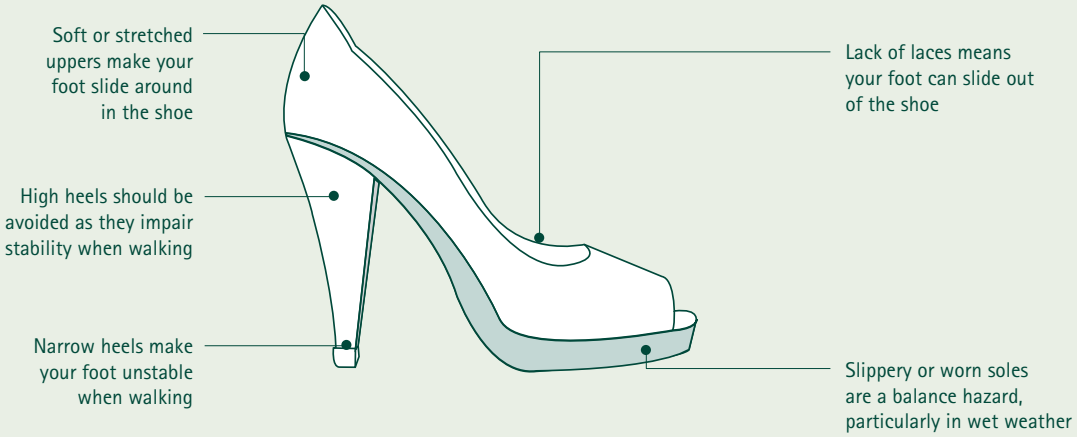
Foot problems are well recognised as a contributing factor to mobility impairment in older people. Older people with foot pain walk more slowly than those without, and find it more difficult to perform daily tasks.[210] The presence of foot problems, such as pain, toe deformities, toe muscle weakness and reduced ankle flexibility, can alter the pressure distribution beneath the feet and impair balance and functional ability.[215,216] Additionally, these foot problems are associated with an increased risk of falls,[217] and the risk rises with the number of foot problems.[218]

Ageing is associated with reduced peripheral sensation, and several prospective studies have found that participants who fall perform worse in tests of lower limb proprioception,[111] vibration sense[219] and tactile sensitivity.[220] Reduced plantar tactile sensitivity has also been mentioned as a risk factor for falls,[216] because it might influence the ability to maintain postural control when walking, particularly on irregular surfaces.[221] This is particularly relevant in people with diabetes.[222] People with diabetic neuropathy have impaired standing stability[223] and are at increased risk for falls and fractures.[224] Podiatry may help manage these conditions.[225-227]

What makes a shoe safe?



What makes a shoe unsafe?



Source: Lord[165]

Figure 9.1 The theoretical optimal 'safe' shoe, and 'unsafe' shoe

9.2 Principles of care

9.2.1 Assessing feet and footwear

An assessment of footwear and foot problems should be included as part of an individualised, multifactorial and multiple intervention for preventing falls in the community.[196,197] The following components of feet and footwear assessment are most relevant to this group of older people:

- *Footwear:* use the safe shoe checklist, which is a reliable tool for evaluating specific shoe features that could improve postural stability in older people[228] (see Appendix 4).
- *Foot problems:* assess foot pain and other foot problems regularly. An older person with an undiagnosed peripheral neuropathy should be referred to a medical practitioner to look for potentially reversible or modifiable causes of the neuropathy. Some of the more common causes of a peripheral neuropathy include diabetes, vitamin B12 deficiency, peripheral vascular disease, alcohol misuse and the adverse effects of some drugs.[229]
- Refer the older person to a health professional who is skilled in assessing feet and footwear (eg a podiatrist) for additional investigations and management as required.[230]

A detailed assessment by a podiatrist for falls risk factors may also be needed. This examination should include:[231]

- *fall history:* including foot pain and footwear
- *dermatological assessment:* skin and nail problems, infection
- *vascular assessment:* peripheral vascular status
- *neurological assessment:* proprioception; balance and stability; sensory, motor and autonomic function
- *biomechanical assessment:* posture, foot and lower limb joint range of motion testing, evaluation of foot deformity (eg hallux valgus), gait analysis
- *footwear assessment:* stability and balance features; prescription of footwear, footwear modifications, or foot orthoses based on assessment of gait in shoes
- *education:* foot care and footwear, to endorse the link between footwear or foot problems and falls risk.

9.2.2 Strategies for improving foot condition and footwear

As foot pain and footwear are amenable to treatment, podiatric intervention has the potential to improve mobility and postural stability. To date, no randomised controlled trials have assessed feet or footwear intervention to prevent falls. However, the following strategies, which are based on other, lower quality studies, may help to prevent falls in older people living in the community:

- Foot problems
  - debride calluses to improve functional ability[225]
  - use toe-strengthening exercises to reduce sway[232]
  - investigate and treat the cause of a peripheral neuropathy where possible.[233]
- Footwear
  - use textured insoles to improve stepping responses to platform perturbation in older people[234]
  - use foot orthoses to improve posture and balance.[209,233]

Older people might be reluctant to change their footwear. A report published in 1993 mentioned several factors that discouraged people from using safe shoes, such as foot problems, difficulty putting them on, expense, style and lack of knowledge about their importance.[208] All health care professionals can play an important role in advising older people about safe footwear by:

- identifying ill-fitting or inappropriate footwear
- screening older people for foot pain or foot problems
- educating older people and carers about basic foot care and providing information about footwear
- ensuring shoes are repaired, when indicated, and cleaned regularly
- recognising that older people who have a shuffling gait may be at higher risk of falling if they wear nonslip shoes on certain carpeted floors
- ensuring that older people with urinary incontinence have dry, clean footwear
- ensuring older people have more than one pair of shoes in case of shoe soiling or damage
- discouraging walking while wearing slippery socks and stockings
- discouraging the use of talcum powders, which may contribute to slippery floors
- referring an older person to a podiatrist for further assessment and management if any of the following conditions or clinical signs are evident
  - foot pain
  - foot problems such as swelling, arthritis, bunions, toe deformities, skin and nail problems (especially corns and calluses) or other foot abnormalities (eg collapsed arches or a high-arched foot)
  - conditions affecting balance, posture or proprioception in the lower limbs, such as diabetes, peripheral neuropathy or peripheral vascular disease
  - unsteady or abnormal gait
  - inappropriate or ill-fitting footwear or a requirement for foot orthoses
- referring the older person to a podiatrist for orthotics in cases of significantly deformed feet.

It is important to recognise that not adhering to any of these interventions will limit the effectiveness of good footwear in preventing falls.

Case study

Mr R visited his general practitioner (GP) for management of his diabetes. He also has a recent history of falls. After a basic foot screening, the GP found that Mr R had poor sensation and some calluses and lesions on his feet, so the GP referred him to a community podiatry service. The podiatrist diagnosed mild peripheral neuropathy, and also found that Mr R was unsteady because he wore oversized sports shoes with a thick, cushioned sole to 'help' his calluses. The podiatrist treated Mr R's lesions and taught him how to buy better fitting footwear that improved his stability, but was still safe for his neuropathic feet. Mr R's balance improved after he purchased more appropriate footwear.

9.3 Special considerations

9.3.1 Cognitive impairment

Older people with cognitive impairment may not report discomfort reliably. Therefore, when they have their footwear checked, their general practitioner or other member of the health care team should check their feet for lesions, deformity and pressure areas. Footwear and foot care issues should also be discussed in detail with carers.

9.3.2 Rural and remote settings

Contact the Australasian Podiatry Council† in your state or territory for details of practitioners visiting rural and remote areas. In areas where podiatry services are infrequent or unavailable, other health care providers will need to screen feet and footwear. Services for Australian Rural and Remote Allied Health (SARRAH) is developing resources that may help rural and remote practitioners.‡

9.3.3 Indigenous and culturally and linguistically diverse groups

Culturally appropriate resources are currently being developed by SARRAH as part of an Indigenous Diabetic Foot Program (see the box containing additional information).

9.4 Economic evaluation

No economic evaluations were found that examined the cost effectiveness of a program related to feet and footwear assessment in the community setting. Some multiple intervention approaches to falls prevention in the community have included feet and footwear assessments (see Section 4.4.1 and Section 4.5.2 for details).

Additional information

Australasian Podiatry Council:
http://www.apodc.com.au

Footwear:

- Safe shoe checklist (see Appendix 4)
- Queensland Government Stay On Your Feet Program falls prevention resources: http://www.health.qld.gov.au/stayonyourfeet

Foot care and ageing feet:

- American Podiatric Medical Association: brochures, fact sheets and other information on topics such as ageing feet: http://www.apma.org/MainMenu/Foot-Health/FootHealthBrochures/GeneralFootHealthBrochures.aspx
- Indigenous Diabetic Foot Program, SARRAH: http://www.sarrah.org.au/site/index.cfm?display=65940
- Society of Chiropodists and Podiatrists: http://www.feetforlife.org

† http://www.apodc.com.au

‡ http://www.sarrah.org.au

10 Syncope

Recommendations

Assessment

- Older people who report unexplained falls or episodes of collapse should be assessed for the underlying cause.

Intervention

- Assessment and management of potential causes of presyncope and syncope should form part of a multifactorial intervention to reduce the rate of falls in older people. (Level I)[7]
- Use cardiac pacing in older people who live in the community, and who have carotid sinus hypersensitivity and a history of syncope or falls, to reduce the rate of falls. (Level II)[47]

10.1 Background and evidence

Syncope is defined as a transient and self-limiting loss of consciousness. It is commonly described as *blacking out* or *fainting*. Presyncope describes the sensation of feeling faint or dizzy and can precede an episode of loss of consciousness. A number of conditions can present with syncope and all share the final common pathway of cerebral hypoperfusion leading to an alteration in consciousness. Older people are more predisposed to syncopal events due to age-related physiological changes that affect ability to adapt to changes in cerebral perfusion.

The overall incidence of syncope in older people who live in the community has been reported as 6.2 per 1000 person years.[235] Some of the more common causes of syncope in older people include vasovagal syncope, orthostatic hypotension, carotid sinus hypersensitivity, cardiac arrhythmias, aortic stenosis and transient ischaemic events. Epilepsy may present as a syncopal-like event. Less common causes of syncope include micturition, defecation, cough and postprandial syncope.

10.1.1 Vasovagal syncope

Vasovagal syncope (usually described as fainting) is the most common cause of syncope and has been reported to be the cause of up to 66% of syncopal episodes presenting to an emergency department.[235] Vasovagal syncope is often preceded by pallor, sweatiness, dizziness and abdominal discomfort, although these features are not always seen in the older person.[235] Commonly reported precipitants of vasovagal syncope include prolonged standing (particularly in hot or confined conditions), fasting, dehydration, fatigue, alcohol, acute febrile illnesses, pain, venipuncture and hyperventilation.

The diagnosis of vasovagal syncope is usually made clinically, although formal assessment with noninvasive cardiac monitoring and prolonged tilting is possible.

Treatment is largely nonpharmacological and is targeted at avoiding the cause. This may include avoiding prolonged standing in hot weather and ensuring that the older person drinks enough to maintain hydration. People also need to be reassured that vasovagal syncope is a benign condition.

10.1.2 Orthostatic hypotension (postural hypotension)

Orthostatic hypotension (also called postural hypotension) refers to a drop in blood pressure on standing either from the sitting or lying position. The drop in blood pressure can be enough to cause symptoms of dizziness or precipitate a syncopal event.[165,236] Orthostatic hypotension is associated with an increased risk of falls.[165,237]

A formal diagnosis of postural hypotension is made by recording a drop in systolic blood pressure of at least 20 mm Hg or a drop in diastolic blood pressure of at least 10 mm Hg within three minutes of standing. The older person should be lying still for at least five minutes before measuring blood pressure (while the older person remains lying down).

Medications and volume depletion are the two most common causes of postural hypotension in older people. Medications commonly associated with postural hypotension include the antihypertensive agents, antianginals, antidepressants, antipsychotics and antiparkinsonian medications and diuretics. Diuretics can have a direct effect on blood pressure and can also cause volume depletion, which in itself can cause postural hypotension. Certain diseases (eg Parkinson's disease, stroke and diabetes) can directly affect autonomic function and interfere with blood pressure regulation. Prolonged periods of immobility can also disrupt postural control of blood pressure.

Treatment involves identifying the precipitating cause and addressing this, including drug modification where possible. Maintaining adequate hydration, particularly during hot weather, is important for the older person (see the point of interest box on maintaining hydration in Section 7.2.1). Pharmacological intervention is needed to treat postural hypotension in a small number of cases. Drugs that might be used include fludrocortisone or midodrine (an alpha-agonist).

10.1.3 Carotid sinus hypersensitivity

Carotid sinus hypersensitivity is an abnormal haemodynamic response to carotid sinus stimulation. When associated with symptoms, it is referred to as a carotid sinus syndrome.

Carotid sinus hypersensitivity may occur when the head is rotated or turned, or when pressure is placed on the carotid sinus. Triggers might include carotid massage, shaving, wearing tight collars or neckwear, or tumour compression.[238]

Three abnormal responses can be noted on direct massage of the carotid sinus. A cardioinhibitory response is defined as a three-second period of asystole following massage of the carotid sinus. The vasodepressor response is defined by a 50 mm Hg drop in blood pressure in the absence of significant cardioinhibition. A combination of the vasodepressor and cardioinhibitory response defines the mixed form of carotid sinus hypersensitivity.

While carotid sinus hypersensitivity is the cause of a small percentage of falls in older people, it is potentially amenable to intervention.[47,239-241] A randomised controlled trial showed that detailed cardiovascular assessment, including carotid sinus massage of older people attending emergency departments after an unexplained fall, led to a subsequent reduction in further falls.[47]

10.1.4 Cardiac arrhythmias

Abnormal heart rhythms can lead to dizziness and syncope. Sick sinus syndrome is an abnormal slowing of the heart caused by degeneration of the cardiac conducting system. It is associated with advanced age. Sick sinus syndrome is managed by inserting a cardiac pacemaker. Slowing of the heart rate can also be associated with certain medications (beta-blockers and digoxin) and the treatment in these cases is reducing or stopping these medications.

Rapid heart rates from abnormal cardiac rhythms can also cause dizziness and syncope. Diagnosis of an abnormal heart rate requires a person to be monitored at the time of the abnormal heart rate, and can often be challenging. Treatment depends on the nature of the abnormal rhythm.

See Section 4.3.3 for more information.

10.2 Principles of care

10.2.1 Assessing syncope

It is important to ensure that older people reporting presyncope or syncope undergo appropriate assessment and intervention, particularly if the cause is not obvious. The symptoms should be reported to their general practitioner and, depending on the history and results of the clinical examination, a number of tests and further investigations may be warranted. This may include an electrocardiogram, echocardiography, Holter monitoring, tilt-table testing and carotid sinus massage or insertion of an implantable loop recorder. The European Taskforce on Syncope has produced a simple algorithm for investigating syncope (see the box containing additional information, below).[236]

10.2.2 Treating syncope

Permanent cardiac pacing is successful for treating certain types of syncope. Pacemakers reduce falls by 70% in people with accurately diagnosed cardioinhibitory carotid sinus hypersensitivity.[47] A number of successful multifactorial falls prevention strategies have included assessments of blood pressure and orthostatic hypotension, and medication review and modification.[19,84,88,167]

The symptoms of orthostatic hypotension can be reduced using the following strategies:

- Ensure good hydration is maintained, particularly in hot weather.[99,242,243]
- Encourage the older person to sit up slowly from lying, stand up slowly from sitting and wait a short time before walking.[242,243]
- Minimise exposure to high temperatures or other conditions that cause peripheral vasodilation, including hot baths.[243]
- Minimise periods of prolonged bed rest and immobilisation.
- Encourage older people to rest with the head of the bed raised.
- Increase salt intake in the diet (if not contraindicated).
- Where possible, avoid prescribing medications that may cause hypotension.
- Identify any need to use appropriate peripheral compression devices, such as antiembolic stockings.[243]
- Monitor and record postural blood pressure.[99]

Case study — postprandial hypotension

Mr L is an 82-year-old man who was taken to an emergency department by ambulance after falling at a shopping centre. At the emergency department, staff learnt that Mr L had suffered three other recent falls, all of which he described as occurring as a result of blackouts. Mr L was referred to a cardiology unit where, after initial assessment, he underwent carotid sinus massage with head-up tilt. During massage of the right carotid sinus with 70° head-up tilt, Mr L had a documented period of three seconds of asystole from which he was symptomatic. He was subsequently fitted with a dual chamber pacemaker. In the six months after this procedure Mr L suffered no further falls.

10.3 Special considerations

10.3.1 Cognitive impairment

Older people with cognitive impairment may have problems recalling the events surrounding a fall. Postural hypotension is common in people with vascular dementia and many people with cognitive impairment and dementia may be taking medications that are associated with postural hypotension and cardiac arrhythmias (eg antihypertensives, antidepressants and antipsychotics).

10.4 Economic evaluation

No economic evaluations were found that examined the cost effectiveness of interventions for syncope in the community setting.

Additional information

The following reference may be useful:

- Task Force on Syncope, European Society of Cardiology (2004). Guidelines on management (diagnosis and treatment) of syncope–update 2004. *European Heart Journal* 25(22):2054–2072. http://eurheartj.oxfordjournals.org/cgi/content/full/25/22/2054

11 Dizziness and vertigo

Recommendations

Assessment

- Vestibular disorders as a cause of dizziness, vertigo and imbalance need to be identified in the community setting. A history of vertigo or a sensation of spinning is highly characteristic of vestibular pathology.
- Use the Dix–Hallpike test to diagnose benign paroxysmal positional vertigo, which is the most common cause of vertigo among older people, and which can be identified in the community setting. This is the only cause of vertigo that can be treated easily.

Note: there is no evidence from randomised controlled trials that treating vestibular disorders will prevent falls.

Good practice points

- Use vestibular rehabilitation to treat dizziness and balance problems where indicated.
- Use the Epley manoeuvre to manage benign paroxysmal positional vertigo.
- All manoeuvres should only be done by an experienced person.

11.1 Background and evidence

Dizziness is common in all age groups but its prevalence in the community increases markedly with age.[244] On questioning, one in three older people who live in the community report symptoms of dizziness,[245] although studies suggest that few of these people were likely to consult their general practitioner for a review of these symptoms.[246]

Dizziness in older people often represents a difficult diagnostic problem, because dizziness is a subjective sensation that may result from impairment or disease in multiple systems.[247] The underlying cause of dizziness is unknown in 20–40% of people.[99] Vestibular dysfunction has been indicated in approximately 50% of people over the age of 70 years who are referred to a dizziness clinic for evaluation, with the single most common diagnosis being benign paroxysmal positional vertigo (BPPV).[244]

When older people describe being 'dizzy', 'giddy' or 'faint', this may mean anything from an anxiety or fear of falling, to postural dysequilibrium, vertigo or presyncope. Therefore, a detailed history is crucial.

11.1.1 Vestibular disorders associated with an increased risk of falling

Vestibular dysfunction is a common cause of dizziness in the older population;[244] however, the association between vestibular dysfunction and falls remains unclear.[248] Age-related changes in the vestibular system can be identified in people older than 70 years.[249] These changes include asymmetrical degenerative changes, which may contribute to falls by impairing balance control and providing inaccurate information about the direction and magnitude of head or body movements. A study of 66 adults found that older people who live in the community and who have sustained a wrist fracture as a result of an accidental fall were more likely to have vestibular asymmetry on testing than an age-matched group of nonfallers.[250]

People with BPPV often have balance problems; however, more research is needed to see whether there is an association between BPPV and falling in older people. A cross-sectional study of 100 people found that 1 in 10 older people presenting to an outpatient clinic with a range of chronic medical conditions had undiagnosed BPPV, and these people were more likely to have sustained a fall in the previous three months.[251]

11.2 Principles of care

11.2.1 Assessing vestibular function

An important step in minimising the risk of falls associated with dizziness is to assess vestibular function. This can be done using the following steps and tests (these tests should only be done by an experienced person):

- Ask the older person about their symptoms. *Dizziness* is a general term that is used to describe a range of symptoms that imply a sense of disorientation.[249] Dizziness may be used as a term by an older person to describe poor balance. *Vertigo*, a subtype of dizziness, is highly characteristic of vestibular dysfunction and is generally described as a sensation of spinning.[252]
- Assess peripheral vestibular function using the Halmagyi head-thrust test.[253] It has good sensitivity only if the vestibular dysfunction is severe or complete.[254]
- Use audiology testing to quantify hearing loss. The auditory and vestibular systems are closely connected; therefore, auditory symptoms (hearing loss, tinnitus) commonly occur in conjunction with symptoms of dizziness and vertigo.[255]
- If needed, request computed tomography or magnetic resonance imaging to identify an acoustic neuroma or central pathology.[252]
- Use the Dix–Hallpike test to diagnose BPPV. This test is included in a diagnostic protocol for evaluating dizziness in older people in general practice[255] and is considered mandatory in all older people with dizziness and vertigo following head trauma.[256] BPPV should be strongly considered as part of the differential diagnosis in older people who report symptoms of dizziness or vertigo after a fall that involved some degree of head trauma.
- Use vestibular function tests to evaluate the integrity of the peripheral (inner ear) and central vestibular structures. These tests are available at some specialised audiology clinics and may be recommended if symptoms persist.[257]
- Refer the older person to a specialist, such as an ear, nose and throat specialist or a neurologist if required.[252]

11.2.2 Choosing interventions to reduce symptoms of dizziness

The following strategies can be used in the community setting to treat dizziness and balance problems caused by vestibular dysfunction. They can be used as part of a multifactorial falls prevention program to reduce the risk of falls related to dizziness.

Medical management

A randomised controlled trial showed that treatment with methylprednisolone within three days of acute onset of vestibular neuritis (viral infection of inner ear structures) improves vestibular function at 12-month follow-up, with complete or almost complete recovery of vestibular function in 76% of the study population.[258]

Based on clinical experience, treatment with antiemetics and vestibular suppression medication may be required to treat the unpleasant associated symptoms of nausea and vomiting.[259] These medications should only be used for a short duration (one to two weeks) because they adversely affect the process of central compensation after acute vestibular disease.[252,259]

Treating BPPV

A range of treatments for BPPV have been described in the literature. These include:

- Brandt and Daroff exercises — these can be done regularly at home[260]
- the Epley manouevre — this is used commonly by clinicians and involves taking the older person slowly through a range of positions that aim to move the freely mobile otoconia (in the inner ear) back into the vestibule;[261] a meta-analysis showed that this manouevre is highly successful for treating BPPV.[262]

Older people with diagnosed BPPV respond as well to treatment as the general population; therefore, no special approaches are needed in this older group.[263] However, it is important to diagnose and treat BPPV as soon as possible, because treatment reduces dizziness and improves general wellbeing.[263]

Vestibular rehabilitation

Vestibular rehabilitation (VR) is a multidisciplinary approach to treating stable vestibular dysfunction. The physiotherapy intervention component focuses on minimising the older person's complaints of dizziness and balance problems through a series of exercises, which are modified to suit each person.[264] The occupational therapy intervention component involves incorporating the movements required for these exercises into daily activities,[265] and psychology input addresses the emotional impact of vestibular dysfunction.[266]

The literature emphasises the following characteristics of VR:

- VR is highly successful in treating stable vestibular problems in people of all ages.[267]
- Starting VR early is recommended in the community setting, because delayed initiation of VR is a significant factor in predicting unsuccessful outcomes over time.[268]
- The success of VR in older people in the community is not influenced by age.[269]
- VR can improve measures of balance performance in people in the community who are older than 65 years;[270,271] however, a study of people with multisensory dizziness found that the prevalence of falls over a 12-month period did not differ between those receiving VR and a control group.[272]

Regular training courses in vestibular rehabilitation are held across Australia, and an increasing number of physiotherapists working in the community setting are now trained to assess and manage dizziness. These physiotherapists can be found by contacting the Australian Physiotherapy Association† or the Australian Vestibular Association.‡

† http://members.physiotherapy.asn.au

‡ http://www.dizzyday.com/avesta.html

Case study

Mr S is an 81-year-old man who presented to his general practitioner (GP) with vague symptoms of giddiness. He reported feeling giddy when getting out of bed in the morning so that he had to sit for five minutes on the edge of the bed before standing up. He walks with a stick, but has had several falls at home without serious injury. He reported that he no longer lies flat in bed (he uses three pillows at night) and was unable to roll to the left without feeling giddy.

Mr S's GP tested him for benign paroxysmal positional vertigo (BPPV) using the Dix–Hallpike test, which identified BPPV in Mr S's left inner ear. He was subsequently treated with an Epley manoeuvre and taught Brandt–Daroff exercises to do daily at home.

Mr S was no longer giddy, could lie flat in bed and was able to roll easily onto his left side. He reported that his balance is also better and he had no recent falls. Some milder symptoms returned about four months later, but these were helped with a repeat of the Epley manoeuvre.

11.3 Special considerations

Dix–Hallpike testing should not be used in people with an unstable cardiac condition or a history of severe neck disease,[273] but can be modified in older people with other comorbidities.[274]

Older people with symptoms of dizziness should be reviewed medically before starting a rehabilitation program as outlined above.

11.4 Economic evaluation

No economic evaluations were found that examined the cost effectiveness of interventions for dizziness and vertigo in the community setting.

Additional information

The following references may be useful:

- Herdman S (2007). *Vestibular Rehabilitation (Contemporary Perspectives in Rehabilitation)*, FA Davis Company, Philadelphia.[275]
- Maarsingh et al (2009). Development of a diagnostic protocol for dizziness in elderly patients in general practice: a Delphi procedure. *BMC Family Practice* 10:12.[255]
- More information on noncardiac dizziness and a video demonstration of the Dix–Hallpike manoeuvre can be found at: http://www.profane.eu.org/CAT

12 Medications

Recommendations

Assessment

- Older people living in the community should have their medications (prescribed and nonprescribed) reviewed at least yearly, and for those on four or more medications, at least six monthly.

Intervention

- Medication review and modification should be undertaken as part of a multifactorial approach to falls prevention. (Level I)[7]
- For individual older people, gradual and supervised withdrawal of psychoactive medications should be considered to prevent falls. (Level II)[44]
- Pharmacist-led education on medication and a program of facilitated medication review by general practitioners should be encouraged in the community setting. (Level II)[48]

Good practice point

- Consider likely pharmacological changes when prescribing any new medication to an older person and avoid prescribing psychoactive drugs if clinically possible.

12.1 Background and evidence

A number of epidemiological studies have shown an association between medication use and falls in older people (see Section 4.3.2 for more information).[7,19,74,84,276] The risk of falls can be increased by medication interaction, unwanted side effects (such as dizziness) and even the desired effects of medications (such as sedation). It is important that the health care team recognises that pharmacological changes with ageing can lead to potentially avoidable events in older people, including falls and fractures.

12.1.1 Medication use is associated with increased risk of falls

A number of factors affect an older person's ability to deal with and respond to medications, which can increase their risk of falls:[165]

- The ageing process, as well as disease, can result in changes in pharmacokinetics (the time course by which the body absorbs, distributes, metabolises and excretes drugs) and pharmacodynamics (effect of drugs on cellular and organ function).
- Not adhering to drug therapy, including medication misuse and overuse, and inappropriate prescribing can increase the risk of adverse effects.

Certain classes of medication are more likely to increase the risk of falls in older people; for example:

- Centrally acting or psychoactive medications are most likely to contribute to falls, with an increased risk of falling while taking these drugs, compared with not taking them, of between 1.25 (25%) and 1.9 (90%).[277] Benzodiazepines are particularly strongly associated with falls.[278]
- Antidepressants are associated with higher risk of falls;[279] in particular, selective serotonin reuptake inhibitors (SSRIs) and tricyclic antidepressants.[278]
- Antiepileptic drugs and drugs that lower blood pressure are weakly associated with an increased risk of falls.[278]
- Some cardiovascular medications (diuretics, digoxin and type IQ anti-arrhythmic drugs), are weakly associated with an increased risk of falls.[280,281]

Other types of cardiac drugs, and analgesic agents, are not associated with an increased risk of falls.[281]

Taking more than one medication has been associated with an increased risk of falls in some studies.[19,276] This may be the result of adverse reactions to one or more of the medications, detrimental drug interactions, or incorrect use of some or all of the medications. According to one study, the relative risk of falling for people using only one medication (compared with people not taking any medication) is 1.4, increasing to 2.2 for people using two medications, and to 2.4 for people using three or more medications.[276]

Multiple drug use may be partly a proxy measure for poor health. Findings of one cross-sectional study of women aged 60–79 years visiting their general practitioner (GP) did not support a strong relationship link between multiple drug use and falls.[279] The risk of falls increased with the number of medications taken. However, once the number of chronic illnesses was adjusted for, the population-attributable risk associated with psychoactive drug use was between 2% and 5%, compared with a 32% risk of having a chronic disease.

For each drug, the potential falls risk modification should be balanced against the benefit of the drug.

12.1.2 Medication review

The National Medicines Policy recommends that a medication review should be a core part of the assessment of an older person, and should be done regularly for older people who have repeat prescriptions (see the National Medicines Policy from the Australian Government Department of Health and Ageing — the website is provided in the box containing additional information, below). The focus should be on appropriate prescribing — that is, checking that medications are used safely and effectively, and that other forms of treatment or management are considered as alternatives, if possible.

There is evidence from a randomised controlled trial that gradual withdrawal of psychoactive medication will reduce falls,[44] and a medication review intervention reduced the risk of falling in older people living in the community in Australia (see Section 4.3.2).[48]

12.2 Principles of care

12.2.1 Reviewing medications

GPs should review medications yearly for all older people and every six months for older people who take four or more medications.[282]

Older people who live in the community are eligible for a domiciliary medication management review (DMMR), which is a service that encourages collaboration between the older person, their GP, pharmacist and other health professional to review medication use. DMMR results in a report from an accredited pharmacist to the referring GP, and a medication management plan agreed between the GP and the older person or their carer. A DMMR is available following a referral from a GP. For more information, see the Australian Government Department of Health and Ageing website.†

Older people who may benefit from a DMMR include those:

- on multiple medications
- who have recently been discharged from hospital
- with recent and significant changes to their medications
- who are seeing a number of different GPs and specialists.

Also, any member of the older person's health care team may use the checklist in the following box to help decide whether a person requires a DMMR from a pharmacist or doctor.[48]

Checklist for medication review[283]

A medication review is needed if the older person:

- is taking four or more different types of medications
- is taking more than 12 doses of medication a day
- had significant changes made to their medication regime in the past three months
- is attending a number of different doctors
- is taking one or more psychoactive medications
- was recently discharged from a hospital (in the past four weeks)
- has multiple medical conditions
- is suspected of not adhering to their medication regime
- shows symptoms that suggest an adverse medication reaction (eg confusion, dizziness, reduced balance)
- is using medications with a narrow therapeutic index or medication requiring therapeutic monitoring (such as warfarin)
- is responding subtherapeutically to treatment.

Figure 12.1 is an example of a medication risk assessment form.

† http://www.health.gov.au/internet/main/publishing.nsf/Content/health-epc-dmmr-answers.htm

1. How old are you? ☐	Are you (please ✓):		Male ☐	Female ☐

	Yes	No	Don't know
2. Do you have 3 or more health conditions? (please ✓)	☐	☐	☐
3. In general, would you say your health is poor?	☐	☐	☐
4. Have you changed your general practitioner in the past 3 months?	☐	☐	☐
5. Do you have more than one doctor involved in your care, including other general practitioners or specialist?	☐	☐	☐
6. Have you been in hospital, hostel or nursing home in the past month?	☐	☐	☐
7. Do you live alone?	☐	☐	☐
8. Have you had a fall in the past 12 months?	☐	☐	☐
9. In the last month have you: Had trouble sleeping	☐	☐	☐
Felt drowsy or dizzy	☐	☐	☐
Felt nauseous	☐	☐	☐
Had stomach problems	☐	☐	☐
Had a skin rash or itch	☐	☐	☐
Leaked urine	☐	☐	☐
Been constipated	☐	☐	☐

10. How many medicines do you use? *(Write in box)* ☐

Medicines includes all medicines prescribed by your doctor or any other doctor, including specialists medicines bought from chemist, supermarket or health food store, medicines you take only occasionally, herbal medicines, vitamins, minerals, puffers, creams, patches, eye drops and laxatives.

If you do NOT take any medicines, then there is no need to fill in the rest of this page	Yes	No	Don't know
11. Have you started a new medicine in the last 4 weeks?	☐	☐	☐
12. Do you use: Any medicine that helps you sleep	☐	☐	☐
Any medicines for your nerves, stress, anxiety or depression	☐	☐	☐
Any medicines your doctor does not know about	☐	☐	☐
13. Have you been taking any medicines for more than 6 months?	☐	☐	☐
14. For any medicine, you currently use, do you have any:	☐	☐	☐
Trouble with side effects	☐	☐	☐
Trouble remembering to take the medicine	☐	☐	☐
Trouble knowing what medicine is for	☐	☐	☐
Trouble using many medicines at once	☐	☐	☐
Trouble reading the label	☐	☐	☐
Trouble affording the medicine	☐	☐	☐
Trouble understanding the label	☐	☐	☐
Trouble opening bottles or packets/applying the medicines	☐	☐	☐
15. Have you had more than 4 changes to your medicines in the past 12 months?	☐	☐	☐
16. Do you share medicines among family and friends?	☐	☐	☐
17. Has your doctor asked you to bring ALL your medicines to an appointment so he can have a look at them, in the past 12 months?	☐	☐	☐

Please give all forms to your doctor

DOCTOR'S USE ONLY:	Medication Review beneficial: Yes / No	Patient agrees: Yes / No

Figure 12.1 Medication risk assessment form[48]

12.2.2 Quality use of medicines

The following strategies help to ensure quality use of medicines, and are good practice for minimising falls in older people in the community:

- Multiple drug use should be limited to reduce side effects and interactions and a tendency towards proliferation of medication use.
- Drugs that act on the central nervous system, especially psychoactive drugs, are associated with an increased risk of falls; therefore, they should be used with caution and only after weighing up their risks and benefits.
- Prescribe the lowest effective dosage of a medication specific to the symptoms.
- Provide support and reassurance to older people who are gradually stopping the use of psychoactive medication(s).
- If the older person needs to take medications known to be implicated in increasing the risk of falls, try to minimise the troublesome effects (ie drowsiness, dizziness, confusion and gait disturbance).
- Provide the older person (and their carer) with an explanation of newly prescribed medications or changes to prescriptions.
- Educate the whole multidisciplinary team, older people and their carers to improve their awareness of the medications associated with an increased risk of falls.
- Document information when implementing, evaluating, intervening, reviewing, educating and making recommendations about the older person's medication use.

Case study

Mr P is an 80-year-old man who is taking nine different medications. He felt unsteady and had several falls, mainly during the night. During a routine check-up, his general practitioner (GP) assessed Mr P's need for a domiciliary medication management review (DMMR).
The GP referred Mr P to his community pharmacist. The community pharmacist coordinated the review and began by making an appointment for an accredited pharmacist to meet Mr P. The interview took place in Mr P's home, and the accredited pharmacist asked him about all the medications he has, those he is taking currently, and other information. Much of the information required for Mr P's review was in the referral and obtained at the meeting, but the pharmacist may also refer to family members, carers, community nurses, Mr P's preferred community pharmacist or other members of the health care team, with Mr P's consent.
The accredited pharmacist clinically assessed the information gathered about Mr P and his medications, and prepared a report for the GP.

Mr P's DMMR report recommended that he could slowly reduce and then stop taking a sleeping tablet and an antidepressant, which he had started taking two years earlier, after the death of his wife. This was agreed after a discussion between Mr P and his GP about the DMMR, and formed part of an agreed medication management plan. Mr P slowly reduced the use of both medications without ill effect. He felt much more alert and confident while up and about, and steadier when getting up at night.

12.3 Special considerations

12.3.1 Cognitive impairment

Adherence to medication can be a problem in older people with cognitive impairment. Blister packs and other technical prompts can be used to aid adherence, but some people will require supervision with medication. Prescribers should aim to keep a drug regimen simple and, where possible, keep the frequency of medication intake to daily or twice daily. People with cognitive impairment can also have trouble understanding instructions or communicating, which can make subjective assessments unreliable. The health care team should pay special attention to altered behaviours and nonverbal cues in people with cognitive impairment.

12.3.2 Rural and remote settings

The health care team may need to seek further professional advice in a remote facility. The National Prescribing Service and the Therapeutic Advice and Information Service website may be useful.†

12.4 Economic evaluation

Day et al modelled the costs (in 2008A$) and health outcomes (falls prevented and hospital admissions averted) of psychoactive medication withdrawal.[138] The medications included benzodiazepines, sertraline, amitriptyline, paroxetine and venlafaxine, and the study population was people aged 65 years and over, living in the community. Costs and health outcomes were assessed over a 12-month period. The analysis based estimates of effectiveness on a small randomised controlled trial.[44] The modelling considered two strategies for withdrawal:

- reformulation by a community pharmacist (to allow a protocol of dose reduction consistent with the randomised controlled trial)[44] with GP management
- 'off-the-shelf' dosage reduction using dosage strengths listed by the Pharmaceutical Benefits Scheme with GP management.

This modelled analysis calculated an intervention cost of A$603.87–797.87 per person for community pharmacist reformulation, and A$234.47 per person for an off-the-shelf reduction. Over 12 months, the cost per fall prevented ranged from A$502 to A$803 per fall prevented for the reformulation option, to A$195 per fall prevented for the off-the-shelf option using venlafaxine as an example. These costs did not include other potential program costs, such as GP and pharmacist education, or the potential costs of any adverse consequences.

Over this same time, the cost per hospital admission averted ranged from A$25 092–33 154 per hospital admission averted for the reformulation option, to A$9743 per hospital admission averted for the off-the-shelf option (venlafaxine).

Medication review was also considered as part of multiple intervention strategies (see Sections 4.4.1 and 4.5.1).

Additional information

Pharmacist roles in assessment and evaluation procedures are governed by the relevant professional practice standards and guidelines:

- Australian Pharmaceutical Formulary
- Pharmaceutical Society of Australia: http://www.psa.org.au
- The Society of Hospital Pharmacists of Australia: http://www.shpa.org.au

Useful resources for staff

- *Australian Medicines Handbook,* 10th edition (2009), produced by the Royal Australian College of General Practitioners (RACGP), the Pharmaceutical Society of Australia (PSA) and the Australasian Society of Clinical and Experimental Pharmacologists and Toxicologists (ASCEPT)
- *Australian Medicines Handbook Drug Choice Companion: Aged Care*, 2nd edition(2006), includes a falls prevention section
- National Medicines Policy: http://www.health.gov.au/internet/main/publishing.nsf/Content/National+Medicines+Policy-1
- National Strategy for Quality Use of Medicines: http://www.health.gov.au/internet/main/publishing.nsf/Content/nmp-pdf-natstrateng-cnt.htm
- Australian Pharmaceutical Advisory Council: http://www.health.gov.au/internet/main/publishing.nsf/Content/nmp-advisory-apac_mem.htm

† http://www.nps.org.au/health_professionals/consult_a_drug_information_pharmacist/

- Domiciliary Medication Management Review (DMMR) (also known as the Home Medicines Review):
  http://www.health.gov.au/internet/main/publishing.nsf/Content/health-epc-dmmr-answers.htm
- National Prescribing Service incorporates drug information service for health professionals:
  http://www.nps.org.au
- Therapeutic Advice and Information Service — can be contacted on 1300 138 677
- Relevant state and territory drug information centres
- Relevant state and territory pharmaceutical advisory services
- *Standards of Practice for Clinical Pharmacy* published by the Society of Hospital Pharmacists:
  http://www.informaworld.com/smpp/content~db=all~content=a713477361
- *Australian Pharmaceutical Formulary and Handbook,* 21st edition (2009), published by the Pharmaceutical Society of Australia, includes guidelines and practice standards for medication management review:
  http://www.psa.org.au
- MIMS medicines database, which includes full and abbreviated information and over-the-counter information
  Contact: CMPMedica Australia
  Phone 02 9902 7700
  http://www.mims.com.au
- Pharmaceutical Health and Rational Use of Medicines Committee:
  http://www.health.gov.au/internet/main/publishing.nsf/Content/nmp-advisory-apac-pharm

Useful resources for older people

- Adverse Medicine Events Line
  Phone: 1300 134 237
- National Prescribing Service, which incorporates drug information service for people on the Medicines Line
  Phone: 1300 888 763
- Pharmaceutical Society of Australia — self-care health information cards entitled *Preventing Falls and Wise Use of Medicines*; available from the PSA, local pharmacy or the website:
  http://www.psa.org.au
- Pharmacy Guild of Australia
  Phone: 02 6270 1888
  Fax: 02 6270 1800
  Email: guild.nat@guild.org.au
  http://www.guild.org.au/index.asp
- Consumer Medicine Information:
  http://www.health.gov.au/internet/main/Publishing.nsf/Content/nmp-consumers-cmi.htm

13 Vision

Recommendations

Assessment

- Include a test of vision as part of a falls risk assessment.
- Encourage older people to have regular eye examinations (every two years) to reduce the incidence of visual impairment, which is associated with an increased risk of falls.

Interventions

- Older people with visual impairment primarily related to cataracts should undergo cataract surgery as soon as practicable. (Level II)[41,42]
- When correcting other visual impairment (eg prescription of new spectacles), explain to the older person and to their family and carers (where appropriate) that extra care is needed while the older person gets used to the new visual information. (Level II)[77]
- Advise older people who take part in regular outdoor activities to avoid bifocals or multifocals and to use single-vision distance spectacles when walking — especially when negotiating steps or walking in unfamiliar surroundings. (Level III-2)[284]
- People with severe visual impairment should receive a home safety assessment and modification program specifically designed to prevent falls. (Level II)[45,46]

Good practice point

- Detailed assessment by an optometrist or orthoptist for a fall-specific eye examination should:
  - identify the presence of eye diseases
  - calculate subjective refraction and determine optimum spectacle correction
  - check for high-contrast visual acuity using the Snellen eye chart and for contrast sensitivity using the Pelli–Robson test charts, the Melbourne Edge Test or similar
  - assess visual fields using the Humphrey Field Analyser or similar
  - assess depth perception.

13.1 Background and evidence

Impaired vision is an important and independent risk factor for falls in older people who live in the community (see also Section 4.3.5 for more information). About 20% of people aged 70 years or older have a visual acuity of less than 6/12.[285] Previous studies have indicated that many older people who wear spectacles with outdated prescriptions or no spectacles at all would benefit from wearing new spectacles with the correct prescription.[286-290] This indicates the importance of regular eye examinations to prevent vision-related impairment and improve quality of life.

13.1.1 Visual functions associated with increased risk of falls

Vision is a key sensory input for maintaining balance and avoiding falls related to obstacles in the environment. Older people rely disproportionately more on visual information than on proprioceptive or vestibular input for balance control.[291] Extensive research in the community setting shows that reduced visual function is associated with an increased risk of falls or fractures. The risk of multiple falls is reported to increase 2.6 times if visual acuity is worse than 6/7.5.[292] Visual acuity of 6/15 or worse almost doubles the risk of hip fracture, and this risk is greater with even lower visual acuity levels.[293] Other visual functions have also been associated with an increased risk of falling. These include reduced contrast sensitivity,[248,294] poor depth perception[284,295] and reduced visual field size.[292,296-299]

Several eye diseases that are common in old age have also been associated with an increased risk of falling:

- Visual changes resulting from cataracts (see Figure 13.2) are associated with increased postural instability[300] and falls risk in older people who live in the community.[301]
- People with glaucoma can present with a range of loss of peripheral visual fields (side vision) depending on disease severity (see Figure 13.3). This affects postural stability[302] and the ability to detect obstacles and navigate through cluttered environments.[297,303]
- Macular degeneration can cause loss of central vision depending on disease severity (see Figure 13.4) and is associated with impaired balance[304] and increased risk of falls.[305]

Figure 13.1 shows normal vision, as a comparison.

13.2 Principles of care

13.2.1 Screening vision

Vision screening should be included in multifactorial falls prevention interventions.[50]

The following strategies can be used to measure vision problems in older people in the community:

- Ask the older person about their vision and record any visual complaints and history of eye problems and eye disease.
- Check for signs of visual deterioration. These can include an inability to see detail in objects, or an inability to read (including avoiding reading) or watch television, and a propensity to spill drinks or bump into objects.
- Measure visual acuity or contrast sensitivity using a standard eye chart (eg Snellen eye chart) or the Melbourne Edge Test, respectively (see Table 13.1).
- Check for signs of visual field loss using a confrontation test (see Table 13.1) and refer for a full automated perimetry test by an optometrist or ophthalmologist if any defects are found. Large, prospective studies have found that falls are mostly associated with loss of field sensitivity, rather than loss of visual acuity and contrast sensitivity.[296,297]
- Arrange regular eye examinations to reduce the incidence of visual impairment,[289] which is associated with an increased risk of falls.[296]

Source: Courtesy of Vision 2020 Australia

Figure 13.1 Normal vision

Source: Courtesy of Vision 2020 Australia

Figure 13.2 Visual changes resulting from cataracts

Source: Courtesy of Vision 2020 Australia

Figure 13.3 Visual changes resulting from glaucoma

Source: Courtesy of Vision 2020 Australia

Figure 13.4 Visual changes resulting from macular degeneration

Table 13.1 outlines the characteristics of eye-screening tests.

Table 13.1 Characteristics of eye-screening tests

Snellen eye chart (for testing visual acuity)	
Description	Standardised eye test of visual acuity. Comprises a series of symbols (usually letters) in lines of gradually decreasing size. Participant is asked to read the chart from a distance of 6 m for standard charts (charts designed for shorter test distances are available; the examiner should check that they are using the correct working distance for the chart). Charts should also be well lit and not obscured by glare or shadows. Visual acuity is stated as a fraction, with 6 being the numerator and the last line read the denominator (the larger the denominator, the worse the visual acuity). Pocket versions of Snellen charts are available for a clinical screen of visual acuity (these smaller charts can be used at a shorter distance than the standard 6 m to test visual acuity).
Time needed	5 minutes
Criterion	A score of 6/12 indicates visual impairment; however, this depends on the age of the person (the cut-off score will decrease with increasing age).

Melbourne Edge Test (for testing contrast sensitivity)[306]	
Description	The test presents 20 circular patches containing edges with reducing contrast. Correct identification of the orientation of the edges on the patches provides a measure of contrast sensitivity in decibel units, where $dB = -10\log_{10}$ contrast, where contrast defines the ratio of luminance levels of the two halves of the circular patch.
Time needed	5 minutes
Criterion	Score of less than 18/24 indicates visual impairment; however, this depends on the age of the person.[306]

Confrontation Visual Field Test[307]	
Description	Crude test of visual fields. Participant and examiner sit between 66 cm and 1 m apart at the same height, with the examiner's back towards a blank wall. To test the right eye, the participant covers the left eye with the palm of their hand and stares at the examiner's nose. The examiner holds up both hands in the upper half of the field, one either side of the vertical, and each with either 1 or 2 fingers extended and asks the participant, 'What is the total number of fingers I am holding up?' The procedure is repeated for the lower half of the field but changing the number of fingers extended in each hand. The procedure is repeated for the left eye. If the participant incorrectly counts the number of fingers in the upper or lower field, the test should be repeated again and then recorded. If the participant moves fixation to view the peripheral targets, repeat the presentation. Results are recorded as finger counting fields R√ and L√ if the participant correctly reports the number of fingers presented. For those who fail this screening, a diagram should be drawn to indicate in which part of the field the participant made an error.
Time needed	4 minutes
Criterion	If the participant incorrectly reports the number of fingers held up in either eye, they should be referred for a full visual field test. If more detailed visual assessment is needed once the older person has been assessed using the crude visual screening methods described above, or if the older person scores poorly on these tests, the general practitioner should refer them to an optometrist, orthoptist or ophthalmologist for a full vision assessment.

13.2.2 Choosing vision interventions

When a visual deficit is identified, the older person's general practitioner (GP) should seek a diagnosis to provide interventions — including referral to an ophthalmologist or optometrist, as necessary.

Cataract surgery

Expedited cataract surgery is the only evidence based vision intervention that has shown to be effective in reducing both falls and fractures in older people.[41,42]

Compared with expedited cataract surgery, prolonged waits on lists for cataract surgery are associated with an increased risk of falls and fractures.[41,42] Therefore, an occupational therapist should assess environmental safety to identify potential hazards, lack of equipment and risky behaviours that might cause falls in people with severe visual impairment, including those waiting for cataract surgery (see *Home safety assessment and modification*, below).

Referral to an ophthalmologist

As part of inpatient hospital care, one randomised controlled trial showed that falls could be reduced by a multifactorial approach that included referring the older person to an ophthalmologist when a new visual problem is detected, or if there is no known reason for poor vision.[195] This could be applied in the community setting as well.

Also, recommend that the older person sees an optometrist if they have impaired visual acuity, wear spectacles that are scratched or do not fit comfortably, or have not had an eye examination in the past year.

Optimal prescription

If the older person wears spectacles, their GP or other member of the health care team may check their visual acuity with their current spectacles and refer them for optometric assessment if it is less than 6/7.5. However, caution is required in frail older people, because comprehensive vision assessment with appropriate treatment may increase the risk of falls (see Section 4.3.5).[77] Large changes in refractive correction should be prescribed only with great care and warnings about adaptation problems, or only a partial change in refractive correction should be made in such cases.

Choice of spectacles

Older people may benefit from an assessment by an optometrist or ophthalmologist who can provide advice on the most appropriate type of spectacle correction. Older people who live in the community and who wear bifocal or multifocal spectacle lenses when walking outside the home and on stairs have a decreased ability to negotiate steps safely[308] and a doubled risk of falls from tripping.[284] Older people with a history of falls or an increased risk of falls should be advised to avoid bifocals or multifocals and to use single-vision distance spectacles when walking — especially when negotiating steps or walking in unfamiliar surroundings. A study also suggested telling older people who wear multifocals and distance single-vision spectacles to bend their heads rather than just lowering their eyes to look downwards to avoid postural instability.[309]

Home safety assessment and modification

Interventions that improve visual cues and minimise environmental hazards should be used, including provision of adequate lighting and contrast (eg by applying adhesive strips for steps or painting the edges of pathways white).[45,46] Occupational therapists can also provide home visits to help older people modify their behaviours, allowing them to live more safely in both the home and external environments[75] (see Chapter 14 on environmental considerations for more information).

Point of interest: mobility training

Vision Australia specialises in safe mobility training for visually impaired people: http://www.visionaustralia.org.au

Case study

Mrs J is 75 years old and badly bruised her left arm after falling over a step. Her general practitioner (GP) tested her vision using a standard Snellen eye chart and found that her visual acuity was reduced. The GP arranged for her to see an ophthalmologist, who diagnosed a cataract in Mrs J's right eye. Within the next month, she was scheduled for cataract extraction. After the operation, Mrs J was pleased to notice an almost immediate improvement in her vision. She now feels much safer while walking in unfamiliar places and has not fallen since the operation.

13.3 Special considerations

13.3.1 Cognitive impairment

Where possible, people with cognitive impairment should have their vision tested using standard testing procedures. Where this is not possible, visual acuity can be assessed using the Landolt C or Tumbling E chart. The Landolt C is a standardised symbol (a ring with a gap, similar to a capital C) used to test vision. The symbol is displayed with the gap in various orientations (top, bottom, left, right), and the person being tested must say which direction it faces. The Tumbling E chart is similar, but uses the letter E in different orientations.

These tests include near-vision, distance and reduced Snellen tests, and can be used to measure and record visual acuity in the same way as standard letter charts.

13.3.2 Rural and remote settings

Health care professionals or carers can contact their local Optometrists Association Australia in their state or territory for an up-to-date list of optometrists providing services in rural and remote areas. To find a local ophthalmologist, the older person's GP or optometrist can provide a referral. Alternatively, contact the Royal Australian and New Zealand College of Ophthalmologists on +61 2 9690 1001. The strategies outlined earlier in this section should be implemented before a referral to an ophthalmologist is made.

13.3.3 Indigenous and culturally and linguistically diverse groups

Where appropriate, visual acuity can be measured for Indigenous people using a culturally appropriate chart known as the 'Turtle Chart',[310] which has a series of turtles of different sizes and orientations. Similarly, there is a series of culturally appropriate brochures and posters that describe different eye diseases and conditions, and different types of spectacle corrections.

13.3.4 People with limited mobility

Domiciliary visits by optometrists or ophthalmologists may be necessary for housebound older people. Contact the Optometrists Association Australia in your state or territory to access a current list of optometrists willing to provide such services.

13.4 Economic evaluation

One economic evaluation of a vision-specific intervention suggested that first-eye cataract surgery for women over 70 years of age offers good value for money.[311] This economic evaluation was run alongside a randomised controlled trial of first-eye cataract surgery in women older than 70 years, in secondary care ophthalmology clinics in the United Kingdom. The evaluation used a health service and personal social service perspective to compare the incremental costs (in 2004UK£) and incremental health outcomes (in terms of falls and quality-adjusted life years — QALYs) of cataract surgery (using no surgery as a control). The incremental cost per fall prevented over the one year of the trial ranged from UK£3983–4390 per fall prevented (depending on whether carer costs were included). The incremental cost per QALY gained over the one-year trial was UK£35 704 (including carer costs) and ranged from UK£18 386–46 033 per QALY gained,

under different sensitivity analyses. When trial results were modelled over a longer timeframe (expected remaining lifetime), the incremental cost per QALY gained was UK£13 172 (including carer costs) and ranged from UK£1741–13 445 per QALY gained.

A second economic evaluation, although not specifically an intervention to improve vision, assessed the cost effectiveness of a home safety or exercise program in people aged 75 years or over with severe visual impairment. Only the home safety program in this population was effective; therefore, the authors only reported the cost effectiveness of this program. The average cost of implementing the home safety program (in 2004NZ$) was NZ$325. The incremental cost per fall prevented was NZ$650 and ranged from NZ$460–1569 per fall prevented.[45]

A third economic evaluation modelled the effect of expedited cataract surgery in Australia.[138] The authors considered that surgery could be expedited using two main strategies:

- reprioritising waiting lists (which can only be cost neutral if there are no negative costs for those who are reprioritised lower in the list)
- increasing the overall capacity of the hospital system.

However, the authors did not model the costs of this second approach. Assuming that reprioritising waiting lists was cost neutral, they did not calculate a cost per fall prevented, but indicated that in Australia over 12 months, this approach would prevent 175 falls and prevent three hospital admissions at no additional cost.[138] The costs associated with assessing people for prioritisation and reorganising theatre and clinic schedules were not included in the models.

Additional information

The following associations may be helpful:

- Optometrists Association Australia
  Tel: 03 9668 8500
  Fax: 03 9663 7478
  Email: oaanat@optometrists.asn.au
  http://www.optometrists.asn.au (the website contains details for state and territory divisions)
- Vision Australia provides services for people with low vision and blindness across Australia:
  http://www.visionaustralia.org.au
- Macular Degeneration Foundation promotes awareness of macular degeneration and provides resources and information:
  http://www.mdfoundation.com.au
- Guide dogs associations in Australia help people with visual impairment to gain freedom and independence to move safely and confidently around the community and to fulfil their potential:
  http://www.guidedogsaustralia.com

14 Environmental considerations

Recommendations

Assessment

- Older people considered to be at higher risk of falling should be assessed by an occupational therapist for specific environmental or equipment needs and training to maximise safety.

Intervention

- Environmental review and home hazard modification should be considered as part of a multifactorial approach in a falls prevention program for older people in the community. (Level I)[7]
- When conducted as a single intervention, home environment interventions are effective for reducing falls in high-risk older people. (Level I)[43]

Good practice point

- It is important to help the older person understand the relevance of any environmental modifications, to improve uptake of such interventions.

14.1 Background and evidence

For older people who live in the community, about 50% of falls occur within their homes and immediate home surroundings.[16,17]

The risk factors for falling in the home or community context are many and complex, but may include poor lighting, clutter, uneven or slippery floors or risk-taking behaviour (eg using unstable furniture as a walking aid).[2]

Environmental modification can help to reduce these risk factors for falls (see also Section 4.3.4 for more information). Modification involves checking the older person's home (and immediate surrounds, such as the garden) for hazards that might cause them to fall, and then modifying or rearranging the environment to remove or minimise these hazards. Environmental hazards can occur within the home (eg untidy electrical cords, poor lighting, loose carpets or mats), within the garden (eg slipping on grass) or away from the home (eg public falls hazards — uneven footpaths, poor lighting in public areas).[2]

Assessment and modification of home hazards by a health care professional (eg an occupational therapist) does help to reduce the risk of falls in older people with a history of past falls.[7,43] A meta-analysis of environmental interventions pooled results from six trials and found a 21% reduction of falls risk.[43] A subanalysis of four datasets showed that home safety assessments that were comprehensive and well focused, and that targeted at-risk older people, had the greatest effect. These targeted interventions reduced falls by 39%, with a number needed to treat (NNT) of four people (that is, for every four people who received the intervention, one benefited). These results indicate home hazard modification is a clinically viable intervention. The at-risk older people included those with a history of falling, those who had fallen more than once, those who had been recently hospitalised, and those with functional decline or a severe vision impairment.

However, an observational study found that only about half of all people receiving home safety modifications adhere to the recommendations.[312] This study also found that a person's belief that home modifications can prevent falls was a predictor of whether they followed the recommendations. It appears that making sure the older person understands the importance of home hazard modifications, and making sure they have realistic perceptions of their personal risk in relation to hazards and how they negotiate the environment, are critical to successful outcomes.

A narrative (nonsystematic) review of the literature found that including environmental risk factor screening and home safety interventions as a preventive strategy helped to reduce falls when used in multifactorial programs in people with a history of falls.[313] This was supported by a meta-regression that compared single and multifactorial community interventions to show that both approaches were effective, with the effective multifactorial interventions all including home safety aspects.[91]

Overall, environmental review and modification should be considered as part of a multifactorial approach in a falls prevention program. Evidence shows that offering home safety as a single intervention has the greatest effect when provided to older people at high risk. Strategies to improve adherence to environmental recommendations should be considered, and it is important to help the older person understand the relevance of any modifications.[2]

Point of interest: home safety assessment and modification can reduce falls

Falls can be reduced using a home safety assessment and modification intervention in older people with severe visual impairment, and those recently discharged from hospital who have fallen in the previous year.

14.2 Principles of care

14.2.1 Assessing the older person in their environment

An environmental assessment should be done by a health professional (eg an occupational therapist) with experience and training in evaluating people and their environment.[7] An occupational therapist can evaluate older people to determine their capacity to plan and perform activities of daily living and to meet the functional demands of the environment.[314]

Within the community setting, an occupational therapy-based falls prevention intervention should:[313,315]

- focus on older people who have a history of falls

- help to make the necessary environmental modifications (eg using follow-up telephone calls or extra home visits, as needed)
- make sure the older person understands their risk factors for falling, and the consequences of falling (to improve adherence)
- recognise the preferences of the older person's family or carer and incorporate these into the intervention.

Where an occupational therapist receives a referral from another member of the health care team and is asked to review an older person because of a fall or risk of falls, the occupational therapist should do the following:[76,315]

- Conduct an initial evaluation and identify the range of environments in which the older person lives or works, chart their daily schedule or routine, and identify relevant activities of daily living for assessment.
- Understand the older person's fall experiences and their beliefs about what causes falls.
- Evaluate the older person's functional status within the context of their home environment by checking their
  - physical resources (strength, range of motion, coordination, sensation, balance) in functional situations, such as reaching and bending
  - perceptual or cognitive function
  - functional vision
  - general mobility.
- Taking into account the person–environment fit, conduct a review of the home and outdoors environment using a validated and comprehensive tool, such as the Westmead Home Safety Assessment (see point of interest box, below). Use the tool with the older person and together identify hazards, possible solutions, and develop an action plan. The process should enable the older person to increase their awareness and observation skills for identifying fall hazards in other environments. Consider risk-taking behaviours and encourage protective adaptations; for example, strategies to reduce rushing to answer the phone or cues to remember to turn the light on at entranceways at night.

At the end of the evaluation, the occupational therapist should provide a summary that identifies requirements for:

- additional safety equipment
- assistive devices and recommendations for their use
- any rearrangement of furniture
- other environmental modifications
- mobility training and safety when walking around in public places.

Point of interest: assessment tools

The Westmead Home Safety Assessment determines how fall history, risky situations, habits, behaviours and personal characteristics affect an individual's safety level. It identifies 72 possible physical and environmental home hazards of older people at risk of falling.[316] Each item on the assessment form is rated as a 'hazard' or 'not a hazard', and information on all categorised hazards are identified and summarised so an action plan can be developed. It should be used in conjunction with the manual, *Home Fall Hazards*,[76] which outlines the evaluation approach to an environmental intervention in the home.

The Falls Behavioural Scale for Older People[317] is a 29-item self-reporting assessment tool that can be used to assess the kinds of everyday behaviours that can offer an older person protection from falling. It can also be given to the older person before a home visit to raise their awareness of a broader range of potential risks, and therefore contribute to discussion and problem solving.

The Home Falls and Accidents Screening Tool (Home Fast), which was developed by the University of Newcastle (Australia), can be used by health care professionals to identify older people who have an increased risk of falling, refer them for a more detailed falls risk assessment and recommend falls prevention interventions. See the Department of Health (State Government of Victoria) website for more information: http://www.health.vic.gov.au/agedcare/maintaining/falls/providers/home/env_check.htm

14.2.2 Designing multifactorial interventions that include environmental modifications

Effective environmental interventions should incorporate modifications, such as:[2,43,194]

- ensuring adequate lighting, and reducing glare
- enhancing contrast at change of flooring levels
- modifying slippery floors or steps
- reducing clutter
- using walking aids
- removing loose carpets
- fixing uneven and broken pathways.

Falls can be further minimised by using luminous toilet signs and night sensor lights, as part of a multifactorial falls prevention intervention (see Chapter 8 on continence for more information about toileting).[194] Other common-sense interventions include installing grab rails in the bathroom, removing leaf litter on outdoor paths, replacing or fixing worn mats, and ensuring that furniture and electrical cords are not placed in walkways.

Appendix 5 contains useful information on modifying flooring, lighting, bathrooms and toilets, hallways, stairways and steps, furniture, beds, chairs, alert or call systems, and external environments.

Health care professionals or carers should discuss with older people if their personal belongings and furniture are to be moved. They should also determine the older person's preferred sleeping arrangements.

Case study

Mrs H, who lives alone, was discharged from hospital following a fall. Before she returned home, an occupational therapist (OT) visited Mrs H's home with her and made a list of things that needed to be changed, to reduce Mrs H's risk of falling again. Mrs H's daughter worked with the OT to make these changes, which included replacing floor mats in the hallway with nonslip coverings, installing a railing to help Mrs H get in and out of the shower, and asking the local newsagent (who delivered the paper in the mornings) to throw the paper on to the driveway, instead of on the lawn (where the grass was slippery and springy).

After Mrs H returned home, the OT discussed with her the importance of making these changes. She also watched Mrs H going about her normal activities of daily living for half a day at home, and together they wrote a list of 'risky behaviours' that might increase Mrs H's risk of falling (eg using an unstable chair instead of a ladder to reach the top cupboard). One week later, the OT rang Mrs H to make sure that she was avoiding these risky behaviours. Mrs H now has a greatly reduced risk of falling, because she understands her own particular risk factors for falling and the benefits of being involved in making changes.

14.3 Special considerations

14.3.1 Cognitive impairment

The physical environment takes on greater significance for older people with diminished physical, sensory or cognitive capacity.[318] The unique characteristics of older people who are cognitively impaired may adversely affect their interaction with the environment. As well as reviewing the environmental factors noted in Appendix 5, health care professionals should make sure that older people who are agitated or who show behavioural disturbances are observed or monitored adequately.

14.3.2 Rural and remote settings

Many of the environmental strategies suggest multidisciplinary involvement and this may not be readily available in rural and remote settings. Videoconferencing, teleconferencing and interagency collaboration may be helpful. Home Fast offers a screening tool for self-reporting to be used by other health professionals (see Appendix 5)[319] and, alternatively, a brief Westmead screening tool is provided in the latest edition of the Stepping On manual.† A Stay On Your Feet home safety checklist for the older person is available from NSW Health‡ or from Queensland Health.§

14.3.3 'At risk' people discharged from hospital

The risk of falling after being discharged from hospital (for any condition) is increased: approximately 15% of people fall soon after they are discharged from hospital.[320] A randomised controlled trial found that home visits by occupational therapists helped to prevent falls in older people who had been recently discharged from hospital.[312]

14.3.4 People with urinary incontinence

Incontinence is a common problem in older people and is associated with an increased risk of falls (see Chapter 8 for more information on continence). Environmental hazards (eg slippery floor coverings, poor lighting) are a particular risk when older people rush to the toilet — particularly at night, when their balance might already be poor.[109]

14.4 Economic evaluation

Two trial-based and two modelled economic evaluations have been conducted for home safety assessment and modification interventions compared with usual care.

Salkeld et al[321] conducted an economic evaluation alongside Cumming's randomised controlled trial of a home safety program.[312] The intervention included home visits by an experienced occupational therapist who assessed and facilitated home and behaviour modifications. Costs (in 1997A$) and health outcomes (falls prevented) over a 12-month period were included. The mean total cost in the intervention group (including hospital and other health care costs) was A$10 084, compared with A$8279 in the control group. The incremental cost per fall prevented was A$4986 for all participants and A$3980 for participants who had fallen in the previous 12 months. When outliers were excluded, the incremental cost per fall prevented was A$1921 for all participants. When only considering the participants who had fallen in the previous year, the intervention was both more effective and cost saving compared with usual care.

A second economic evaluation run alongside a randomised controlled trial (the VIP trial) assessed the cost effectiveness of a home safety program in people aged 75 years or over with severe visual impairment.[45] The home safety program in this population was effective in reducing the rate of falls (see above). The average cost of implementing the home safety program (in 2004NZ$) was NZ$325. The incremental cost per fall prevented compared with no home safety program was NZ$650 and ranged from NZ$460 to $1569.

Two modelled economic evaluations of home safety assessment and modification interventions have also been published. Day et al[138] considered the costs in Australia (in 2008A$) and health outcomes (falls prevented and hospital admissions averted) over a 12-month period for the home safety program in older people recently discharged from hospital and evaluated by Cumming et al.[75] Effectiveness estimates were based on the subgroup with a previous fall (see above),[75] with resource use based on Salkeld et al (see above).[321] Day et al[138] reported an intervention cost of A$413 per person using Australian public sector wage rates. Over 12 months, the cost per fall prevented was A$417 and was A$20 834 per hospital admission averted (base case). The incremental cost per fall prevented ranged from A$290 to A$1199, and the incremental cost per hospital admission averted ranged from A$14 501 to A$59 943.

† http://purl.library.usyd.edu.au/sup/9781920898755

‡ http://www.health.nsw.gov.au

§ http://www.health.qld.gov.au/stayonyourfeet/resources.asp

A modelled economic analysis of a hypothetical home assessment and modification program was conducted by Smith et al.[322] Costs (in 1996A$) and health outcomes (falls prevented and injuries prevented, based on the assumption of a 40% probability of falling and a 10% probability of an injury as a result) were modelled over a one-year and 10-year timeframe. All future costs and health outcomes were discounted at 5% per year. Over one year, there was an incremental cost of A$172.08 per person, an incremental cost per fall prevented of A$1720.80 and an incremental cost per injury prevented of A$17 208. In sensitivity analyses, the incremental cost per fall prevented ranged from A$721 to A$4571 and the incremental cost per injury prevented ranged from A$7208 to A$45 708. Over 10 years, there was an incremental cost saving of A$91.57 per person, suggesting that the intervention was less costly and more effective than usual care. In sensitivity analyses, the incremental cost for 10 years ranged from –A$77 to A$646; the incremental cost-effectiveness ratio (ICER) therefore ranged from being less costly and more effective than usual care to A$1936 per fall prevented and A$19 355 per injury prevented.

Additional information

The following associations and organisations may be helpful:

- OT AUSTRALIA
  Ph: 03 9415 2900
  Fax: 03 9416 1421
  Email: info@ausot.com.au
  http://www.ausot.com.au
- Home Modification Information Clearinghouse collects and distributes information on home maintenance and modification, to help frail, older people, people with a disability and their carers to remain at home:
  http://www.homemods.info

15 Individual surveillance and observation

Good practice points

- Sitter programs (eg using staff or volunteers to sit with at-risk older people) may be useful for individual people.
- Bed, chair or foot alarms can alert a carer that the person is attempting to mobilise.
- A personal alarm, when worn, can trigger an alert that a person has fallen, and minimise the time they lie on the floor.
- Electronic sensor monitoring systems are being developed and tested, but they are not likely to be available widely for some time.

15.1 Background and evidence

An Australian report on falls leading to hospitalisation found that half of these falls (49.1%; N=32 770) occurred in the home, including in the driveway.[323]

The effects of individual surveillance and observation have not been studied in the community setting, nor are they easy for health care professionals to implement or monitor. Therefore, no recommendations can be made for this intervention in the community setting, despite the clear role of surveillance and observation in addressing falls in hospitals and residential aged care facilities.

Instead, the list of key points above should be considered good practice in the absence of data, and are intended to help health care professionals, and carers and family of older people who live in the community to minimise the risk of falls. Further information, where available, is included in the remainder of this section.

15.2 Principles of care

Little research on surveillance or observation has been done in the community setting. The following general principles of observation and surveillance are based on good practice in the hospital setting, and may be useful in the community setting.

Older people who have a high risk of falling should be informed of their risk. A multifactorial trial conducted in the hospital setting gave family members and carers an information brochure to use in discussions with the older person about falls in hospitals.[324] It is possible that adapting a brochure for the community could be helpful for families and informal carers to discuss falls with the older person. This type of information should be targeted to those older people who have the highest risk of falling.

15.2.1 Assessment

A home visit by an occupational therapist — with the older person — should be considered, as part of discharge planning. Referral to a falls clinic may be useful. If the older person wants to remain in their own home, the health care team (eg general practitioner, allied health staff, carers and family) should make the home environment as safe as possible, including setting up a monitoring system to minimise the time spent on the floor in the event of a fall (see below).

15.2.2 Sitter programs

Some hospitals and residential aged care facilities have introduced sitter programs.[325-327] These programs use volunteers, families or paid staff to sit with older people who have a high risk of falling. The role of the sitter is to provide company for the person and to notify the appropriate personnel when the older person wishes to undertake an activity where they may be at risk of falling. Sitter programs may be a viable strategy in some community settings, to reduce falls for selected people. However, sitter programs require planning, resources, education, investment (particularly for paid individuals) and ongoing coordination. Sitter programs have not been specifically researched in the community setting, so it is not clear whether they would be helpful for older people living at home. Also, they may be too expensive for many older people and their carers or family, However, the older person's general practitioner or other member of the health care team could encourage the older person's carers, family or friends to spend time sitting with the older person, particularly in waking hours.

15.2.3 Response systems

Response systems are usually a form of monitor, incorporating an alarm that sounds when a person moves or presses a button. A number of response systems are commercially available. A prospective cohort study investigated the use of alarms by people older than 90 years of age living either in their own home or within a care home. Many participants who lived alone owned a call alarm (70%; 57 out of 81 participants).[328] Despite this, use of the alarm was low among older people in the community who had a fall when alone (78%; 28 out of 36 participants). Reasons for not using the alarm included not wearing it, wearing it but not wanting to use it (wanting to stay independent, fearful of being taken to hospital) and difficulty in activating it.

In some systems, an alarm is activated by a pressure sensor when a person starts to move from a bed or chair. In other systems, an alarm sounds when any part of a person's body moves within a space monitored by the alarm. Another style of system activates when a person falls, but does not get up. For example, a bedside foot alarm to wake a sleeping carer may help to reduce the time the older person spends on the floor after a fall, although this has not been investigated in the community setting. Alternatively, a light sensor under the bed can be triggered when the older person steps out of bed during the night and alerts the sleeping carer.

Response systems require capital investment and rely on a third party[329] (eg the older person's carer, family, neighbour or general community) to respond when the alarm sounds.

Alarm systems that are triggered when a person has fallen are not preventive. Instead, they simply report the fall after the event, and minimise the time spent on the floor.

Surveillance and observation approaches are particularly useful for older people who forget or do not realise their limitations. Good practice involves:

- identifying those older people who are at risk in the community
- assessing them in their own homes, and modifying the home environment and behaviour so the older person is as safe as possible
- involving their carer, family and neighbours, where possible, to provide additional surveillance
- encouraging them to enrol in an exercise program specifically for falls prevention, and undertake regular exercises either at home or in a class
- providing them with a personal alarm to use if they do fall, and ensure they wear the alarm at all times (including in the shower or in bed — both of which are high-risk times).

Case study

Mrs Z is 79 years old and lives by herself. Her family worry about her, but also know that it is important to Mrs Z that she maintains her independence as long as possible. Mrs Z has had three falls previously, all related to meal preparation. Her family have discussed with her strategies to reduce her risk of falling, including using a four-wheel walker with a seat that would allow her to carry her food and drinks. Her family also help by bringing her meals five times a week. Mrs Z's neighbour visits her twice a week to help her in the kitchen.

Mrs Z's family has also bought Mrs Z a pendant alarm that she wears around her neck to activate if she has a fall and cannot get up. She was admitted to the emergency department of the local hospital after a fall. The hospital has put a green sticker in her case notes to indicate that she has an increased risk of falls.

15.3 Special considerations

15.3.1 Cognitive impairment

It is not necessarily correct to assume that if someone is cognitively impaired due to dementia, they should be subjected to intrusive surveillance to prevent falls.[328] Care should be taken that alarms do not infringe autonomy. The lack of clear research results (probably due to the difficulties in researching this area), and the ethical, legal and cost considerations of monitoring people, should be factored into decisions.

15.3.2 Indigenous and culturally and linguistically diverse groups

In some cultures it is accepted practice to sit for long periods with ill relatives and elders. This may afford a greater role to carers, family members and friends in supervising the older person's activity to reduce the risk of falls.

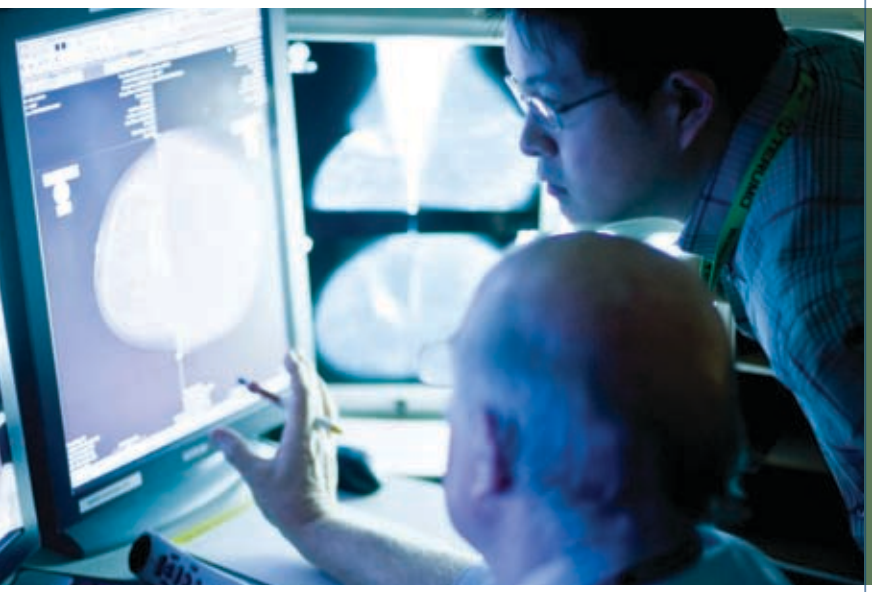
15.4 Economic evaluation

No economic evaluations were identified that specifically considered interventions for individual surveillance in the community setting. Some interventions have been conducted in a hospital environment; however, it is unclear whether the results are applicable to the community setting (see Chapter 15 in the hospital guidelines for more information).

Additional information

Australian Resource Centre for Health Care Innovation:
http://www.archi.net.au/e-library/safety/falls

A range of alarm systems and alert devices are on the market for purchase, including motion sensors, video surveillance and pressure sensors. They should be tested for suitability before purchase and appropriate training and response mechanisms be arranged.



Part D
Minimising injuries from falls


RESTROOM

16 Hip protectors

Recommendations

Assessment

- When assessing an older person's need for hip protectors, the general practitioner or other health professional should consider the older person's recent falls history, age, mobility, disability status, and whether they have osteoporosis or a low body mass index.
- Assess the older person's cognition and independence in daily living skills (eg dexterity in dressing) to help determine whether they will be able to use hip protectors.

Intervention

- Physiotherapists or other members of the health care team should teach older people and their carers how to put hip protectors on properly, because their effectiveness is reduced when they are not worn correctly. (Level II)[330]
- When using hip protectors as part of a falls prevention strategy, the health care team or carer should check regularly that the older person is wearing their protectors, that the hip protectors are in the correct position, and that they have not stopped wearing them because of discomfort, inconvenience or other reasons. (Level I)[331]

Note: hip protectors have not been shown to prevent hip fractures in the community setting.

Good practice point

- Hip protectors should not be relied on to reduce falls-related injuries in the community setting, due to problems with adherence. However, because they offer some protection to older people in residential aged care, hip protectors can be considered in community settings as part of a strategy to minimise harm from falls, as long as they are worn properly and their use is monitored.

16.1 Background and evidence

Hip fractures are fractures to the top of the femur (thigh bone) immediately below the hip joint, and are usually the result of a fall.[331] Hip fractures are one of the more severe injuries associated with a fall. Hip fractures usually require surgery and lengthy rehabilitation, and only 60% of people discharged home after a hip fracture regain their previous level of mobility 12 months later.[44] Pelvic fractures can also occur, although these are less common.

Hip protectors are one method that aims to reduce the risk of hip fracture. Hip protectors come in various styles, but are designed to absorb or disperse forces on the hip if a fall onto the hip area occurs. Hip protectors consist of undergarments with protective material inserted over the hip regions. They are sometimes called 'hip protector pads', 'protector shields' or 'external hip protector pads'. These guidelines refer to them all as hip protectors.

Little research has looked at hip protector use in the community setting, and the research that has been done is confounded by low adherence rates. A Cochrane review of hip protectors found that data from two randomised controlled trials that recruited older people living in the community showed no reduction in the incidence of hip fractures in the people who used hip protectors (energy-dispersing hip protectors; see below) compared with a control group.[331] However, the review noted that many people in a community setting did not wear their protectors all the time, which may have contributed to the poor results.

16.1.1 Types of hip protectors

There are three types of hip protectors:

- Soft hip protectors (type A) are available in a variety of designs. Their common feature is that they are made from a soft material, rather than a rigid plastic shell.
- Hard hip protectors (type B) consist of a firmer curved shell, sewn or slipped into a pocket in a lycra undergarment similar to underpants or bike pants. Most research on hip protectors involves hard shield hip protectors.
- Adhesive hip protectors (type C) are an adhesive hip pad that is stuck directly to the skin of the wearer. Few studies use this type of hip protector.

Section 16.2.2 contains information on how the different types of hip protectors are worn.

16.1.2 How hip protectors work

Hip protectors work by absorbing or dispersing the energy created by a fall away from the hip joint so that the soft tissues and muscles of the surrounding thigh absorb the energy.[7] The hard plastic hip protector shields divert the force of the fall from the bones of the hip to the surrounding muscles of the thigh. The soft hip protectors seem to work mainly by absorbing the energy of the fall. Hip protectors must be worn over the greater trochanter of the femur to be effective.

More than 95% of hip fractures occur from a fall with direct impact on the hip,[332] with only a small number of spontaneous fractures caused by osteoporosis or other bone pathology. Other hip fractures may occur if a person falls onto their buttock or if a rotational force through the neck of the femur is applied.[333]

The force generated by a fall from a standing height is large and has the potential to break the hip of a person of almost any age. The force applied to the femur near the hip in a fall from standing height is approximately 6000 newtons. The most effective padding system can reduce this to approximately 2000 newtons in a laboratory test.[334,335]

It is not necessary to wear a hip protector over a hip that has been surgically repaired with internal fixation or hip replacement, because the neck of the femur has either been replaced or reinforced (using hemiarthroplasty, or a pin and plate, etc).[333] Equally, it has not been demonstrated to be harmful to do so.

16.1.3 Risk associated with hip protectors

A randomised controlled trial of hip protectors (which was included in the Cochrane review mentioned above) noted adverse effects in 5% of people.[336] Hip protectors can cause bruising if the person falls onto the hip protector. Also, skin infections and pressure ulcers (bedsores) can develop under or around the area where hip protectors are worn.

For frail, older people, hip protectors can cause difficulties with toileting. For example, older people can become less independent in everyday activities because of the extra time and effort needed to put on and take off hip protectors (this can also cause incontinence in some people; see Chapter 8 on continence for more information). Also, if dexterity is an issue for the resident, wearing hip protectors can add to the falls risk as the resident must manage another garment during dressing and undressing, particularly in the toilet.

16.1.4 Adherence to the use of hip protectors

A disadvantage of hip protectors is that people often stop wearing them because of discomfort, practicality[331] or other factors, as discussed above.[337-340] In some settings, cost might also be a barrier to hip protector use (see Section 16.2.5).[341]

Adherence to the use of hip protectors is crucial to their effectiveness.[342] In the first reported randomised trial of hip protectors, only 24% of a subgroup of participants wore hip protectors when they fell.[343] This trial was included in the 2005 Cochrane review, and the other trials included also reported low adherence rates, which may have influenced the poor outcome.

To help older people continue to wear their hip protectors, the older person's needs and preferences must be matched with the availability of different types of undergarment material, removable or sewn-in hip protectors shields, and different styles of undergarments, including those allowing use of continence aids.[344] In many cases, adherence is most affected by the older person's motivation to wear the hip protectors[344] and by the type of hip protector (ie hard or soft).[331] In other cases, wearing a hip protector may be a visual reminder of the consequences of falling, and cause the older person or their carer to modify their behaviour to minimise risk.[331]

Point of interest: Cochrane review of hip protector use and adherence

The 2005 Cochrane Collaboration review[331] contains tables that summarise the randomised trials of hip protectors (see http://www.thecochranelibrary.org and search for 'hip protectors').

16.2 Principles of care

Because of the diversity of older people living in the community, there should be a choice of types and sizes of hip protectors available. Soft, energy-absorbing shields are often reported as being more comfortable for wearing in bed. A choice of underwear styles and materials means that problems with hot weather, discomfort and appearance can be addressed.

16.2.1 Assessing the use of hip protectors

When assessing an older person's need for hip protectors, the health care team should consider the older person's recent history of falls, age, level of disability, mobility, whether they are unsteady on their feet, and whether they have osteoporosis. Assessing the older person's cognition and independence in daily living skills (eg dexterity in dressing) may also help determine whether they will be able to use hip protectors. A falls risk assessment can be used to determine whether someone has a high risk of hip fractures and therefore be considered for the use of hip protectors (see Chapter 5 for more information on falls risk assessment).

16.2.2 Wearing hip protectors

Soft hip protectors (type A) must be held in place over the greater trochanter of the femur if the hip protectors are to be of any benefit. Continence pads can be comfortably worn with soft hip protectors, but should be fitted first, next to the older person's skin, before the hip protectors are put on.[345]

Hard hip protectors (type B) are held in place over the hip by lycra undergarments similar to underpants or bicycle pants. Different sizes (small to extra large) and designs for men and women are available. Continence pads can be worn in separate pants, underneath the garments holding the hip protectors.[346]

16.2.3 Using hip protectors at night

There is a risk of falling and breaking the hip during the evening and night. If the risk is high enough to justify the use of hip protectors, and the older person gets out of bed to go to the toilet at night, the use of hip protectors at night should be considered. The soft pads (type A) are relatively comfortable when positioned correctly and can be worn more easily in bed, because they are less obtrusive than the hard shell protectors (type B).[346]

16.2.4 Training in hip protector use

Fitting and managing hip protectors is often the responsibility of a particular member of the health care team — usually the community nurse or allied health professional. Nurses and home care workers are in a key position to encourage adherence to the use of hip protectors, because they often help frail, older people with dressing, bathing and toileting. Nurses and home care workers should be given education and support for developing strategies to encourage adherence to the correct use of hip protectors.

Two studies have demonstrated the benefits of training staff in the correct application, reason for use, and importance of supporting and encouraging the use of hip protectors.[4,330] Training the individual wearer may also improve adherence by addressing any barriers that the older person sees to wearing hip protectors, and providing precise instructions and demonstrations on how to wear them.[347] Before the older person starts wearing hip protectors, the health care team and carers should discuss arrangements for cleaning hip protectors. Washing in domestic washing machines and dryers is feasible, but some hip protectors will not withstand commercial laundering. While self-adhesive hip protectors may be appealing in some instances (ie they can be worn under the older person's own undergarments), it is unclear whether they can be used safely in the long term.

16.2.5 Cost of hip protectors

Cost of hip protectors appears to be a factor influencing uptake. Reimbursement by private health funds or by appliance supply schemes may improve this problem. It is unclear to what degree cost affects adherence to the longer term use of hip protectors.

16.2.6 Review and monitoring

Currently, the design and production of hip protectors is unregulated, and there are no national or international testing procedures for their effectiveness.[331]

A standard definition of adherence to the use of hip protectors should be used when reviewing and monitoring their use.[347] The most easily measured marker of adherence is the number of 'protected falls', which is the proportion of falls in which a hip protector is worn.

Case study

Mr T is an 84-year-old man who lives with his 79-year-old wife in their own home. Recently, Mr T fell and broke his hip. Hospital tests at the time of the fracture also revealed that Mr T had reduced bone mineral density, and so was at increased risk of further fractures. Although physiotherapy and rehabilitation were successful and he has no physical side effects from his broken hip, he is scared about falling again. This means he is reluctant to take part in his normal activities of daily living, and has become more dependent on Mrs T.

The occupational therapist, who makes regular home visits to Mr T, talked to him about using hip protectors, to give him more confidence when moving about at home. She showed him how to put it on correctly, and also explained that, although some studies of older people in residential care have shown an effect in reducing hip fractures, no one really knows whether hip protectors are effective in the home. However, Mr T feels safer when wearing it, and moves around with greater confidence and steadiness. In turn, this reduces his risk of falling again and helps him to be more active.

16.3 Special considerations

16.3.1 Cognitive impairment

Older people with cognitive impairment have a higher prevalence of falls and fractures[348] and should be considered for hip protector use if they are living with another family member. Older people with cognitive impairment will often need help with learning to use, and continuing to use, hip protectors. Hip protectors may need to be used with an additional risk-management strategy for older people known to have balance difficulties and who wander.

16.3.2 Indigenous and culturally and linguistically diverse groups

The use of hip protectors in people from Indigenous and culturally and linguistically diverse groups has not been researched specifically. Firmly fitting underwear may be unfamiliar in some cultures, but the extent to which this may influence adherence to the use of hip protectors is unknown.

16.3.3 Climate

Much of the research in relation to hip protectors has been done in cooler climates. Adherence in warmer and more humid areas may be problematic.[206]

16.4 Economic evaluation

One modelled economic evaluation of hip protector use in the community setting has been conducted.[349] However, the results may not be truly applicable to a community setting due to limitations in the data used to inform the model. Effectiveness estimates used in community-based models are likely to overestimate any benefit: analyses have overestimated adherence to the use of hip protectors, and have underestimated the decrease in quality of life caused by wearing them — neither of which may be the case in real life. For these reasons, the results below should be interpreted with some caution.

16.4.1 Hip protector use in the community

Honkanen et al[349] conducted a modelled analysis of the use of hip protectors, assuming optimistic estimates of efficacy (relative risk of fracture of 0.16) and adherence, in people 65 years and older, who lived in the community and who had not had a hip fracture. Costs (in US$) to Medicare and State Medicaid were estimated, and health outcomes included fractures, survival and quality-adjusted life years (QALYs). Incremental cost-effectiveness ratios (ICERs) were reported as cost per QALY gained for sex-specific cohorts initiating hip protector use at age 65, and every five years thereafter until age 85. Results were influenced substantially by sex, starting age, and assumed changes in quality of life. For example, the analysis suggested that hip protector use was associated with lower costs and improved QALYs in women initiating use at age 80, and in men at age 85. However, in men starting use before age 80 and women starting use before age 75, hip protectors resulted in higher costs and fewer QALYs because of the decreases in quality of life associated with wearing them. Even using optimistic estimates of efficacy and adherence, the benefit of hip protectors in this modelled population is somewhat uncertain.

16.4.2 Hip protector use in mixed settings

In addition, a number of models estimated the costs and health outcomes of hip protector use in mixed populations (including both community-dwelling and residential aged care populations). The methodological issues outlined above (optimistic efficacy estimates; optimistic adherence estimates and limited quality of life decreases with the use of hip protectors) have often been assumed. The direct applicability of the results from these mixed populations to a community setting is highly uncertain. Analyses have been summarised briefly here, and are also presented in Chapter 17 in the residential aged care booklet.

Two analyses[350,351] modelled costs (US$) and health outcomes (in QALYs) in mixed residential aged care facility and community populations. One analysis[350] in a United Kingdom population reported that the ICER ranged from US$11 722 per QALY gained for women without a prior fracture, to US$47 426 per QALY gained for men without a previous fracture. For people with a previous fracture, hip protectors had lower costs and higher QALYs in women, and an ICER of US$17 017/QALY gained for men. A United States model,[351] where the primary analysis assumed full adherence and a minimal loss in quality of life associated with hip protector use, reported cost savings in women and in men over 75 years, and an improvement in the number of QALYs in women. However, men younger than 85 years experienced a loss in QALYs because of the decrease in quality of life associated with wearing hip protectors. In both analyses, results were based on optimistic estimates of efficacy, adherence and quality of life, which have uncertain applicability in a community population. Kumar and Parker[352] devised a simple model of costs (1998UK£) and potential benefits at a United Kingdom district hospital over 1994–97. It appears that both residential aged care and community populations were included. Cost per fracture prevented ranged from UK£678 000 in men aged 50–59 years, to UK£9309 in women aged 75–79 years.

Additional information

Appendix 6 contains a checklist of issues to consider before using hip protectors.[344]

17 Vitamin D and calcium supplementation

Recommendations

Assessment

- Consider adequacy of calcium and vitamin D as part of routine assessment of falls risk in older people living in the community.

Intervention

- Vitamin D and calcium supplementation should be recommended as an intervention strategy to prevent falls in older people who live in the community, particularly if they are not exposed to the minimum recommended levels of sunlight. Benefits from supplementation are most likely to be seen in people who have vitamin D insufficiency (25(OH)D <50 nmol/L) or deficiency (25(OH)D <25 nmol/L). (Level I-*)[49]

Good practice points

- Encourage older people to include high calcium foods in their diet, and exclude foods that limit calcium absorption.
- For older people with cognitive impairment who have problems with medication adherence, consider using an intermittent but high-dose preparation of vitamin D (that is, less frequent administration, but the same total dose as recommended for older people without cognitive impairment).

17.1 Background and evidence

Low vitamin D levels have been associated with reduced bone mineral density, high bone turnover and increased risk of hip fracture.[353] Furthermore, vitamin D may prevent falls by improving muscle strength and psychomotor performance, independent of any other role in maintaining bone mineral density.[70,354]

Point of interest: how vitamin D reduces the risk of falling

The active vitamin D metabolite (25-hydroxyvitamin D) binds to a highly specific nuclear receptor in muscle tissue. This improves muscle function, which in turn may be why vitamin D reduces the risk of falling.[70]

Vitamin D levels are measured by blood 25-hydroxyvitamin D (25(OH)D) levels. The levels of 25(OH)D that were previously recommended for adequate vitamin D stores are now thought to be too low.[353,355] The incidence of vitamin D deficiency (25(OH)D levels less than 25 nmol/L) in Australia has been reported as 67% of geriatric hospital admissions, 22–86% in residential aged care and 61% of people with hip fractures in all settings.[353]

People who have a high risk of vitamin D deficiency include older people, those with skin conditions that require them to avoid the sun, dark-skinned people (particularly if veiled) and people with malabsorption.[353] Vitamin D deficiency is significantly more common among people with dementia and people from culturally and linguistically diverse groups.[356]

Intervention approaches for improving the levels of vitamin D in older people have used a range of options with varying success levels, including vitamin D supplementation alone, vitamin D supplementation together with calcium supplementation, and exposure to sunlight. These approaches are explained in the following sections (see also Section 4.3.1 for more information).

Nutrition management is an important element of good aged care practice, and can play an important role in some aspects of falls prevention, directly and indirectly (eg good nutrition is required to gain optimal effect from an exercise program). However, other than vitamin D and calcium supplementation (and related nutritional involvement in osteoporosis management), nutrition is not included as a separate core falls prevention activity in these guidelines, because it is an area with limited research to guide best practice in falls prevention to date.

17.1.1 Vitamin D supplementation (with or without calcium)

A high-quality systematic review (a Cochrane review) analysed 111 randomised controlled trials of various falls prevention interventions for older people living in the community.[7] The review included 13 trials that assessed vitamin D supplementation, with or without calcium supplementation (among other interventions, such as exercise and multifactorial falls prevention programs). The review found no evidence for an effect of vitamin D (with or without calcium supplementation) on the rate or risk of falling. However, a subgroup analysis of people with vitamin D deficiency showed a significant reduction in both the rate and risk of falls — although this result must be interpreted with caution and followed up with further research. Vitamin D analogues (eg calcitriol) may be useful for preventing falls, but more information is needed before a recommendation can be made. Vitamin D analogues are also associated with adverse effects, such as hypercalcaemia.

A separate study of the alfacalcidol form of vitamin D supplementation in non-vitamin D-deficient older people in the community supports the hypothesis that treatment with vitamin D (or its analogues) requires a minimum daily calcium intake of more than 500 mg/day to produce clinically significant results.[355] The Australian recommended daily intake (RDI) for calcium in older people is 800 mg for men and 1000 mg for women.[357] However, this level may be too low, with other sources recommending a daily intake of 1500 mg for both men and women.[358]

17.1.2 Vitamin D, sunlight and winter

The main source of vitamin D is from sunlight.[357] Evidence suggests that sourcing vitamin D from dietary intake alone is not sufficient.[353] However, sun exposure may not work in older adults if their skin does not convert cholesterol precursors to vitamin D efficiently. Additionally, frail older people may be at greater risk because sun exposure recommendations can be difficult for them to follow.

In the absence of routine fortification of food, sunlight exposure, regular consumption of oily fish and/or vitamin D supplementation are the mainstay approaches to ensuring adequate levels of 1,25-dihydroxycholecalciferol.

The Geelong Osteoporosis Study found that, in winter, serum vitamin D is reduced, bone resorption is increased, and the proportion of falls resulting in fracture is increased.[359] The role of vitamin D supplementation during the Australian winter has yet to be investigated.

Point of interest: vitamin D and latitude

Little vitamin D is produced beyond latitudes of about 35° (ie Victoria and Tasmania) in winter, especially in older people. This is because of an increase in the zenith angle of the sun (the angle between directly overhead and a line through the sun) resulting in more photons being absorbed by the stratospheric ozone layer.[360]

17.1.3 Toxicity and dose

Toxicity of vitamin D cannot be caused by prolonged sun exposure; however, it can occur from supplementation with vitamin D.[357] Hypercalcaemia may occur if vitamin D is given, particularly in the form of the vitamin D analogues.[361] There is no RDI for vitamin D, although trials that show benefit from vitamin D have used a minimum of 800 IU daily.[7] The United State Institute of Medicine's Food and Nutrition Board proposes a daily intake of 600 IU vitamin D in people over 71 years of age.[353] In Australia and New Zealand, a minimum daily dose of 400 IU is recommended, with higher doses required for those with vitamin D levels lower than 50 nmol/L (25(OH)D <50 nmol/L).[362]

17.2 Principles of care

One intervention that has been studied in some detail is the use of vitamin D for preventing falls. Several meta-analyses with different inclusion criteria examining the effect of vitamin D on falls in older people have reported conflicting results (see Section 4.3.1).[7,70,71]

The basic principles of vitamin D interventions for preventing falls are to:

- assess adequacy of vitamin D and calcium (eg using food preference records; food and fluid intake records; 25(OH)D blood levels; a history of the older person's daily routine)
- ensure minimum sun exposure to prevent vitamin D deficiency (ie 5–15 minutes exposure, four to six times per week, being careful not to have overexposure to the sun; a vitamin D supplement of at least 800 IU per day is recommended if sun exposure is not possible)
- consider vitamin D and calcium supplementation (for confirmed cases of vitamin D deficiency, supplement with 3000–5000 IU per day for at least one month)
- encourage older people to include foods high in calcium in their diets[363]
- discourage older people from consuming foods that prevent calcium absorption (analysis of food intake records or diet history should show a daily intake of calcium of 800 mg for men and 1000 mg for women).[363]

Case study

Mrs S presented to her general practitioner (GP) after falling recently at home. She lives alone and rarely goes out. As part of her falls risk assessment, the GP established that Mrs S has limited exposure to sunlight and that her diet is neither rich in vitamin D nor calcium. The GP discussed the importance of both calcium and vitamin D with Mrs S. They realised that Mrs S is unlikely to be able to maintain adequate vitamin D levels with sun exposure or diet. However, she is happy to increase the calcium content of her diet by drinking two glasses of milk, in addition to her other dietary sources of calcium. Mrs S and the GP agreed that she needs oral vitamin D supplementation and that her calcium needs will be met by altering her diet.

17.3 Special considerations

17.3.1 Cognitive impairment

Cognitive impairment may result in reduced oral intake of calcium and reduced exposure to sunlight if outdoor mobility is limited. Furthermore, medication adherence may be problematic in some older people with cognitive impairment. In these cases, the possibility of intramuscular preparation of vitamin D may need to be considered.

17.3.2 Indigenous and culturally and linguistically diverse groups

Increased skin pigment reduces the amount of vitamin D production after sun exposure, so people who have dark skin are more susceptible to reduced vitamin D levels. People who are heavily clothed and veiled for religious or cultural reasons also have an increased risk of reduced vitamin D levels.

17.4 Economic evaluation

A number of vitamin D and calcium-based compounds are publicly funded via the Pharmaceutical Benefits Scheme. See Chapter 18 on osteoporosis management for more information.

Additional information

The following useful publications provide information on dietary intake of vitamin D and calcium:

- *Dietary Guidelines for All Australians*, published by the National Health and Medical Research Council (2003): http://www.nhmrc.gov.au/publications/synopses/dietsyn.htm
- Mason RS, Sambrook PN, Eisman JA (2004). Vitamin D in Australia: issues and recommendations. *Australian Family Physician* 33(3):133-138. http://www.osteoporosis.org.au/files/research/vitamind_nowson_2004.pdf
- *Recommendations from the Vitamin D and Calcium Forum* (2005). *Medicine Today* 6(12):43–50. http://www.osteoporosis.org.au/files/research/Vitdforum_OA_2005.pdf
- Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia (2005). Vitamin D and adult bone health in Australia and New Zealand: a position statement. *Medical Journal of Australia* 182:281–285.
- Osteoporosis Australia provides information and resources to reduce fractures and improve bone health in the community: http://www.osteoporosis.org.au

18 Osteoporosis management

Recommendations

Assessment

- Older people with a history of recurrent falls should be considered for a bone health check. Also, older people who sustain a minimal-trauma fracture should be assessed for their risk of falls.

Intervention

- Older people with diagnosed osteoporosis or a history of low-trauma fractures should be offered treatment for which there is evidence of benefit. (Level I)[364]

Good practice point

- When using osteoporosis treatments, older people should be co-prescribed vitamin D with calcium.

18.1 Background and evidence

18.1.1 Falls and fractures

Only a small proportion of falls result in fractures and most, if not all, fractures occur after falls.[365] Bone mineral density (BMD) is an important measure in predicting fractures in both men and women, and quadriceps strength and postural sway are of similar importance in predicting fractures.[366] No therapy is likely to normalise bone mineral density, but small improvements can reduce fracture risk.[367]

With this in mind, interventions that reduce the risk of falls may prevent fractures, even if bone density is not altered. This is of particular relevance to the very old, who have an increased risk due to low BMD, and whose likelihood of a fracture increases with each additional fall.

18.1.2 Diagnosing osteoporosis

Osteoporosis Australia (a national, nongovernment organisation that aims to reduce fractures and improve bone health in the community) states that the presence of osteoporosis can sometimes be recognised by a fracture, usually of the wrist, hip or spine; an increased curve of the thoracic (mid) spine; or loss of height.[368] A 30% loss of anterior vertebral height is sufficient to diagnose osteoporosis for the Pharmaceutical Benefits Scheme (PBS).

Osteoporosis is diagnosed by having a BMD test, and there are several methods for testing bone density. The most reliable and accurate test is the dual energy X-ray absorptiometry (DXA), which is available widely in Australia. All bone mineral density tests measure the amount of mineral in a specific area of bone. The DXA test will give results as the following two scores:[368]

- *T score*, which compares bone density with that of an average young adult of the same sex. A T score of zero means bones are the same density as the average younger population and no treatment is necessary. A T score above one means bones are denser than the average younger population, and a T score below zero means bones are less dense than the average younger population. Treatment should be considered if the score is below one (osteopaenia = 1 to –2.5) and the older person has several clinical risk factors for osteoporosis. T scores below –2.5 indicate osteoporosis and treatment is strongly recommended to stop further bone loss and fractures.
- *Z score*, which compares bone density with the average from the person's age group and sex. If the Z score is zero, bones are average for their age and sex; below zero indicates bones are below average density and above zero indicates bones are above average density for age. A Z score below –2 means bone is being lost more rapidly than matched peers, so treatment needs to be monitored carefully. A Z score below –2 may also indicate an underlying disease is responsible for the osteoporosis.

18.1.3 Evidence for medication interventions

A previous fracture is one of the strongest risk factors for future fractures.[369] However, studies suggest that many people who sustain fractures are not checked or treated for osteoporosis, or are not treated adequately to reduce future fracture risk, even when osteoporosis has been diagnosed.[370,371]

This is despite the fact that several effective drug treatments are now available. A meta-analysis and various randomised controlled trials have shown beneficial effects of oral or intravenous bisphosphonates in postmenopausal women who have low bone density;[364,372] a systematic review has shown the benefits of selective oestrogen receptor modulators in postmenopausal women with osteoporosis;[373] and a randomised controlled trial has shown the benefits of strontium ranelate for preventing osteoporosis in postmenopausal women.[374] These drugs are now considered the first line treatments for osteoporosis.

As most of the randomised controlled trials of antiresorptive agents have used concomitant calcium and vitamin D (see Chapter 17), it is appropriate to ensure vitamin D deficiency is corrected and to add a calcium supplement to these therapies when dietary calcium intake is suboptimal.

Bisphosphonates

Bisphosphonates are potent inhibitors of bone resorption. They stick to the bone surface and make the cells that destroy bone tissue less effective. This allows bone-rebuilding cells to work more effectively, resulting in increased bone density.[368,372] Currently, four bisphosphonates are available on the PBS to treat osteoporosis. Three drugs are available for men and postmenopausal women with an osteoporotic fracture:[368]

- Risedronate (Actonel, Actonel Combi and Actonel Combi D) increases bone density and reduces risk or frequency of fractures at the spine and hip in postmenopausal women who have low bone density.[372]

- Alendronate (Fosamax, Fosamax Plus, Alendro) increases bone density and reduces frequency of fractures at the hip and spine.
- Zoledronic acid (Aclasta) is also used to treat osteoporosis in postmenopausal women or to prevent additional fractures in men and women who have recently had a hip fracture. Because zoledronic acid works for a long time, only a single dose is required each year, making this osteoporosis therapy advantageous for frail older people living in the community or residential aged care.

A fourth bisphosphonate medication is also available for osteoporosis:

- Etidronate (Didrocal) increases bone density and reduces risk of fractures in the spine, but not the hip.[364,368,375]

An association between bisphosphonate use and a rare dental condition termed osteonecrosis of the jaw has been reported.[372] Osteoporosis Australia recommends that the small risk of this condition needs to be considered against the significantly reduced risk of fracture and other skeletal complications in older people with established osteoporosis. One approach is to ensure appropriate oral health and dental treatment before prescription, particularly if high doses or intravenous drugs are prescribed, or if a dental extraction is already planned.[376]

Alendronate and risedronate have been associated with adverse gastrointestinal effects (eg dyspepsia, abdominal pain, oesophageal ulceration).[372] Therefore, older people who have reflux oesophagitis or hiatus hernia should be screened before use.[377] However, most studies have shown that the overall risk of adverse gastrointestinal events associated with risedronate or alendronate use is low; although there are a small number of studies that report the opposite.[378] There is also evidence that risedronate is less risky than alendronate.[378] The potential of experiencing gastrointestinal side effects from either drug is lowered when the dose is decreased to once per week.[373]

Selective oestrogen receptor modulators

Selective oestrogen receptor modulators (SERMs) are a special class of drug with many features similar to oestrogen in hormone replacement therapy; however, they do not stimulate the breast or uterus tissues. As a result, SERMs have the positive effect of oestrogens on bone without increasing the risk of breast and uterine cancer. Raloxifene (Evista) increases bone density and reduces the risk of fractures in the spine. Evidence also shows it reduces the incidence of breast cancer.[364,368,375] However, SERMs have also been associated with an increased risk of venous thromboembolism.[379]

Strontium ranelate

Clinical trials have shown that strontium ranelate reduces the risk of both vertebral and peripheral fractures.[374] Strontium ranelate is the only anti-osteoporotic agent that both increases bone formation markers and reduces bone resorption markers, resulting in a rebalance of bone turnover in favour of bone formation.

18.2 Principles of care

It is important to recognise that people sustaining low-trauma fractures after the age of 60 probably have osteoporosis and an increased risk of subsequent fracture.[380] Bone densitometry and specific anti-osteoporosis therapy should be considered in these people.

18.2.1 Assessing bone health

Older people with a history of recurrent falls should be considered for a bone health check. Also, older people who sustain a minimal-trauma fracture should be assessed for their risk of falls.[381]

18.2.2 Providing interventions

As discussed above, several drug treatments are available for treating osteoporosis in postmenopausal women, which may, in turn, reduce falls and associated injury. These drugs, which are considered to be the first-line treatment, include:

- oral or intravenous bisphosphonates in postmenopausal women who have low bone density[364,372]
- selective oestrogen receptor modulators in postmenopausal women with osteoporosis[373]
- strontium ranelate for preventing osteoporosis in postmenopausal women.[374]

However, there is a lack of data on drug treatment of osteoporosis in older men. Bisphosphonates can be used to reduce the risk of vertebral fractures and increase bone density in older men at risk of osteoporosis.[368] Bisphosphonates work best when co-prescribed with vitamin D and calcium.

For older people with a history of recurrent falls, or those who have sustained a minimal-trauma fracture, the general practitioner (GP) and health care team can consider strategies for optimising function, minimising the time spent on the floor after a fall, protecting bones, improving environmental safety and prescribing vitamin D.

18.2.3 Review and monitoring

The health care team (including the person's GP) should be on the alert for anyone who has obvious signs of osteoporosis (eg thoracic kyphosis, previous low-trauma fracture). GPs can screen for osteoporosis using indirect indicators or risk factors, such as the older person's lifestyle — including whether they are reluctant to go outside, especially if they live in southern states where there is less exposure to ultraviolet light in winter and a greater risk of vitamin D deficiency (see Chapter 17 on vitamin D supplementation).

Case study

Mrs E is a 75-year-old lady who fell, fracturing her humerus (upper arm) while walking in her home. Specific questioning revealed she had an early menopause and that she rarely went outside because she worried about developing skin cancer. An orthopaedic surgeon treated her fracture in the local hospital. The surgeon suggested that Mrs E start taking calcium and vitamin D, and referred her to the osteoporosis clinic.

18.3 Special considerations

18.3.1 Cognitive impairment

Some older people with cognitive impairment need to be supervised in the correct and safe manner of taking some oral bisphosphonates. This is because there are restrictions on lying down or eating after taking these medications.

18.4 Economic evaluation

A number of antiresorptive agents (such as bisphosphonates and strontium) and vitamin D analogues (alone or in combination with antiresorptive agents) are available on the PBS for treatment of osteoporosis (prevention of fracture) in specific populations. The safety, effectiveness and cost effectiveness of these agents have been reviewed by the Pharmaceutical Benefits Advisory Committee, and the fact that they are subsidised by the PBS indicates that they offer acceptable value for money in the Australian context, for specific populations.

Table 18.1 provides specific PBS subsidy details for various agents affecting BMD (current at 27 August 2009).

Table 18.1 Pharmaceutical Benefits Scheme details for osteoporosis drugs

Drug	Subsidised indications
Alendronate Alendronate + cholecalciferol Risedronate Risedronate + calcium carbonate Risedronate + calcium carbonate + cholecalciferol	Treatment as the sole PBS-subsidised antiresorptive agent for osteoporosis in a person aged 70 years of age or older with a bone mineral density T-score of –3.0 or less. Treatment as the sole PBS-subsidised antiresorptive agent for established osteoporosis in people with fracture due to minimal trauma.
Etidronate + calcium carbonate	Treatment as the sole PBS-subsidised antiresorptive agent for established osteoporosis in people with fracture due to minimal trauma.

Drug	Subsidised indications
Zoledronic acid	Treatment as the sole PBS-subsidised antiresorptive agent for (a) established osteoporosis in women with fracture due to minimal trauma; or (b) established osteoporosis in men with hip fracture due to minimal trauma; or (c) for osteoporosis in women aged 70 years or older with a bone mineral density T-score of –3.0 or less (only 1 treatment each year for 3 consecutive years per person is subsidised).
Calcitriol	Treatment for established osteoporosis in people with fracture due to minimal trauma.
Raloxifene	Treatment as the sole PBS-subsidised antiresorptive agent for established postmenopausal osteoporosis in people with fracture due to minimal trauma.
Strontium ranelate	Treatment as the sole PBS-subsidised antiresorptive agent for osteoporosis in a woman aged 70 years or older with a bone mineral density T-score of –3.0 or less. Treatment as the sole PBS-subsidised antiresorptive agent for established postmenopausal osteoporosis in people with fracture due to minimal trauma.
Teriparatide	Treatment as the sole PBS-subsidised agent by a specialist or consultant physician, for severe, established osteoporosis in a person with a very high risk of fracture who (a) has a bone mineral density T-score of –3.0 or less; and (b) has had two or more fractures due to minimal trauma; and (c) has experienced at least one symptomatic new fracture after at least 12 months of continuous therapy with an antiresorptive agent at adequate doses.

PBS = Pharmaceutical Benefits Scheme

Note: All agents require authority permission for prescription.

Additional information

For readers seeking definitive information on osteoporosis management, particularly related to medication management, the following resources are recommended:

- The National Institute for Health and Clinical Excellence (NICE), an independent organisation in the United Kingdom, produces clinical practice guidelines, including guidelines on osteoporosis management, based on the best available evidence. The guidelines contain recommendations on the appropriate treatment and care of people with specific diseases and conditions:
  http://www.nice.org.uk
- Osteoporosis Australia is a national organisation that aims to reduce fractures and improve bone health in the community. They provide information kits on falls and fractures:
  Ph: 02 9518 8140
  Fax: 02 9518 6306
  Toll Free: 1800 242 141
  http://www.osteoporosis.org.au

Part E
Responding to falls


TEAM

19 Post-fall management

Good practice points

- After the immediate follow-up of a fall, determine how and why a fall may have occurred and implement actions to reduce the risk of another fall.
- It is better to ask an older person whether they remember the sensation of falling or whether they think that they blacked out, because many older people who have syncope are unclear whether they blacked out.
- An in-depth analysis of the fall may be required if there has been a serious injury following a fall, or if a death from a fall has occurred in the presence of a member of the health care team.

19.1 Background

The health care team should take all falls seriously, because falls may be the first and main indication of some other underlying and treatable problem in an older person.[382] Older people who fall are more likely to fall again.[383] All members of the health care team (for example, general practitioner (GP), occupational therapist, physiotherapist), and older people and their families should be aware of what constitutes a fall (see Section 1.3.1 for a definition).

It is also vital that staff of community services know what to do when an older person falls, or if a client reports a recent fall to them. Local community service guidelines should also include actions to follow for moving someone who has fallen, including when to seek assistance and reporting requirements.

19.2 Responding to falls

Many older people who fall do not report the fall to their GP, other health professionals[384] and sometimes even their family. Reporting all falls to a health care professional is important, given that a previous fall is a strong risk factor for future falls and falls injuries,[365] and that there is good evidence that single and multifactorial falls prevention actions can be effective for older people living in the community. If a community services staff member notices signs that a fall may have occurred (eg unexplained bruising), they should discuss this with the older person, and emphasise the importance of being assessed by a health care professional to see whether they need treatment.

Responding to falls involves following up all falls that occur,[382] providing immediate and longer term care, and reporting and recording the fall.[99]

The circumstances surrounding a fall are of critical importance. However, this information is often difficult to obtain and may need to be sourced from people other than the older person themself, including community service providers, carers and family. This may be particularly important if the older person does not recall the circumstances of the fall or hitting the ground on direct questioning.

19.2.1 Falls incident policies

The following list is a guide to what should be included in a falls incident policy or protocol for a community service (based on good practice from the hospital and residential aged care settings). Depending on the background, training and experience of the staff member from a community service, the policy may primarily involve seeking assistance (eg an ambulance) or medical review in the first instance.

Checklist for managing the older person immediately after a fall

Offer basic life support and provide reassurance

- Check for ongoing danger.
- Check whether the older person is responsive (eg responds to verbal or physical stimulus).
- Check the older person's airways, breathing and circulation.
- Reassure and comfort the older person.[346,382]

Check for injuries

- Conduct a preliminary assessment, including checking for level of consciousness and vital signs.[382]
- Check for signs of injury, including abrasion, contusion, laceration, fracture and head injury.[346,382,385]
- Within the capacity of background, training and experience of the staff member from a community service, assess and treat any injury, and initiate diagnostic and treatment interventions for contributing causes, or ensure medical assistance is sought.[382]

Move the older person

- Assess whether it is safe to move the older person from their position, and note any special considerations in moving them. Use a lifting device or seek help instead of trying to lift the older person alone. It may be appropriate to call the ambulance service. Follow appropriate service occupational health and safety guidelines on lifting.[382]

Monitor the older person

- Ensure ongoing monitoring of the older person, because some injuries may not be apparent at the time of the fall.[99,346]
- Observe older people who have fallen and who are taking anticoagulants or antiplatelets (blood-thinning agents), because they have an increased risk of bleeding and intracranial haemorrhage. Older people who have a history of alcohol abuse may be more prone to bleeding. The older person's GP should be contacted and relevant details provided on any transfer information if an ambulance has been called.

Report the fall

- Report all falls to the older person's GP, even if injuries are not apparent.[99,385]
- At the earliest opportunity, notify the person nominated to be contacted in case of an emergency.[382,385]
- Note any details of the fall for reference in reporting the fall, including the older person's description, if possible.[382,385] At a minimum, this should include the location and time of the fall, what the older person was doing immediately before they fell, the mechanisms of the fall (eg slip, trip, overbalance, dizziness), and whether they lost consciousness or had a conscious collapse.
- Complete an incident-reporting form for all falls,[99,382,385,386] regardless of where the fall occurred, or whether the older person is injured, as per service guidelines.
- Document all details in the older person's case file (or report this information to the older person's case manager at the community agency), including their appearance or response, evidence of injury, location of the fall, notification of GP and actions taken.[346,385]

Discuss the fall and future risk management

- Communicate to all relevant staff, family and carers that the older person has fallen and has an increased risk of falling again.[385]
- Discuss the circumstances of their fall, its consequences, and actions planned to reduce future falling risk with the older person who fell, and their family.
- Assume that once an older person has fallen, they automatically become at high risk of falling again until they have been assessed.[346]

19.2.2 Post-fall follow-up

After the immediate follow-up of a fall, determine how and why a fall may have occurred and implement actions to reduce the risk of another fall. To do this, complete the following steps (or refer to the GP or other health professional for this):

- Investigate the cause of the fall, including assessing for delirium.
- Review the implementation of existing falls prevention strategies, including standard falls prevention strategies.[99,346,385]
- Undertake a falls risk assessment (see Chapter 5), because new risk factors may be present.[99,346,385]
- Implement a targeted, individualised plan for daily care, based on the findings of the falls risk assessment tool. Multifactorial interventions should be carried out as appropriate and may include, but are not limited to: gait, balance and exercise programs, footwear review, medication review, hypotension management, environmental modification and cardiovascular disorder treatment (see Part C).[100] This will often involve referral to other members of the health care team.
- Encourage the older person to resume their normal level of activity, because many older people are apprehensive after a fall and the fear of falling is a strong predictor of future falls.[387]
- Consider the use of injury-prevention interventions.[99,346,385] For example, discuss with the GP the use of hip protectors, and vitamin D and calcium supplementation (see Chapters 16 and 17).
- Consider investigations for osteoporosis in the presence of low-trauma fractures (see Chapter 18).
- Ensure effective communication of assessment and management recommendations to everyone involved.[99,346,385]

19.3 Analysing the fall

An in-depth analysis of a fall is sometimes known as a root-cause analysis (RCA). In a hospital or residential aged care setting, where a duty of care exists, an RCA is always required if a fall causes death. Also, reporting falls is mandatory in these settings. However, if an older person living in the community dies because of a fall, service providers are not necessarily expected to conduct an RCA. The death certification process by the attending medical practitioner will address the necessary reporting requirements (eg the report to the coroner).

Each community service should have a review process in place.

19.4 Reporting and recording falls

After a fall, it is important that all members of the older person's health care team (eg GP, occupational therapist), the older person themselves, and their carer, knows about the fall and the factors that might have caused it.

It is useful for service providers to have guidelines for reporting falls. These guidelines should identify the person to whom falls should be first reported (eg service coordinator, GP, person responsible in case of an emergency). The guidelines should also state clearly what level of information should be collected and reported, and this should be relevant to the type of service being provided. For example, a personal care attendant may simply report a fall to their service coordinator, while a community nurse may collect and report detailed information about a fall to the older person's GP.

The following list, which is based on the Australian Incident Monitoring System and the *Queensland Health Falls Prevention Guidelines*[346] is a guide to what items could be included:

- demographic details of the person (including date of birth)
- current and relevant diagnoses or problems
- date, time and place of the fall
- type of fall (eg slip, trip, bumping into or falling on an object)[99]
- activity at time of the fall (eg attempting to stand, walking)
- whether the older person is independent or dependent on carer or aides
- steps taken previously to reduce falls risk and injury risk
- any recent change in medications that might be associated with falls risk
- relevant information about clothing, footwear, eyewear and mobility aids, used at the time of the fall[99]
- factors contributing to the fall, such as environmental conditions (eg floor, lighting, clutter)[99]
- status after the fall (eg baseline observations, injuries)
- interventions to be used after the fall, and medical treatment required
- the older person's perception of the fall, including description of any preceding sensations or symptoms[99] and what they think could have prevented the fall
- any witnesses to the fall
- any other comments.

To achieve the most accurate information about the fall, the description of the fall should also allow for free text. There should be room on the reporting or incident form for additional comments to be made.

19.5 Comprehensive assessment after a fall

Older people who fall repeatedly and people prone to injurious falls require a comprehensive and detailed assessment.[100] For a more detailed assessment, the older person should be referred to a specialist (eg geriatrician) where possible.

The *Guideline for the Prevention of Falls in Older Persons* (developed by the American Geriatrics Society, the British Geriatrics Society and the American Academy of Orthopaedic Surgeons Panel on Falls Prevention) makes two specific recommendations for assessing older people who have fallen:[100]

- Older people who present for medical attention because of a fall, report recurrent falls in the past year, or demonstrate abnormalities of gait or balance should be assessed for their risk of falls. This assessment should be done by a clinician with appropriate skills and experience, which may require a referral to a specialist (eg geriatrician).
- A fall assessment includes
  - taking a history of fall circumstances, medications, acute or chronic medical problems, and mobility levels
  - examining vision, gait and balance, and lower extremity joint function
  - examining basic neurological function, including mental status, muscle strength, lower extremity peripheral nerves, proprioception, reflexes, and testing cortical, extrapyramidal and cerebellar function
  - assessing basic cardiovascular status, including heart rate and rhythm, postural pulse and blood pressure and, if appropriate, heart rate and blood pressure responses to carotid sinus stimulation.

19.6 Loss of confidence after a fall

A common but often overlooked consequence of a fall is a loss of confidence in walking, or fear of falling,[388] which can occur even in the absence of any injury. In the period after a fall, the health care team (including the carer, where appropriate) should observe the older person who has fallen to note any change in usual activity that might indicate the presence of, or increase in, fear of falling. Discussion with the older person about any concerns about falling might also be an opportunity to identify its presence.

In community settings, common approaches to improving loss of confidence or fear of falling include participation in a balance and mobility training exercise program, and other falls prevention activities, including use of hip protectors.[388,389]

19.7 Falls clinics

Falls clinics are conducted by a multidisciplinary team with skills in falls assessment and management for people who have fallen.[390] There are limited numbers of falls clinics available and a referral is usually required. Usually the falls clinic is conducted as part of an outpatient service. The team usually develops an intervention strategy for the older person, as well as advice, education and training for the older person, their carer and other members of the health care team. Falls clinics can also refer the older person to mainstream services for ongoing management.

Falls clinics should not be the first intervention for an older person who has fallen, or is at risk of falling.

Additional information

The following guidelines and website are useful:

- Falls and Mobility Clinics: Program Guidelines and Performance Indicators, Department of Human Services, Acute Health Division, Melbourne (2001)
- Victorian Falls Clinic Coalition: http://www.nari.unimelb.edu.au/vic_falls/vic_falls_contact.htm

Appendices

Appendix 1
Contributors to the guidelines

Chapter authors and reviewers

Chapter	Author(s)	Reviewer
Preliminaries	Ms Meg Heaslop	Mr Graham Bedford
Part A — Introduction		
Background	Ms Meg Heaslop	Mr Graham Bedford
Falls and falls injuries in Australia	Ms Meg Heaslop	Assoc Prof Stephen Lord
Involving older people in falls prevention	Dr Constance Vogler	Dr Constance Vogler
Part B — Standard falls prevention strategies		
Falls prevention interventions	Ms Meg Heaslop	Dr Constance Vogler
Part C — Management strategies for common falls risk factors		
Falls risk screening and assessment	Assoc Prof Clare Robertson	Prof Keith Hill
Balance and mobility limitations	Dr Cathie Sherrington	Dr Cathie Sherrington
Cognitive impairment	Dr Kim Delbaere	Dr Jeffrey Rowland
Continence	Dr Kim Delbaere	Assoc Prof Pauline Chiarelli
Feet and footwear	Dr Kim Delbaere	Assoc Prof Hylton Menz
Syncope	Dr Janet Salisbury	Assoc Prof Jacqueline Close
Dizziness and vertigo	Dr Kate Murray	Assoc Prof Jacqueline Close
Medications	Assoc Prof Jacqueline Close	Assoc Prof Jacqueline Close
Vision	Assoc Prof Stephen Lord Assoc Prof Jacqueline Close Dr Kim Delbaere	Prof Joanne Wood
Environmental considerations	Ms Meg Heaslop	Assoc Prof Lindy Clemson
Individual surveillance and observation	Ms Jacinda Wilson	Assoc Prof David Fonda

Chapter	Author(s)	Reviewer
Part D — Minimising injuries from falls		
Hip protectors	Ms Meg Heaslop	Prof Ian Cameron
Vitamin D and calcium supplementation	Assoc Prof Jacqueline Close Ms Meg Heaslop	Prof Terry Diamond
Osteoporosis management	Assoc Prof Stephen Lord Ms Meg Heaslop	Dr Peter Ebling
Part E — Responding to falls		
Post-fall management	Ms Meg Heaslop	Assoc Prof Michael Dorevitch

Guideline	Australian reviewer	International reviewer
Community	Dr Nancye Peel	Assoc Prof Clare Robertson
Hospital	Assoc Prof Jacqueline Close	Prof David Oliver
Residential aged care facility	Ms Mandy Harden	Assoc Prof Ngaire Kerse
Additional work		
Economic evaluations	Dr Kirsten Howard	
Editors	Ms Meg Heaslop, Biotext Pty Ltd Dr Janet Salisbury, Biotext Pty Ltd	
Design	True Characters Pty Ltd	

Contributors

Name	Position
Mr Graham Bedford	Policy Team Manager, Australian Commission on Safety and Quality in Health Care
Prof Ian Cameron	Professor of Rehabilitation Medicine, The University of Sydney Head, Rehabilitation Studies Unit, The University of Sydney
Assoc Prof Pauline Chiarelli	Associate Professor, Convener of Bachelor of Physiotherapy Program, School of Health Sciences, The University of Newcastle
Assoc Prof Lindy Clemson	Associate Professor in Ageing and Thompson Fellow, Faculty of Health Sciences, The University of Sydney
Assoc Prof Jacqueline Close	Senior Staff Specialist, Prince of Wales Hospital and Clinical School, The University of New South Wales; Honorary Senior Research Fellow, Prince of Wales Medical Research Institute, The University of New South Wales
Dr Kim Delbaere	Postdoctoral researcher, Prince of Wales Medical Research Institute, The University of New South Wales
Prof Terry Diamond	Senior Endocrinologist, St George Hospital and Associate Professor in Endocrinology, The University of New South Wales

Name	Position
Assoc Prof Michael Dorevitch	Senior Geriatrician, Austin Health
Dr Peter Ebeling	Professor of Medicine, Department of Medicine (RMH/WH), The University of Melbourne Head, Endocrinology, Western Health
Assoc Prof David Fonda	Associate Professor of Medicine, Monash University Consultant Geriatrician, Cabrini Medical Centre
Ms Mandy Harden	CNC Aged Care Education/Community Aged Care Services, Hunter New England Area Health Services
Prof Keith Hill	Professor of Allied Health, La Trobe University Northern Health, Senior Researcher, Preventive and Public Health Division, National Ageing Research Institute
Dr Kirsten Howard	Senior Lecturer, Health Economics, School of Public Health, The University of Sydney
Assoc Prof Ngaire Kerse	Associate Professor, General Practice and Primary Health Care, School of Population Health, Faculty of Medical and Health Sciences, The University of Auckland
Assoc Prof Stephen Lord	Principal Research Fellow, Prince of Wales Medical Research Institute, The University of New South Wales
Ms Lorraine Lovitt	Leader, New South Wales Falls Prevention Program, Clinical Excellence Commission
Assoc Prof Hylton Menz	National Health and Medical Research Council Research Fellow Director, Musculoskeletal Research Centre, Faculty of Health Sciences, La Trobe University
Dr Kate Murray	Principal, Dizzy Day Clinics
Prof David Oliver	Consultant Physician and Clinical Director, Royal Berkshire Hospital, United Kingdom Visiting Professor of Medicine for Older People, School of Community and Health Science, City University, London
Dr Nancye Peel	Research Fellow, Academic Unit in Geriatric Medicine, School of Medicine, The University of Queensland
Assoc Prof Clare Robertson	Research Associate Professor, Department of Medical and Surgical Sciences, Dunedin School of Medicine, University of Otago
Dr Jeffrey Rowland	Staff Physician, The Prince Charles Hospital
Dr Cathy Sherrington	Senior Research Fellow, Musculoskeletal Division, The George Institute for International Health and Faculty of Medicine, The University of Sydney
Dr Anne Tiedemann	Research Officer, Prince of Wales Medical Research Institute, The University of New South Wales
Dr Constance Vogler	Clinical Senior Lecturer, Medicine, Northern Clinical School, The University of Sydney; Staff Specialist Geriatrician, Royal North Shore Hospital
Prof Joanne Wood	Professor, School of Optometry and Institute of Health and Biomedical Innovation, Queensland University of Technology

Appendix 2
Falls risk screening and assessment tools

A2.1 FROP-Com Screen[106]

Falls Risk for Older People in the Community (FROP-Com) Screen

Screen all people 65-years and older
(50 years and older Aboriginal & Torres Strait Islander people)

Date of screen: / /

(Affix Patient ID Label)

UR No _____

Surname _____

Given Name _____

FALLS HISTORY		SCORE
1. Number of falls in the past 12 months?	☐ None (0) ☐ 1 fall (1) ☐ 2 falls (2) ☐ 3 or more (3)	[ ]
FUNCTION: ADL status		
2. Prior to this fall, how much assistance was the individual requiring for instrumental activities of daily living (eg cooking, housework, laundry)? • If no fall in last 12 months, rate current function	☐ None (completely independent) (0) ☐ Supervision (1) ☐ Some assistance required (2) ☐ Completely dependent (3)	[ ]
BALANCE		
3. When walking and turning, does the person appear unsteady or at risk of losing their balance? • Observe the person standing, walking a few metres, turning and sitting. If the person uses an aid observe the person with the aid. Do not base on self-report. • If level fluctuates, tick the most unsteady rating. If the person is unable to walk due to injury, score as 3.	☐ No unsteadiness observed (0) ☐ Yes, minimally unsteady (1) ☐ Yes, moderately unsteady (needs supervision) (2) ☐ Yes, consistently and severely unsteady (needs constant hands on assistance) (3)	[ ]
	Total risk score	[ ]

Total score	0	1	2	3	4	5	6	7	8	9
Risk of being a faller	0.25		0.7		1.4		4.0		7.7	
Grading of falls risk	0–3 Low risk				4–9 High risk					
Recommended actions	Further assessment and management if functional/balance problem identified (score of one or higher)				Perform the Full FROP-Com assessment and / or corresponding management recommendations					

Date: / /

Name _____ Signature _____ Designation _____

A2.2 FROP-Com

Falls Risk for Older People – Community setting (FROP-Com)

Personal details

Name: _____

Personal Code #: _____

Date of Assessment: / /

Address: _____

Date of Birth: / / Telephone _____

Marital Status: Single / Married (defacto) / Widowed / Divorced (separated) / Unknown (circle)

Usual living arrangements: _____

Recent health / community services use:

1. Community Aged Care Packages/Services	Yes / No	2. Community Rehabilitation	Yes / No
3. Doctors Appointment	Yes / No	4. Doctor Home Visit	Yes / No
5. Home Help	Yes / No	6. Home Modifications	Yes / No
7. Home Rehabilitation	Yes / No	8. Linkages Package	Yes / No
9. Meals on Wheels	Yes / No	10. OT Home visit.	Yes / No
11. Outpatient Appointment	Yes / No	12. Other	Yes / No
13. Post Acute Care	Yes / No	14. Personal Care	Yes / No
15. Respite Care	Yes / No	16. District Nursing Services	Yes / No
17. Physiotherapist Appointment	Yes / No	18. Dietician	Yes / No
19. Podiatrist	Yes / No	20. Personal Alarm	Yes / No
21. Day Centre	Yes / No	22. Falls and Balance clinic	Yes / No

- Is English the individuals preferred language? If not, what is? _____ ☐ Yes ☐ No
- Does the individual have functional English? ☐ Yes ☐ No

HISTORY OF FALLS *(0-3 points)*		SCORE
1. Number of falls in the past 12 months?	☐ None (0) ☐ 1 fall (1) ☐ 2 falls (2) ☐ 3 or more (3)	[ ]
2. Was an injury sustained in any of the fall/s in the past 12 months? *(rate most severe injury due to a fall in the past 12 months)*	☐ No (0) ☐ Minor injury, did not require medical attention (1) ☐ Minor injury, did require medical attention (2) ☐ Severe injury (fracture, etc) (3)	[ ]
3. Describe the circumstances of the most recent fall in the past 12 months. Time of fall: AM / PM (please circle) Location of fall: inside home / outside home / community Direction of fall: left / right / forward / backward / down / can't remember / other Cause of fall: trip / slip / loss of balance / knees gave way / fainted / feeling dizzy or giddy / alcohol or meds / fell out of bed / unknown Injuries:		
Sub total for this page		**[ ]**

Medications *(0-3 points)*		SCORE
4. List all medications currently taken.	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	
5. Number of prescription medications.	☐ No medication (0) ☐ 1–2 medications(1) ☐ 3 medications (2) ☐ 4 or more medications (3)	[ ]
6. Does the patient take any of the following type of medication? ☐ sedative ☐ antidepressant ☐ anti-epilectics ☐ central acting analgesic ☐ digoxin ☐ diuretics ☐ type 1a antiarrythmic ☐ vestibular suppressant	☐ None apply (0) ☐ 1–2 apply (1) ☐ 3 apply (2) ☐ 4 or more apply (3)	[ ]
Medical conditions *(0-3 points)*		SCORE
7. Does the individual have a chronic medical condition/s affecting their balance & mobility? ☐ Arthritis ☐ Respiratory condition ☐ Parkinson's disease ☐ Diabetes ☐ Dementia ☐ Peripheral neuropathy ☐ Cardiac condition ☐ Stroke ☐ Other neurological conditions ☐ Lower limb amputation. ☐ Osteoporosis ☐ Vestibular disorder ☐ Other dizziness ☐ Back pain ☐ lower limb joint replacement	☐ None apply (0) ☐ 1–2 apply (1) ☐ 3–4 apply (2) ☐ 5 or more apply (3) Osteoporosis: ☐ Unknown ☐ does not have	[ ]
Sensory loss		SCORE
8. Does the client have an uncorrected sensory deficit/s that limits their functional ability?	Vision ☐ No (0) ☐ Yes (1) Somato Sensory ☐ No (0) ☐ Yes (1)	[ ]
Feet & footwear		SCORE
9. Does the client have foot problems, e.g. corns, bunions, swelling etc.	☐ No (0) ☐ Yes (1) (specify):	[ ]
10. Does the client have inappropriate, poorly fitting or worn footwear?	☐ No (0) ☐ Yes (1) (specify):	[ ]
	Sub total for this page	**[ ]**

Cognitive status *(0-3 points)*		SCORE
11. AMTS score ☐ Age ☐ Time to the nearest hour ☐ Address to recall – 42 West St ☐ Current year ☐ Current location (where are we?) ☐ Recognition of two persons (Dr, nurse) ☐ Date of birth ☐ Years of first World War ☐ Name of current prime minister ☐ Count backwards from 20 by ones	Number of correct responses: ☐ 9-10 (0 points) ☐ 7–8 (1 point) ☐ 5–6 (2 points) ☐ 4 or less (3 points) Score: / 10	[ ]
Continence		SCORE
12. Is the individual continent?	☐ Yes (0) ☐ No (1)	[ ]
13. Does the individual regularly have to go to the toilet in the night (3 or more times)?	☐ No (0) ☐ Yes (1) (if uses a bottle, rate as 0)	
Nutritional status *(0-3 points)*		SCORE
14. Has the individual's food intake declined in the past three months due to a loss of appetite, digestive problems, chewing or swallowing difficulties?	☐ Small change, but intake remains good (1) ☐ Moderate loss of appetite (2) ☐ Severe loss of appetite / poor oral intake (3)	[ ]
15. Weight loss during the last 3-12 months.	☐ Nil (0) ☐ Minimal (<1 kg) or unsure (1) ☐ Moderate (1–3kg) (2) ☐ Marked (>3kg) (3)	[ ]
16. Number of alcoholic drinks consumed in the past week	☐ Nil (0) ☐ 1–3 (1) ☐ 4–10 (2) ☐ 11+ (3)	[ ]
Environment *(0-3 points)*		SCORE
17. Did the home environment appear safe? *(NOTE: only rate if undertaking a home visit assessment, leave blank otherwise)*	☐ Yes (0) ☐ Minimal environmental hazards (1) ☐ Moderate environmental hazards requiring modification (2) ☐ Extremely unsafe environment (3)	[ ]
Functional Behaviour *(0-3 points)*		SCORE
18. Observed behaviours in Activities of Daily Living and Mobility indicate	☐ Consistently aware of current abilities / seeks appropriate assistance as required (0) ☐ Generally aware of current abilities / occasional risk-taking behaviour (1) ☐ Under-estimates abilities / inappropriately fearful of activity (2) ☐ Over-estimates abilities / frequent risk-taking behaviour (3)	[ ]
	Sub total for this page	[ ]

Function *(0-3 points)*		SCORE
19. Prior to this fall, how much assistance was the individual requiring for personal care activities of daily living (eg dressing, grooming, toileting)? *(NOTE: If no fall in last 12 months, rate current function)*	☐ none (completely independent) (0) ☐ supervision (1) ☐ some assistance required(2) ☐ completely dependent (3)	[ ]
20. Has this changed since the most recent fall? *(leave blank if no falls in 12 months)*	☐ No (0) ☐ Yes (1) (specify):	[ ]
21. Prior to this fall, how much assistance was the individual requiring for instrumental activities of daily living (eg shopping, housework, laundry)? *(NOTE: If no fall in last 12 months, rate current function)*	☐ none (completely independent) (0) ☐ supervision (1) ☐ some assistance required(2) ☐ completely dependent (3)	[ ]
22. Has this changed since the most recent fall? *(leave blank if no falls in 12 months)*	☐ No (0) ☐ Yes (1) (specify):	[ ]
Balance *(0-3 points)*		SCORE
23. Does the individual, upon observation of walking and turning, appear unsteady or at risk of losing their balance? *(NOTE: Rate with usual walking aid. Tick one only, if level fluctuates, tick the most unsteady rating)*	☐ No unsteadiness observed (0) ☐ Yes, minimally unsteady on walking or turning (1) ☐ Yes, moderately unsteady on walking or turning (needs supervision) (2) ☐ Yes, consistently and severely unsteady on walking or turning (needs constant hands on assistance (3)	[ ]
Gait / Physical Activity *(0-3 points)*		SCORE
24. Can the individual walk safely around their own home?	☐ Independent, no gait aid needed (0) ☐ Independent with a gait aid (1) ☐ Safe with supervision / physical assistance (2) ☐ Unsafe (3)	[ ]
25. Can the individual walk safely in the community?	☐ Independent, no gait aid needed (0) ☐ Independent with a gait aid (1) ☐ Safe with supervision / physical assistance (2) ☐ Unsafe (3)	[ ]
26. If a walking aid is used, list the aid and when it is used.	Aid ☐ indoors ☐ outdoors	
27. How physically active is the individual?	☐ Very active (exercises 3 times per week) (0) ☐ Moderately active (exercises less than twice per week) (1) ☐ Not very active (rarely leaves the house) (2) ☐ Inactive (rarely leaves one room of the house) (3)	[ ]
28. Has this changed since the most recent fall?	☐ No (0) ☐ Yes (1) (specify):	[ ]
Grading of falls risk: ☐ Mild to moderate falls risk 0 – 20 Implement actions for identified individual risk factors, & recommend health promotion behaviour to minimise future ongoing risk (eg – increased physical activity, good nutrition) ☐ High falls risk 21 – 60 Implement actions for identified individual risk factors, and implement additional actions for high falls risk *(maximum =60)*	**Sub total for this page**	[ ]
	Sub total for page 1	[ ]
	Sub total for page 2	[ ]
	Sub total for page 3	[ ]
	Total Risk Score	[ ]

Appendix 3

Rowland Universal Dementia Assessment Scale (RUDAS)[157]

RUDAS

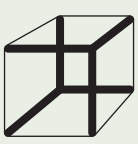
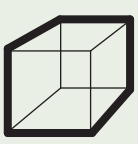
Rowland Universal Dementia Assessment Scale: A Multicultural Mini-Mental State Examination.

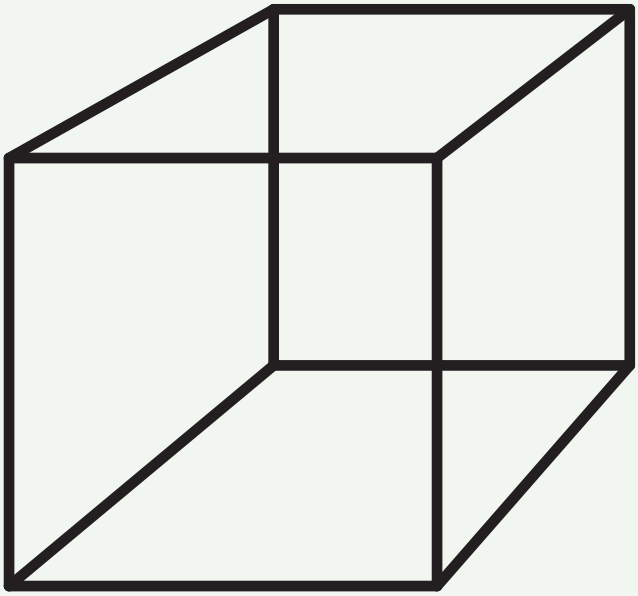
(Storey, Rowland, Basic, Conforti & Dickson, 2002)

Date: / /

Name: _____

Patient Name: _____

Item	Max Score
Memory	
1. (Instructions) I want you to imagine that we are going shopping. Here is a list of grocery items. I would like you to remember the following items which we need to get from the shop. When we get to the shop in about 5 mins. time I will ask you what it is that we have to buy. You must remember the list for me. **Tea, Cooking Oil, Eggs, Soap** Please repeat this list for me. *(Ask person to repeat the list 3 times). (If person did not repeat all four words, repeat the list until the person has learned them and can repeat them, or, up to a maximum of five times.)*	
Visuospatial Orientation	
2. I am going to ask you to identify/show me different parts of the body. *(Correct = 1).* *Once the person correctly answers 5 parts of this question, do not continue as the maximum score is 5.* (1) show me your right foot 1 (2) show me your left hand 1 (3) with your right hand touch your left shoulder 1 (4) with your left hand touch your right ear 1 (5) which is (indicate/point to) my left knee 1 (6) which is (indicate/point to) my right elbow 1 (7) with your right hand indicate/point to my left eye 1 (8) with your left hand indicate/point to my left foot 1	/5
Praxis	
3. I am going to show you an action/exercise with my hands. I want you to watch me and copy what I do. Copy me when I do this … *(One hand in fist, the other palm down on table – alternate simultaneously.)* Now do it with me: Now I would like you to keep doing this action at this pace until I tell you to stop – approximately 10 seconds. *(Demonstrate at moderate walking pace).* Score as: Normal = 2 *(very few if any errors; self-corrected, progressively better; good maintenance; only very slight lack of synchrony between hands)* Partially Adequate = 1 *(noticeable errors with some attempt to self-correct; some attempt at maintenance; poor synchrony)* Failed = 0 *(cannot do the task; no maintenance; no attempt whatsoever)*	/2
Visuoconstructional Drawing	
4. Please draw this picture exactly as it looks to you *(Show cube on back of page).* Score as: *(Yes = 1)* (1) Has person drawn a picture based on a square? 1 (2) Do all internal lines appear in person's drawing? 1 (3) Do all external lines appear in person's drawing? 1 (2)  (3) 	/3



Item				Max Score
Judgment				
5. You are standing on the side of a busy street. There is no pedestrian crossing and no traffic lights. Tell me what you would do to get across to the other side of the road safely. *(If person gives incomplete response that does not address both parts of answer, use prompt:* "Is there anything else you would do?"*) Record exactly what patient says and circle all parts of response which were prompted.*				
Score as:				
Did person indicate that they would look for traffic?	(YES = 2;YES PROMPTED = 1; NO = 0)		2	
Did person make any additional safety proposals?	(YES = 2;YES PROMPTED = 1; NO = 0)		2	/4
Memory Recall				
1. (Recall) We have just arrived at the shop. Can you remember the list of groceries we need to buy? *(Prompt: If person cannot recall any of the list, say* "The first one was 'tea'." *(Score 2 points each for any item recalled which was not prompted — use only 'tea' as a prompt.)*				
Tea	2			
Cooking Oil	2			
Eggs	2			
Soap	2			/8
Language				
6. I am going to time you for one minute. In that one minute, I would like you to tell me the names of as many different animals as you can. We'll see how many different animals you can name in one minute. *(Repeat instructions if necessary). Maximum score for this item is 8. If person names 8 new animals in less than one minute there is no need to continue.*				
1.		5.		
2.		6.		
3.		7.		
4.		8.		/8
TOTAL SCORE =				**/30**

Appendix 4

Safe shoe checklist[346]

The requirement for safe, well-fitting shoes varies, depending on the individual and their level of activity. The features outlined below may help in the selection of an appropriate shoe. The shoe should:

Heel	☐	Have a low heel (ie less than 2.5 cm) to ensure stability and better pressure distribution on the foot. A straight-through sole is also recommended.
	☐	Have a broad heel with good ground contact.
	☐	Have a firm heel counter to provide support for the shoe.
Sole	☐	Have a cushioned, flexible, nonslip sole. Rubber soles provide better stability and shock absorption than leather soles. However, rubber soles do have a tendency to stick on some surfaces.
Weight	☐	Be lightweight.
Toe box	☐	Have adequate width, depth and height in the toe box to allow for natural spread of toes.
	☐	Have approximately 1 cm space between the longest toe and the end of the shoe when standing.
Fastenings	☐	Have laces, buckles, elastic or velcro to hold the shoe securely onto the foot.
Uppers	☐	Be made from accommodating material. Leather holds its shape and breathes well; however, many people find walking shoes with soft material uppers are more comfortable.
	☐	Have smooth and seam-free interiors.
Safety	☐	Protect feet from injury.
Shape	☐	Be the same shape as the feet, without causing pressure or friction to the foot.
Purpose	☐	Be appropriate for the activity being undertaken during their use. Sports or walking shoes may be ideal for daily wear. Slippers generally provide poor foot support and may only be appropriate when sitting.
Orthoses	☐	Have comfortably accommodating orthoses, such as ankle foot orthoses or other supports, if required. The podiatrist, orthotist or physiotherapist can advise the best style of shoe if orthoses are used.

This is a general guide only. Some people may require the specialist advice of a podiatrist for the prescription of appropriate footwear for their individual needs.

Appendix 5
Home Fast

Home Falls and Accidents Screening Tool (Home FAST)

Instructions: please circle responses as either: yes, no or not applicable (n/a)

Score one point for each "no" response. Overall score is out of 25.

1. **Are walkways free of cords and other clutter?**

   Yes / No

   Definition: *no cords or clutter across or encroaching on walkways/doorways. Includes furniture and other items that obstruct doorways or hallways, items behind doors preventing doors opening fully, raised thresholds in doorways.*

   Comments: _____

2. **Are floor coverings in good condition?**

   Yes / No

   Definition: *carpets/mats lie flat/no tears/ not threadbare/no cracked or missing tiles – including stair coverings.*

   Comments: _____

3. **Are floor surfaces non slip?**

   Yes / No

   Definition: *score "no" if lino or tiles are in the kitchen, bathroom or laundry, in addition to any polished floors or tiled/lino surfaces elsewhere. Can only score "yes" if, in addition to other rooms, the kitchen, bathroom and laundry have non slip or slip resistant floor surfaces.*

   Comments: _____

4. **Are loose mats securely fixed to the floor?**

   Yes / No

   N/A *(there are no loose mats in house)*

   Definition: *mats have effective slip resistant backing/are taped or nailed to the floor.*

   Comments: _____

5. **Can the person get in and out of bed easily and safely?**

   Yes / No

   Definition: *bed is of adequate height and firmness. No need to pull self up on bedside furniture etc.*

   Comments: _____

6. **Can the person get up from their lounge chair easily?**

   Yes / No

   N/A *(person uses wheelchair constantly)*

   Definition: *chair is of adequate height, chair arms are accessible to push up from, seat cushion is not too soft or deep.*

   Comments: _____

7. Are all the lights bright enough for the person to see clearly?

Yes / No

Definition: *total wattage per room from globes to be more than 75w, or fluorescent lighting, and no shadows thrown across rooms, no excess glare.*

Comments: _____

_____

_____

8. Can the person switch a light on easily from their bed?

Yes / No

Definition: *person does not have to get out of bed to switch a light on at night – has a flashlight or bedside lamp, or adequate night lighting to the toilet.*

Comments: _____

_____

_____

9. Are the outside paths, steps and entrances well lit at night?

Yes / No

N/A *(no outside step, path, or entrance, ie: door opens straight onto footpath)*

Definition: *lights exist over back and front doors, globes at least 75w, walkways used exposed to light – including communal lobbies.*

Comments: _____

_____

_____

10. Is the person able to get on and off the toilet easily and safely?

Yes / No

N/A *(person uses commode constantly)*

Definition: *toilet is of adequate height, person does not need to hold onto sink/towel rail/toilet roll holder to get up, rail exists beside toilet if needed.*

Comments: _____

_____

_____

11. Is the person able to get in and out of the bath easily and safely?

Yes / No

N/A *(no bath in home, or bath never used)*

Definition: *person is able to step over the edge of the bath without risk, and can lower themselves into the bath and get up again without needing to grab onto furniture (or uses bath board or stands to use a shower over the bath without risk).*

Comments: _____

_____

_____

12. Is the person able to walk in and out of the shower recess easily and safely?

Yes / No

N/A *(no shower in home)*

Definition: *person can step over shower hob, or screen tracks without risk and without having to hold onto anything for support.*

Comments: _____

_____

_____

13. Is there an accessible/sturdy grab rail/s in the shower or beside the bath?

Yes / No

Definition: *Rails that are fixed securely to the wall, that are not towel rails, and that can be reached without leaning enough to lose balance.*

Comments: _____

_____

_____

14. Are slip resistant mats/strips used in the bath/bathroom/shower recess?

Yes / No

Definition: *Well maintained slip resistant rubber mats, or non-slip strips secured in the base of the bath or shower recess.*

Comments: _____

_____

_____

15. Is the toilet in close proximity to the bedroom?

Yes / No

Definition: *Toilet is no more than two doorways away from the bedroom (including the bedroom door) – does not involve going outside or unlocking doors to reach it.*

Comments: _____

_____

_____

16. Can the person easily reach items in the kitchen that are used regularly without climbing bending or upsetting his or her balance?

Yes / No

Definition: *cupboards are accessible between shoulder and knee height – no chairs or stepladders are required to reach things.*

Comments: _____

_____

_____

17. Can the person carry meals easily and safely from the kitchen to the dining area?

Yes / No

Definition: *meals can be carried safely, or transported using a trolley to wherever the person usually eats.*

Comments: _____

_____

_____

18. Do the indoor steps/stairs have an accessible/sturdy grab rail extending along the full length of the steps/stairs?

Yes / No

N/A *(no steps/stairs inside house)*

Definition: *grab rail must be easily gripped, firmly fixed, sufficiently robust and available for the full length of the steps or stairs.*

Comments: _____

_____

_____

19. Do the outdoor steps/stairs have an accessible/sturdy grab rail extending along the full length of the steps/stairs?

Yes / No

N/A *(no steps/stairs outside house)*

Definition: *Steps = more than two consecutive steps (changes in floor level). Grab rail must be easily gripped, firmly fixed, sufficiently robust and available for the full length of the steps or stairs.*

Comments: _____

_____

_____

20. Can the person easily and safely go up and down the steps/stairs inside or outside the house?

Yes / No

N/A *(No steps/stairs exist)*

Definition: *steps are not too high, too narrow or too uneven for feet to be firmly placed on the steps (indoors and outdoors), person is not likely to become tired or breathless using steps/stairs, and has no medical factors likely to impact on safety on stairs, e.g. foot drop, loss of sensation in feet, impaired control of movement etc.*

Comments: _____

_____

_____

21. Are the edges of the steps/stairs (both inside and outside the house) easily identified?

Yes / No

N/A *(No steps/stairs exist)*

Definition: *no patterned floor coverings, tiles or painted areas which could obscure the edge of the step, and there is adequate lighting of steps/stairs.*

Comments: _____

_____

_____

22. Can the person use the entrance door/s safely and easily?

Yes / No

Definition: *locks and bolts can be used without bending or over-reaching, there is a landing so the person does not have to balance on steps to open the door and/or screen door.*

Comments: _____

_____

_____

23. Are paths around the house in good repair, and free of clutter?

Yes / No

N/A *(no garden, path or yard exists)*

Definition: *no cracked/loose pathways, overgrowing plants/weeds, overhanging trees, garden hoses encroaching on walkways.*

Comments: _____

_____

_____

24. Is the person currently wearing well fitting slippers or shoes?

Yes / No

Definition: *Supportive, firmly fitting shoes with low heels and non-slip soles. Slippers must also support the foot in a good position. No shoes scores "no".*

Comments: _____

_____

_____

25. If there are pets – can the person care for them without bending or being at risk of falling over?

Yes / No

N/A *(there are no pets/animals)*

Definition: *pets = any animals that the person has responsibility for. To score "yes" person does not have to feed pets when they are jumping up or getting under foot, person does not have to bend to the floor to refill bowls/dish or clean pets, and pets do not require a lot of exercise.*

Comments: _____

_____

_____

Author: Dr. Lynette Mackenzie, Discipline of Occupational Therapy, Faculty of Health Sciences,
The University of Sydney, PO Box 170, Lidcombe NSW 1825, Australia.
Tel: +61 2 9351 9832
Fax: +61 2 9351 9166
Email: L.Mackenzie@usyd.edu.au

Appendix 6

Checklist of issues to consider before using hip protectors[344]

A checklist of issues to consider before using hip protectors is as follows:

- Is the risk of hip fracture high enough to justify their use?
- Will the user wear them as directed?
- Will the user be able to put them on and pull them down for toileting; if not, is assistance available?
- How will they be laundered?
- Who will encourage their use?
- Who will pay for them?
- Is the potential wearer aware of the different types of hip protectors available?

Additionally, a checklist of issues when using hip protectors is as follows:

- Is the fit adequate?
- Are they being worn in the correct position?
- Are they being worn at the correct times and should they be worn at night?
- Are continence pads worn if needed?
- Should other underwear be worn under the hip protectors?
- Is additional encouragement needed to improve adherence?
- When should the hip protectors be replaced?
- Has education been provided to care staff?

Glossary

Cognitive impairment	Impairment in one or more domains of normal brain function (eg memory, perception, calculation).
Cognitively intact	Suffering no form of cognitive impairment.
Comorbidity	Two or more health conditions or disorders occurring at the same time.
Consumer	Refers to older people, patients, clients and carers in all settings. It also refers to people receiving care in residential aged care settings and their carers.
Delirium	An acute change in cognitive function characterised by fluctuating confusion, impaired concentration and attention.
Dementia	Impairment in more than one cognitive domain that impacts on a person's ability to function, and that progresses over time.
Extrinsic factors	Factors that relate to a person's environment or their interaction with the environment.
Facility	Used to refer to both hospitals and residential aged care facilities.
Fall	A standard definition of a fall should be used in Australian facilities, so that a nationally consistent approach to falls prevention can be applied. For these guidelines, the expert panel and taskforce agreed on the following definition: 'a fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level' World Health Organization: http://www.who.int/ageing/publications/Falls_prevention7March.pdf
Falls Guidelines	Used in place of the full title of the three guidelines, *Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Hospitals 2009, Preventing Falls and Harm From Falls In Older People: Best Practice Guidelines for Australian Residential Aged Care Facilities 2009* and *Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Community Care 2009.*
Falls risk assessment	A more detailed and systematic process than a falls-risk screen and is used to identify a person's risk factors for falling.
Falls risk screen	The minimum process for identifying older people at greatest risk of falling. It is also an efficient process, because fewer than five risk factors are usually required to identify who should be assessed more comprehensively for falls risk.
Hip protector	A device worn over the greater trochanter of the femur, designed to absorb and deflect the energy created by a fall away from the hip joint. The soft tissues of the surrounding thigh absorb the energy instead.
Hospital	Refers to both acute and subacute settings.
Hypotension, orthostatic	A drop in blood pressure resulting from a change in position from lying to standing.
Hypotension, postprandial	A drop in blood pressure experienced after eating.
Incremental cost-effectiveness ratio (ICER)	A measure of the cost effectiveness of an intervention, which is calculated by comparing the costs and health outcomes of the new program with the costs and health outcomes of an alternative health care program. Interventions with lower ICERs are better value for money.

Injurious fall	These guidelines use the Prevention of Falls Network Europe (ProFaNE) panel definition of an injurious fall. They consider that the only injuries that could be confirmed accurately using current data sources were peripheral fractures (defined as any fracture of the limb girdles and of the limbs). Head injuries, maxillo-facial injuries, abdominal, soft tissue and other injuries are not included in the recommendation for a core dataset. However, other definitions of an injurious fall include traumatic brain injuries (TBIs) as a falls-related injury, particularly as falls are the leading cause of TBIs in Australia.
Intervention	A therapeutic procedure or treatment strategy designed to cure, alleviate or improve a certain condition.
Intrinsic factors	Factors that relate to a person's behaviour or condition.
Life years saved or life years generated (LYS)	A measure of the gain in health outcomes from an intervention.
Multifactorial interventions	Where people receive multiple interventions, but the combination of these interventions is tailored to the individual, based on an individual assessment.
Multiple interventions	Where everyone receives the same, fixed combination of interventions.
Older person or older people	In the community setting, these guidelines use *older person* or *older people* in favour of *patient* or *client* wherever possible. These guidelines define older people as 65 years of age and over. When considering Indigenous Australians, the term *older people* refers to people 50 years of age and over.
Patient	Refers to both patients and clients in acute and subacute hospital settings.
Pharmacodynamics	The study of the biochemical and physiological effects that medications have on the body.
Pharmacokinetics	The study of the way in which the body handles medications, including the processes of absorption, distribution, excretion and localisation in tissues and chemical breakdown.
Psychoactive medication	A medication that affects the mental state. Psychoactive medications include antidepressants, anticonvulsants, antipsychotics, mood stabilisers, anxiolytics, hypnotics, antiparkinsonian drugs, psychostimulants and dementia medications.
Quality-adjusted life year (QALY)	A summary measure used in assessing the value for money of an intervention. It is based on the number of years of life that would be added by an intervention, and combines survival and quality of life in a single composite measure.
Resident	Refers to people receiving care in residential aged care settings.
Residential aged care facility (RACF)	Refers to both high and low-care settings.
Root-cause analysis (RCA)	An in-depth analysis of an event, including individual and broader system issues, to provide greater understanding of causes and future prevention.
Single interventions	Interventions targeted at a single risk factor.
Syncope	A temporary loss of consciousness with spontaneous recovery, which occurs when there is a transient decrease in cerebral blood flow.
Vision	The ability of the unaided eye to see fine detail.
Visual acuity	A measure of the ability of the eye to see fine detail when the best spectacle or contact lens prescription is worn. Visual acuity (VA) = d/D (written as a fraction) where: d=the viewing distance (usually 6 metres), and D=the number under or beside the smallest line of letters that the person is able to see. Normal visual acuity is 6/6 or better. If someone can only see the '60' line at the top of the chart, the acuity is recorded as being 6/60. Some people can see better than 6/6 (eg 6/5, 6/3); however, 6/6 has been established as the standard for good vision.

References

1 ACSQHC (Australian Commission on Safety and Quality in Health Care) (2005). *Preventing Falls and Harm From Falls in Older People — Best Practice Guidelines for Australian Hospitals and Residential Aged Care Facilities 2005*, Australian Government, Canberra.

2 NARI (National Ageing and Research Institute) (2004). *An Analysis of Research on Preventing Falls and Falls Injury in Older People: Community, Residential Care and Hospital Settings (2004 update)*, Australian Government Department of Health and Ageing, Injury Prevention Section.

3 *Aged Care Act 1997.* http://scaletext.law.gov.au

4 van Schoor N, Deville W, Bouter L and Lips P (2002). Acceptance and compliance with external hip protectors: a systematic review of the literature. *Osteoporosis International* 13(12):917–924.

5 WHO (World Health Organization). *Definition of a Fall.* http://www.who.int/violence_injury_prevention/other_injury/falls/links/en/index.html (Accessed July 2007)

6 Rushworth N (2009). *Brain Injury Australia Policy Paper: Falls-Related Traumatic Brain Injury.* http://www.bia.net.au/reports_factsheets/BIA%20Paper_Falls%20related%20TBI.pdf (Accessed 29 July 2009)

7 Gillespie L, Robertson M, Gillespie W, Lamb S, Gates S, Cumming R and Rowe B (2009). Interventions for preventing falls in older people living in the community. *Cochrane Database of Systematic Reviews* (2) Art.No.: CD007146. DOI: 10.1002/14651858.CD007146.pub2.

8 NHMRC (National Health and Medical Research Council) (2007). *NHMRC Additional Levels of Evidence and Grades for Recommendations for Developers of Guidelines. Stage 2 Consultation.* http://www.nhmrc.gov.au/_files_nhmrc/file/guidelines/Stage%202%20Consultation%20Levels%20and%20Grades.pdf (Accessed 20 May 2009)

9 Glasziou P, Del Mar C and Salisbury J (2007). *Evidence-Based Practice Workbook,* Blackwell, Melbourne.

10 NHMRC (National Health and Medical Research Council) (1999). *A Guide to the Development, Implementation and Evaluation of Clinical Practice Guidelines*, Australian Government, Canberra.

11 Shumway-Cook A, Ciol M, Hoffman J, Dudgeon B, Yorkston K and Chan L (2009). Falls in the Medicare population: incidence, associated factors, and impact on health care. *Physical Therapy* 89(4):324–332.

12 Lord SR, Ward JA, Williams P and Anstey KJ (1993). An epidemiological study of falls in older community-dwelling women: the Randwick falls and fractures study. *Australian Journal of Public Health* 17(3):240–245.

13 Campbell AJ, Borrie MJ and Spears GF (1989). Risk factors for falls in a community-based prospective study of people 70 years and older. *Journal of Gerontology* 44(4):M112–117.

14 Tinetti M, Speechley M and Ginter S (1988). Risk factors for falls among elderly persons living in the community. *New England Journal of Medicine* 319(26):1701–1707.

15 O'Loughlin JL, Robitaille Y, Boivin JF and Suissa S (1993). Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. *American Journal of Epidemiology* 137(3):342–354.

16 Luukinen H, Koski K, Laippala P and Kivela S (1995). Predictors for recurrent falls among the home-dwelling elderly. *Scandinavian Journal of Primary Health Care* 13(4):294–299.

17 Campbell A, Borrie M, Spears G, Jackson S, Brown J and Fitzgerald J (1990). Circumstances and consequences of falls experienced by a community population 70-years and over during a prospective study. *Age and Ageing* 19(2):136–141.

18 Lord S, Ward J, Williams P and Anstey K (1994). Physiological factors associated with falls in older community-dwelling women. *Journal of the American Geriatrics Society* 42(10):1110–1117.

19 Close J, Ellis M, Hooper R, Glucksman E, Jackson S and Swift C (1999). Prevention of falls in the elderly trial (PROFET): a randomised controlled trial. *Lancet* 353(9147):93–97.

20 Baker SP and Harvey AH (1985). Fall injuries in the elderly. *Clinics in Geriatric Medicine* 1(3):501–512.

21 Cripps R and Carman J (2001). *Falls by the elderly in Australia: trends and data for 1998*, Injury Research and Statistics Series, Australian Institute of Health and Welfare, Adelaide.

22 New South Wales Health (1994). *The epidemiology of falls in older people in NSW*, New South Wales Health, Sydney.

23 Gibson M, Andreas R, Isaacs B, Radebaugh T and Worm-Petersen J (1987). The prevention of falls in later life. A report of the Kellogg International Work Group on the Prevention of Falls by the Elderly. *Danish Medical Bulletin* 34(suppl. 4):1–24.

24 Marottoli RA, Berkman LF and Cooney LM, Jr. (1992). Decline in physical function following hip fracture. *Journal of the American Geriatrics Society* 40(9):861–866.

25 Oliver D, Hopper A and Seed P (2000). Do hospital fall prevention programs work? A systematic review. *Journal of the American Geriatrics Society* 48(12):1679–1689.

26 King MB and Tinetti ME (1995). Falls in community-dwelling older persons. *Journal of the American Geriatrics Society* 43(10):1146–1154.

27 Mallinson WJ and Green MF (1985). Covert muscle injury in aged patients admitted to hospital following falls. *Age and Ageing* 14(3):174–178.

28 Wild D, Nayak US and Isaacs B (1981). How dangerous are falls in old people at home? *British Medical Journal (Clinical Research Edition)* 282(6260):266–268.

29 Vellas B, Cayla F, Bocquet H, de Pemille F and Albarede JL (1987). Prospective study of restriction of activity in old people after falls. *Age and Ageing* 16(3):189–193.

30 Tinetti ME, Liu WL and Claus EB (1993). Predictors and prognosis of inability to get up after falls among elderly persons. *Journal of the American Medical Association* 269(1):65–70.

31 Kiel DP, O'Sullivan P, Teno JM and Mor V (1991). Health care utilization and functional status in the aged following a fall. *Medical Care* 29(3):221–228.

32 Tinetti ME and Williams CS (1998). The effect of falls and fall injuries on functioning in community-dwelling older persons. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 53(2):M112–119.

33 Tinetti ME, Mendes de Leon CF, Doucette JT and Baker DI (1994). Fear of falling and falls-related efficacy in relationship to functioning among community-living elders. *Journal of Gerontology* 49(3):M140–147.

34 Lord SR (1994). Predictors of nursing home placement and mortality of residents in intermediate care. *Age and Ageing* 23(6):499–504.

35 Tinetti M and Williams C (1997). Falls, injuries due to falls, and risk of admission to a nursing home. *New England Journal of Medicine* 337(18):1279–1284.

36 DoHA (Australian Government Department of Health and Ageing) (2003). *Projected Costs of Fall Related Injury to Older Persons Due to Demographic Change in Australia*, Department of Health and Ageing, Australian Government, Canberra.

37 National Falls Prevention for Older People Initiative (2000). *Step Out with Confidence—A Study into the Information Needs and Perceptions of Older Australians Concerning Falls and their Prevention*, Commonwealth Department of Health and Aged Care, Managing Innovation—Marketing Consultancy Network Pty Ltd. http://www.health.gov.au/internet/wcms/publishing.nsf/content/health-pubhlth-strateg-injury-fall-documents.htm

38 NCC-NSC (National Collaborating Centre for Nursing and Supportive Care) (2004). *Clinical Practice Guideline for the Assessment and Prevention of Falls in Older People*. http://guidance.nice.org.uk/CG21

39 Clemson L, Cumming R, Kendig H, Swann M, Heard R and Taylor K (2004). The effectiveness of a community-based program for reducing the incidence of falls in the elderly: a randomized trial. *Journal of the American Geriatrics Society* 52(9):1487–1494.

40 Sherrington C, Whitney J, Lord S, Herbert R, Cumming R and Close J (2008). Effective exercise for the prevention of falls: a systematic review and meta-analysis. *Journal of the American Geriatrics Society* 56(12):2234–2243.

41 Foss A (2006). Falls and health status in elderly women following second eye cataract surgery: a randomised controlled trial. *Age and Ageing* 35(1):66–71.

42 Harwood R, Foss A, Osborn F, Gregson R, Zaman A and Masud T (2005). Falls and health status in elderly women following first eye cataract surgery: a randomised controlled trial. *British Journal of Ophthalmology* 89(1):53–59.

43 Clemson L, Mackenzie L, Ballinger C, Close J and Cumming R (2008). Environmental interventions to prevent falls in community-dwelling older people: a meta-analysis of randomized trials. *Journal of Aging and Health* 20(8):954–971.

44 Campbell A, Robertson M, Gardner M, Norton R and Buchner D (1999). Psychotropic medication withdrawal and a home-based exercise programme to prevent falls: results of a randomised controlled trial. *Journal of the American Geriatrics Society* 47(7):850–853.

45 Campbell A, Robertson M, La Grow S, Kerse N, Sanderson G, Jacobs R, Sharp D and Hale L (2005). Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial. *British Medical Journal* 331(7520):817–820.

46 La Grow S, Robertson M, Campbell A, Clarke G and Kerse N (2006). Reducing hazard related falls in people 75 years and older with significant visual impairment: how did a successful program work? *Injury Prevention* 12(5):296–301.

47 Kenny R, Richardson D, Steen N, Bexton R, Shaw F and Bond J (2001). Carotid sinus syndrome: a modifiable risk factor for non-accidental falls in older adults. *Journal of the American College of Cardiology* 38(5):1491–1496.

48 Pit S, Byles J, Henry D, Holt L, Hansen V and Bowman D (2007). A Quality Use of Medicines program for general practitioners and older people: a cluster randomised controlled trial. *Medical Journal of Australia* 187(1):23–30.

49 Cameron I, Murray G, Gillespie L, Cumming R, Robertson M, Hill K and Kerse N (2008). Interventions for preventing falls in older people in nursing care facilities and hospitals. *Cochrane Database of Systematic Reviews* (3) Art. No.: CD005465. DOI: 10.1002/14651858.CD005465.

50 Day L, Fildes B, Gordon I, Fitzharris M, Flamer H and Lord S (2002). Randomised factorial trial of falls prevention among older people living in their own homes. *British Medical Journal* 325(7356):128.

51 McClure R, Turner C, Peel N, Spinks A, Eakin E and Hughes K (2005). Population-based interventions for the prevention of falls-related injuries in older people. *Cochrane Database of Systematic Reviews* (2) Art. No.: CD004441. DOI: 10.1002/14651858.CD004441.pub2.

52 Campbell A, Robertson M, Gardner M, Norton R, Tilyard M and Buchner D (1997). Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *British Medical Journal* 315:1065–1069.

53 Robertson M, Gardner M, Devlin N, McGee R and Campbell A (2001). Effectiveness and economic evaluation of a nurse-delivered home exercise programme to prevent falls 1: randomised controlled trial. *British Medical Journal* 322(7288):697–701.

54 Li F, Harmer P, Fisher K, McAuley E, Chaumeton N, Eckstrom E and Wilson N (2005). Tai chi and fall reductions in older adults: a randomized controlled trial. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 60(2):187–194.

55 Voukelatos A, Cumming R, Lord S and Rissel C (2007). A randomized, controlled trial of tai chi for the prevention of falls: the Central Sydney Tai Chi Trial. *Journal of the American Geriatrics Society* 55(8):1185–1191.

56 Wolf S, Barnhart H, Kutner N, McNeely E, Coogler C and Xu T (1996). Reducing frailty and falls in older persons: an investigation of tai chi and computerized balance training. Atlanta FicSIT Group. Frailty and injuries: cooperative studies of intervention techniques. *Journal of the American Geriatrics Society* 44(5):489–497.

57 Woo J, Hong A, Lau E and Lynn H (2007). A randomised controlled trial of tai chi and resistance exercise on bone health, muscle strength and balance in community-living elderly people. *Age and Ageing* 36(3):262–268.

58 Barnett A, Smith B, Lord S, Williams M and Baumand A (2003). Community-based group exercise improves balance and reduces falls in at-risk older people: a randomised controlled trial. *Age and Ageing* 32:407–414.

59 Buchner D, Cress M, de Lateur B, Esselman P, Margherita A, Price R and Wagner E (1997). The effect of strength and endurance training on gait, balance, fall risk, and health services use in community-living older adults. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 52(4):M218–224.

60 Madureira M, Takayama L, Gallinaro A, Caparbo V, Costa R and Pereira R (2007). Balance training program is highly effective in improving functional status and reducing the risk of falls in elderly women with osteoporosis: a randomized controlled trial. *Osteoporosis International* 18(4):419–425.

61 McMurdo M, Mole P and Paterson C (1991). Controlled trial of weight bearing exercise in older women in relation to bone density and falls. *British Medical Journal* 314(7080):569.

62 Skelton D, Dinan S, Campbell M and Rutherford O (2005). Tailored group exercise (Falls Management Exercise — FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age and Ageing* 34(6):636–639.

63 Suzuki T, Kim H, Yoshida H and Ishizaki T (2004). Randomized controlled trial of exercise intervention for the prevention of falls in community-dwelling elderly Japanese women. *Journal of Bone and Mineral Metabolism* 22(6):602–611.

64 Robertson M, Campbell A, Gardner M and Devlin N (2002). Preventing injuries in older people by preventing falls: a meta-analysis of individual-level data. *Journal of the American Geriatrics Society* 50(5):905–911.

65 Low S, Ang L, Goh K and Chew S (2009). A systematic review of the effectiveness of tai chi on fall reduction among the elderly. *Archives of Gerontology and Geriatrics* 48(3):325–331.

66 Wolf S, Sattin R, Kutner M, O'Grady M, Greenspan A and Gregor R (2003). Intense tai chi exercise training and fall occurrences in older, transitionally frail adults: a randomized, controlled trial. *Journal of the American Geriatrics Society* 51(12):1693–1701.

67 Logghe IH, Zeeuwe PE, Verhagen AP, Wijnen-Sponselee RM, Willemsen SP, Bierma-Zeinstra SM, van Rossum E, Faber MJ and Koes BW (2009). Lack of effect of tai chi chuan in preventing falls in elderly people living at home: a randomized clinical trial. *Journal of the American Geriatrics Society* 57(1):70–75.

68 Lord S, Castell S, Corcoran J, Dayhew J, Sci B, Matters B, Shan A and Williams P (2003). The effect of group exercise on physical functioning and falls in frail older people living in retirement villages: a randomized, controlled trial. *Journal of the American Geriatrics Society* 51(12):1685–1692.

69 Close J, Lord S, Menz H and Sherrington C (2005). What is the role of falls? *Best Practice and Research in Clinical Rheumatology* 19(6):913–935.

70 Bischoff-Ferrari H, Dawson-Hughes B, Willett W, Staehelin H, Bazemore M, Zee R and Wong J (2004). Effect of vitamin D on falls: a meta-analysis. *Journal of the American Medical Association* 291(16):1999–2006.

71 Latham N, Anderson C and Reid I (2003). Effects of vitamin D supplementation on strength, physical performance, and falls in older persons: a systematic review. *Journal of the American Geriatrics Society* 51(9):1219–1226.

72 Chapuy M, Arlot M, Delmas P and Meunier P (1994). Effect of calcium and cholecalciferol treatment for three years on hip fractures in elderly women. *British Medical Journal* 308(6936):1081–1082.

73 Allain T and Dhesi J (2003). Hypovitaminosis D in older adults. *Gerontology* 49:273–278.

74 Van der Velde N, Stricker B, Pols H and van der Cammen T (2006). Risk of falls after withdrawal of fall-risk-increasing drugs: a prospective cohort study. *British Journal of Clinical Pharmacology* 63(2):232–237.

75 Cumming R, Thomas M, Szonyi G, Salkeld G, O'Neill E, Westbury C and Frampton G (1999). Home visits by an occupational therapist for assessment and modification of environmental hazards: a randomized trial of falls prevention. *Journal of the American Geriatrics Society* 47(12):1397–1402.

76 Clemson L (1997). *Home Fall Hazards. A Guide to Identifying Fall Hazards in the Homes of Elderly People (An Accompaniment to the Westmead Home Safety Assessment)*, Co-ordinates Publications, West Brunswick, Australia.

77 Cumming R (2007). Improving vision to prevent falls in frail older people: a randomized trial. *Journal of the American Geriatrics Society* 55(2):175–181.

78 Kempton A, van Beurden E, Sladden T, Garner E and Beard J (2000). Older people can stay on their feet: final results of a community-based falls prevention programme. *Health Promotion International* 15(1):27–33.

79 Tinetti ME, Baker DI, King M, Gottschalk M, Murphy TE, Acampora D, Carlin BP, Leo-Summers L and Allore HG (2008). Effect of dissemination of evidence in reducing injuries from falls. *New England Journal of Medicine* 359(3):252–261.

80 Beard J, Rowell D, Scott D, van Beurden E, Barnett L, Hughes K and Newman B (2006). Economic analysis of a community-based falls prevention program. *Public Health* 120(8):742–751.

81 Johansson P, Sadigh S, Tillgren P and Rehnberg C (2008). Non-pharmaceutical prevention of hip fractures — a cost-effectiveness analysis of a community-based elderly safety promotion program in Sweden. *Cost Effective Resource Allocation* 6:11.

82 Gates S, Fisher J, Cooke M, Carter Y and Lamb S (2008). Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. *British Medical Journal* 336(7636):130–133.

83 Close J, Hooper R, Glucksman E, Jackson S and Swift C (2003). Predictors of falls in a high risk population: results from the prevention of falls in the elderly trial (PROFET). *Emergency Medicine Journal* 20(5):421–425.

84 Davison J, Bond J, Dawson P, Steen I and Kenny R (2005). Patients with recurrent falls attending accident & emergency benefit from multifactorial intervention — a randomised controlled trial. *Age and Ageing* 34(2):162–168.

85 Nikolaus T and Bach M (2003). Preventing falls in community-dwelling frail older people using a home intervention team (HIT): results from the randomized Falls-HIT trial. *Journal of the American Geriatrics Society* 51(3):300–305.

86 Wagner E, LaCroix A, Grothaus L, Leveille S, Hecht J, Artz K, Odle K and Buchner D (1994). Preventing disability and falls in older adults: a population-based randomized trial. *American Journal of Public Health* 84(11):1800–1806.

87 Hornbrook M, Stevens V, Wingfield D, Hollis J, Greenlick M and Ory M (1994). Preventing falls among community-dwelling older persons: results from a randomized trial. *Gerontologist* 34(1):16–23.

88 Tinetti M, Baker D, McAvay G, Claus E, Garrett P, Gottschalk M, Koch M, Trainor K and Horwitz R (1994). A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine* 331(13):821–827.

89 Hendriks M, Bleijlevens M, van Haastregt J, Crebolder H, Diederiks J, Evers S, Mulder W, Kempen G, van Rossum E, Ruijgrok J, Stalenhoef P and van Eijk J (2008). Lack of effectiveness of a multidisciplinary fall-prevention program in elderly people at risk: a randomized, controlled trial. *Journal of the American Geriatrics Society* 56(8):1390–1397.

90 van Haastregt J, Diederiks J, van Rossum E, de Witte L, Voorhoeve P and Crebolder H (2000). Effects of a programme of multifactorial home visits on falls and mobility impairments in elderly people at risk: randomised controlled trial. *British Medical Journal* 321(7267):944–998.

91 Campbell A and Robertson M (2007). Rethinking individual and community fall prevention strategies: a meta-regression comparing single and multifactorial interventions. *Age and Ageing* 36(6):656–662.

92 Elley C, Robertson M, Garrett S, Kerse N, McKinlay E, Lawton B, Moriarty H, Moyes S and Campbell A (2008). Effectiveness of a falls-and-fracture nurse coordinator to reduce falls: a randomized, controlled trial of at-risk older adults. *Journal of the American Geriatrics Society* 56(8):1383–1389.

93 Rizzo J, Baker D, McAvay G and Tinetti M (1996). The cost-effectiveness of a multifactorial targeted prevention program for falls among community elderly persons. *Medical Care* 34(9):954–969.

94 Hendriks M, Evers S, Bleijlevens M, van Haastregt J, Crebolder H and van Eijk J (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.

95 Shaw F, Bond J, Richardson D, Dawson P, Steen I, McKeith I and Kenny R (2003). Multifactorial intervention after a fall in older people with cognitive impairment and dementia presenting to the accident and emergency department: randomised controlled trial. *British Medical Journal* 326(7380):73.

96 Oliver D, Connelly J, Victor C, Shaw F, Whitehead A, Genc Y, Vanoli A, Martin F and Gosney M (2007). Strategies to prevent falls and fractures in hospitals and care homes and effect of cognitive impairment: systematic review and meta-analyses. *British Medical Journal* 334(7584):82.

97 Ellis A and Trent R (2001). Hospitalized fall injuries and race in California. *Injury Prevention* 7(4):316–320.

98 Gray L and Wooton R (2008). Comprehensive geriatric assessment 'online'. *Australasian Journal on Ageing* 27(4):205–2008.

99 VQC (Victorian Quality Council) (2004). *Research supplement. Minimising the Risk of Falls and Falls-related Injuries: Guidelines for Acute, Sub-acute and Residential Care Settings*, Department of Human Services Metropolitan Health and Aged Care Services Division, Victorian Government, Melbourne.

100 AGS (American Geriatrics Society) (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society* 49:664–672.

101 Shumway-Cook A, Baldwin M, Polissar N and Gruber W (1997). Predicting the probability for falls in community-dwelling older adults. *Physical Therapy* 77(8):812–819.

102 Gunter K, White K, Hayes W and Snow C (2000). Functional mobility discriminates nonfallers from one-time and frequent fallers. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 55(11):M672–676.

103 Rose D, Jones C and Lucchese N (2002). Predicting the probability of falls in community-residing older adults using the 8-foot up-and-go: a new measure of functional mobility. *Journal of Aging and Physical Activity* 10(4):466–475.

104 Tiedemann A, Shimada H, Sherrington C, Murray S and Lord S (2008). The comparative ability of eight functional mobility tests for predicting falls in community-dwelling older people. *Age and Ageing* 37(4):430–435.

105 Cwikel J, Fried A, Biderman A and Galinsky D (1998). Validation of a falls-risk screening test, the Elderly Fall Screening Test (EFST), for community-dwelling elderly. *Disability and Rehabilitation* 20(5):161–167.

106 Russell M, Hill K, Blackberry I, Gurrin L, Day L and Dharmage S (2008). The reliability, sensitivity and specificity of the falls risk for older people in the community (FROP-Com) assessment tool. *Age and Ageing* 37(6):634–639.

107 Russell M, Hill K, Blackberry I, Gurrin L, Dharmage S and Day L (2009). Development of the falls risk for older people in the community (FROP-Com) screening tool. *Age and Ageing* 38(1):40–46.

108 Tinetti M, Williams T and Mayewski R (1986). Fall risk index for elderly patients based on number of chronic disabilities. *American Journal of Medicine* 80(3):429–434.

109 Oliver D (2004). Risk factors and risk assessment tools for falls in hospital in-patients: a systematic review. *Age and Ageing* 33(2):122–130.

110 Haines T, Hill K, Walsh W and Osborne R (2007). Design-related bias in hospital fall risk screening tool predictive accuracy evaluations: systematic review and meta-analysis. *Journals of Gerontology Series A: Biological Sciences and Medical Science*s 62:664–672.

111 Lord S, Menz H and Tiedemann A (2003). A physiological profile approach to falls risk assessment and prevention. *Physical Therapy* 83(3):237.

112 Shaw F (2007). Prevention of falls in older people with dementia. *Journal of Neural Transmission* 114(10):1259–1264.

113 Feder G, Cryer C, Donovan S and Carter Y (2000). Guidelines for the prevention of falls in people over 65. *British Medical Journal* 321(7267):1007–1011.

114 Lundebjerg N, Rubenstein L and Kenny R (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society* 49(5):664–672.

115 Moreland J, Richardson J, Chan D, O'Neill J, Bellissimo A, Grum R and Shanks L (2003). Evidence-based guidelines for the secondary prevention of falls in older adults. *Gerontology* 49(2):93–116.

116 Nelson M, Rejeski WJ, Blair S, Duncan P, Judge J, King A, Macera C and Castaneda-Sceppa C (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise* 39(8):1435–1445.

117 Boyle P, Buchman A, Wilson R, Bienias J and Bennett D (2007). Physical activity is associated with incident disability in community-based older persons. *Journal of the American Geriatrics Society* 55(2):195–201.

118 Marcus B, Williams D, Dubbert P, Sallis J, King A, Yancey A, Franklin B, Buchner D, Daniels S and Claytor R (2006). Physical activity intervention studies: what we know and what we need to know: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity); Council on Cardiovascular Disease in the Young; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research. *Circulation* 114(24):2739–2752.

119 Heesch K, Byles J and Brown W (2008). Prospective association between physical activity and falls in community-dwelling older women. *Journal of Epidemiology* 62(5):421–426.

120 Ebrahim S, Thompson P, Baskaran V and Evans K (1997). Randomized placebo-controlled trial of brisk walking in the prevention of postmenopausal osteoporosis. *Age and Ageing* 26(4):253–260.

121 Lawton B, Rose S, Elley C, Dowell A, Fenton A and Moyes S (2008). Exercise on prescription for women aged 40–74 recruited through primary care: two year randomised controlled trial. *British Medical Journal* 337:A2509.

122 Ganz D, Bao Y, Shekelle P and Rubenstein L (2007). Will my patient fall? *Journal of the American Medical Association* 297(1):77–86.

123 Kerrigan D, Lee L, Nieto T, Markman J, Collins J and Riley P (2000). Kinetic alterations independent of walking speed in elderly fallers. *Archives of Physical Medicine and Rehabilitation* 81(6):730–735.

124 Howe T, Rochester L, Jackson A, Banks P and Blair V (2007). Exercise for improving balance in older people. *Cochrane Database of Systematic Reviews* (4) Art. No.: CD004963. DOI: 10.1002/14651858.CD004963.pub2.

125 Latham N, Anderson C, Bennett D and Stretton C (2003). Progressive resistance strength training for physical disability in older people. *Cochrane Database of Systematic Reviews* (2) Art. No.: CD002759. DOI: 10.1002/14651858.CD002759.

126 Perera S, Mody S, Woodman R and Studenski S (2006). Meaningful change and responsiveness in common physical performance measures in older adults. *Journal of the American Geriatrics Society* 54(5):743–749.

127 Latham N, Mehta V, Nguyen A, Jette A, Olarsch S, Papanicolaou D and Chandler J (2008). Performance-based or self-report measures of physical function: which should be used in clinical trials of hip fracture patients? *Archives of Physical Medicine and Rehabilitation* 89(11):2146–2155.

128 Moe-Nilssen R, Nordin E and Lundin-Olsson L (2008). Criteria for evaluation of measurement properties of clinical balance measures for use in fall prevention studies. *Journal of Evaluation of Clinical Practices* 14(2):236–240.

129 Duncan P, Studenski S, Chandler J and Prescott B (1992). Functional reach: predictive validity in a sample of elderly male veterans. *Journal of Gerontology* 47(3):M93–98.

130 Podsiadlo D and Richardson S (1991). The timed 'Up & Go': a test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society* 39(2):142–148.

131 Csuka M and McCarty D (1985). Simple method for measurement of lower extremity muscle strength. *American Journal of Medicine* 78(1):77–81.

132 Berg K, Wood-Dauphinee S, Williams J and Maki B (1992). Measuring balance in the elderly: validation of an instrument. *Canadian Journal of Public Health* 83(suppl. 2):S7–11.

133 Tinetti M (1986). Performance-oriented assessment of mobility problems in elderly patients. *Journal of the American Geriatrics Society* 34(2):119–126.

134 Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C and Todd C (2005). Development and initial validation of the Falls Efficacy Scale-International (FES-I). *Age and Ageing* 34(6):614–619.

135 ACSM (American College of Sports Medicine) (1999). American College of Sports Medicine and American Heart Association joint position statement: recommendations for cardiovascular screening, staffing, and emergency policies at health/fitness facilities. *Medicine and Science in Sports and Exercise* 31(2):353-354.

136 Visser H (1983). Gait and balance in senile dementia of Alzheimer's type. *Age and Ageing* 12(4):296–301.

137 Liu-Ambrose T, Donaldson MG, Ahamed Y, Graf P, Cook WL, Close J, Lord SR and Khan KM (2008). Otago home-based strength and balance retraining improves executive functioning in older fallers: a randomized controlled trial. *Journal of the American Geriatrics Society* 56(10):1821–1830.

138 Day L, Hoareau E, Finch C, Harrison J, Segal L and Bolton T (2008). *Modelling the Impact, Costs and Benefits of Falls Prevention Measures to Support Policy-Makers and Program Planners*, Monash University Accident Research Centre, Melbourne.

139 Robertson MC, Devlin N, Scuffham P, Gardner MM, Buchner DM and Campbell AJ (2001). Economic evaluation of a community based exercise programme to prevent falls. *Journal of Epidemiology and Community Health* 55(8):600–606.

140 Robertson M, Gardner M, Devlin N, McGee R and Campbell A (2001). Effectiveness and economic evaluation of a nurse-delivered home exercise program to prevent falls 2: controlled trial in multiple centres. *British Medical Journal* 322(7288):701–704.

141 Weber J, Coverdale J and Kunik M (2004). Delirium: current trends in prevention and treatment. *Internal Medicine Journal* 34(3):115–121.

142 Access Economics (2005). *Dementia Estimates and Projections: Australian States and Territories*, Alzheimer's Australia.

143 Folstein M, Bassett S, Romanoski A and Nestadt G (1991). The epidemiology of delirium in the community: the Eastern Baltimore Mental Health Survey. *International Psychogeriatrics* 3(2):169–176.

144 Inouye S (2006). Delirium in older persons. *New England Journal of Medicine* 354(11):1157–1165.

145 Hill K, Vu M and Walsh W (2007). Falls in the acute hospital setting — impact on resource utilisation. *Australian Health Reviews* 31(3):471–477.

146 van Dijk P, Meulenberg O, van de Sande H and Habbema J (1993). Falls in dementia patients. *Gerontologist* 33(2):200–204.

147 Buchner D and Larson E (1987). Falls and fractures in patients with Alzheimer-type dementia. *Journal of the American Medical Association* 257(11):1492–1495.

148 Morris J, Rubin E, Morris E and Mandel S (1987). Senile dementia of the Alzheimer's type: an important risk factor for serious falls. *Journal of Gerontology* 42(4):412–417.

149 Thapa P, Gideon P, Fought R and Ray W (1995). Psychotropic drugs and risk of recurrent falls in ambulatory nursing home residents. *American Journal of Epidemiology* 142(2):202–211.

150 Passant U, Warkentin S and Gustafson L (1997). Orthostatic hypotension and low blood pressure in organic dementia: a study of prevalence and related clinical characteristics. *International Journal of Geriatric Psychiatry* 12(3):395–403.

151 Mossey J (1985). Social and psychologic factors related to falls among the elderly. *Clinics in Geriatric Medicine* 1(3):541–553.

152 Nakamura T, Meguro K and Sasaki H (1996). Relationship between falls and stride length variability in senile dementia of the Alzheimer type. *Gerontology* 42(2):108–113.

153 van Doorn C, Gruber-Baldini A, Zimmerman S, Hebel J, Port C, Baumgarten M, Quinn C, Taler G, May C and Magaziner J (2003). Dementia as a risk factor for falls and fall injuries among nursing home residents. *Journal of the American Geriatrics Society* 51(9):1213–1218.

154 Shaw F (2002). Falls in cognitive impairment and dementia. *Clinics in Geriatric Medicine* 18(2):159–173.

155 Folstein M, Folstein S and McHugh P (1975). 'Mini-mental state': a practical method for grading the cognitive status of patients for the clinician. *Journal of Psychiatric Research* 12(3):189–198.

156 Rowland J, Basic D, Storey J and Conforti D (2006). The Rowland Universal Dementia Assessment Scale (RUDAS) and the Folstein MMSE in a multicultural cohort of elderly persons. *International Psychogeriatrics* 18(1):111–120.

157 Storey J, Rowland J, Basic D, Conforti D and Dickson H (2004). The Rowland Universal Dementia Assessment Scale (RUDAS): a multicultural cognitive assessment scale. *International Psychogeriatrics* 16(1):13–31.

158 Inouye S, van Dyck C, Alessi C, Balkin S, Siegal A and Horwitz R (1990). Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Annals of Internal Medicine* 113(12):941–948.

159 Wei L, Fearing M, Sternberg E and Inouye S (2008). The confusion assessment method: a systematic review of current usage. *Journal of the American Geriatrics Society* 56(5):823–830.

160 Joanna Briggs Institute (2001). Maintaining oral hydration in older people. *Best Practice* 5:1–5.

161 Keller N (2006). Maintaining oral hydration in older adults living in residential aged care facilities. *International Journal of Evidence Based Healthcare* 4:68–73.

162 Peet S, Castleden C and McGrother C (1995). Prevalence of urinary and fecal incontinence in hospitals and residential and nursing homes for older people. *British Medical Journal* 311(7012):1063–1064.

163 Thom D, Haan M and Van Den Eeden S (1997). Medically recognized urinary incontinence and risks of hospitalisation, nursing home admission and mortality. *Age and Ageing* 26(5):367–374.

164 Resnick N (1996). Geriatric incontinence. *Urologic Clinics of North America* 23(1):55–74.

165 Lord S, Sherrington C and Menz H (2007). *Falls in Older People: Risk Factors and Strategies for Prevention*, Cambridge University Press, New York.

166 Rubenstein L, Josephson K and Osterweil D (1996). Falls and fall prevention in the nursing home. *Clinics in Geriatric Medicine* 12(4):881–902.

167 Spice C, Morotti W, George S, Dent T, Rose J, Harris S and Gordon C (2009). The Winchester Falls Project: a randomised controlled trial of secondary prevention of falls in older people. *Age and Ageing* 38(1):33–40.

168 Delbaere K, Close J, Menz H, Cumming R, Cameron I, Sambrook P, March L and Lord S (2008). Development and validation of fall risk screening tools for use in residential aged care facilities. *Medical Journal of Australia* 189(4):193–196.

169 Tromp A, Smit J, Deeg D, Bouter L and Lips P (1998). Predictors of falls and fractures in the Longitudinal Aging Study Amsterdam. *Journal of Bone and Mineral Research* 12(12):1932–1939.

170 Brown J, Vittinghoff E, Wyman J, Stone K, Nevitt M, Ensrud K and D G (2000). Urinary incontinence: does it increase risk for falls and fractures? *Journal of the American Geriatrics Society* 48(7):721–725.

171 Teo J, Briffa N, Devine A, Dhaliwal S and Prince R (2006). Do sleep problems or urinary incontinence predict falls in elderly women? *Australian Journal of Physiotherapy* 52(1):19–24.

172 Perry S, Shaw C, Assassa P, Dallosso H, Williams K, Brittain K, Mensah F, Smith N, Clarke M, Jagger C, Mayne C, Castleden C, Jones J and McGrother C (2000). An epidemiological study to establish the prevalence of urinary symptoms and felt need in the community: the Leicestershire MRC Incontinence Study. Leicestershire MRC Incontinence Study Team. *Journal of Public Health Medicine* 22(3):427–434.

173 Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A and Wein A (2002). The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Neurourology and Urodynamics* 21:167–178.

174 Chiarelli P, Brown W and McElduf P (2000). Constipation in Australian women: prevalence and associated factors. *International Urogynecology Journal* 11(2):71–78.

175 Stewart R, Moore M, May F, Marks R and Hale W (1992). Nocturia: a risk factor for falls in the elderly. *Journal of the American Geriatrics Society* 40(12):1217–1220.

176 de Lillo A and Rose S (2000). Functional bowel disorders in the geriatric patient: constipation, fecal impaction, and fecal incontinence. *American Journal of Gastroenterology* 95(4):901–905.

177 Charach G, Greenstein A, Rabinovich P, Groskopf I and Weintraub M (2001). Alleviating constipation in the elderly improves lower urinary tract symptoms. *Gerontology* 47(2):72–76.

178 Bhargava S, Canda A and Chapple C (2004). A rational approach to benign prostatic hyperplasia evaluation: recent advances. *Current Opinion in Urology* 14(1):1–6.

179 Hampel C, Weinhold D, Benken N, Eggersmann C and Thüroff J (1997). Prevalence and natural history of female incontinence. *European Urology* 32(suppl. 2):3–12.

180 Abrams P (2003). Describing bladder storage function: overactive bladder syndrome and detrusor overactivity. *Urology* 62(5 suppl. 2):28–37.

181 Ashley M, Gryfe C and Amies A (1977). A longitudinal study of falls in an elderly population II: some circumstances of falling. *Age and Ageing* 6(4):211–220.

182 Tinetti M, Inouye S, Gill T and Doucette J (1995). Shared risk factors for falls, incontinence, and functional dependence. Unifying the approach to geriatric syndromes. *Journal of the American Medical Association* 273(17):1348–1353.

183 Fonda D, DuBeau C, Harari D, Palmer M, Ouslander J and Roe B (2005). Incontinence in the frail elderly. In: *Incontinence*, vol. 2, *Management*, Abrams P, Andersson K and Brubaker L (eds), Proceedings of the Third International Consultation on Incontinence, Monte Carlo, 26–29 June 2004, Health Publications Ltd, Plymouth, UK, 1163–1239.

184 Hay-Smith E and Dumoulin C (2006). Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. *Cochrane Database of Systematic Reviews* (1) Art. No.: CD005654. DOI: 10.1002/14651858.CD005654.

185 Sahlin Y and Berner E (2007). Fecal incontinence. In: *Evidence-Based Physical Therapy for the Pelvic Floor*, Bø K, Berghmans B, Mørkved S and Kampen M (eds), Churchill Livingstone Elsevier, 304–308.

186 Schnelle J, Kapur K, Alessi C, Osterweil D, Beck J, Al-Samarrai N and Ouslander J (2003). Does an exercise and incontinence intervention save healthcare costs in a nursing home population? *Journal of the American Geriatrics Society* 51(2):161–168.

187 Eustice S, Roe B and Paterson J (2000). Prompted voiding for the management of urinary incontinence in adults. *Cochrane Database of Systematic Reviews* (2) Art. No.: CD002113. DOI: 10.1002/14651858.CD002113.

188 Ostaszkiewicz J, Johnston L and Roe B (2004). Timed voiding for the management of urinary incontinence in adults. *Cochrane Database of Systematic Reviews* (1) Art. No.: CD002802. DOI: 10.1002/14651858.CD002802.pub2.

189 Ostaszkiewicz J, Johnston L and Roe B (2004). Habit retraining for the management of urinary incontinence in adults. *Cochrane Database of Systematic Reviews* (2) Art. No.: CD002801. DOI: 10.1002/14651858.CD002801.pub2.

190 Gardner J and Fonda D (1994). Urinary incontinence in the elderly. *Disability and Rehabilitation* 16(3):140–148.

191 Dmochowski R, Sanders S, Appell R, Nitti V and Davila G (2005). Bladder-health diaries: an assessment of 3-day vs 7-day entries. *BJU International* 96(7):1049–1054.

192 Brown J, Bradley C, Subak L, Richter H, Kraus S, Brubaker L, Lin F, Vittinghoff E and Grady D (2006). The sensitivity and specificity of a simple test to distinguish between urge and stress. *Annals of Internal Medicine* 144(10):715–723.

193 Bakarich A, McMillan V and Prosser R (1997). The effect of a nursing intervention on the incidence of older patient falls. *Australian Journal of Advanced Nursing* 15(1):26–31.

194 Fonda D, Cook J, Sandler V and Bailey M (2006). Sustained reduction in serious falls-related injuries in older people in hospital. *Medical Journal of Australia* 184(8):379–382.

195 Healey F, Monro A, Cockram A, Adams V and Heseltine D (2004). Using targeted risk factor reduction to prevent falls in older in-patients: a randomised controlled trial. *Age and Ageing* 33(4):390–395.

196 Menant J, Steele J, Menz H, Munro B and Lord S (2008). Optimising footwear for older people at risk of falls. *Journal of Rehabilitation Research and Development* 45(8):1167–1181.

197 Menz H and Lord S (1999). Foot problems, functional impairment, and falls in older people. *Journal of the American Podiatric Medical Association* 89(9):458–467.

198 Koepsell T, Wolf M, Buchner D, Kukull W, LaCroix A, Tencer A, Frankenfeld C, Tautvydas M and Larson E (2004). Footwear style and risk of falls in older adults. *Journal of the American Geriatrics Society* 52(9):1495–1501.

199 Berg W, Alessio H, Mills E and Tong C (1997). Circumstances and consequences of falls in independent community-dwelling older adults. *Age and Ageing* 26(4):261–268.

200 Sherrington C and Menz H (2003). An evaluation of footwear worn at the time of falls-related hip fracture. *Age and Ageing* 32(3):310–314.

201 Robbins S, Waked E and McClaran J (1995). Proprioception and stability: foot position awareness as a function of age and footwear. *Age and Ageing* 24(1):67–72.

202 Menant J, Perry S, Steele J, Menz H, Munro B and Lord S (2008). Effects of shoe characteristics on dynamic stability when walking on even and uneven surfaces in young and older people. *Archives of Physical Medicine and Rehabilitation* 89(10):1970–1976.

203 Menant J, Steele J, Menz H, Munro B and Lord S (2008). Effects of footwear features on balance and stepping in older people. *Gerontology* 54(1):18–23.

204 Lord S and Bashford G (1996). Shoe characteristics and balance in older women. *Journal of the American Geriatrics Society* 44(4):429–433.

205 Keegan T, Kelsey J, King A, Quesenberry C and Sidney S (2004). Characteristics of fallers who fracture at the foot, distal forearm, proximal humerus, pelvis, and shaft of the tibia/fibula compared with fallers who do not fracture. *American Journal of Epidemiology* 159(2):192–203.

206 Kerse N, Butler M, Robinson E and Todd M (2004). Wearing slippers, falls and injury in residential care. *Australian and New Zealand Journal of Public Health* 28(2):180–187.

207 Menz H, Morris M and Lord S (2006). Footwear characteristics and risk of indoor and outdoor falls in older people. *Gerontology* 52(3):174–180.

208 Dunne R, Bergman A, Rogers L, Inglin B and Rivara F (1993). Elderly persons' attitudes towards footwear—a factor in preventing falls. *Public Health Reports* 108(2):245–248.

209 Perry S, Radtke A, McIlroy W, Fernie G and Maki B (2008). Efficacy and effectiveness of a balance-enhancing insole. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 63(6):595–602.

210 Benvenuti F, Ferrucci L, Guralnik J, Gangemi S and Baroni A (1995). Foot pain and disability in older persons: an epidemiologic survey. *Journal of the American Geriatrics Society* 43:479–484.

211 Dunn J, Link C, Felson D, Crincoli M, Keysor J and McKinlay J (2004). Prevalence of food and ankle conditions in a multiethnic community sample of older adults. *American Journal of Epidemiology* 159(5):491–498.

212 Menz H and Morris M (2005). Footwear characteristics and foot problems in older people. *Gerontology* 51(1):346–351.

213 Brodie B, Rees C, Robins D and Wilson A (1988). Wessex Feet: a regional foot health survey, volume I: the survey. *The Chiropodist* 43:152–165.

214 Gorter K, Kuyvenhoven M and de Melker R (2000). Nontraumatic foot complaints in older people. A population-based survey of risk factors, mobility, and well-being. *Journal of the American Podiatric Medical Association* 90(8):397–402.

215 Menz H and Lord S (2001). Foot pain impairs balance and functional ability in community-dwelling older people. *Journal of the American Podiatric Medical Association* 91:222–229.

216 Menz H, Morris M and Lord S (2005). Foot and ankle characteristics associated with impaired balance and functional ability in older people. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 60(12):1546–1552.

217 Menz H, Morris M and Lord S (2006). Foot and ankle risk factors for falls in older people: a prospective study. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 61(8):866–870.

218 Menz H and Lord S (2001). The contribution of foot problems to mobility impairment and falls in older people. *Journal of the American Geriatrics Society* 49:1651–1656.

219 Koski K, Luukinen H, Laippala P and Kivelä S (1998). Risk factors for major injurious falls among the home-dwelling elderly by functional abilities. A prospective population-based study. *Gerontology* 44(4):232–238.

220 Lord S, Lloyd D and Li S (1996). Sensori-motor function, gait patterns and falls in community-dwelling women. *Age and Ageing* 25(4):292–299.

221 Menz H, Lord S, St George R and Fitzpatrick R (2004). Walking stability and sensorimotor function in older people with diabetic peripheral neuropathy. *Archives of Physical Medicine and Rehabilitation* 85(2):245–252.

222 Wallace C, Reiber G, LeMaster J, Smith D, Sullivan K, Hayes S and Vath C (2002). Incidence of falls, risk factors for falls, and falls-related fractures in individuals with diabetes and a prior foot ulcer. *Diabetes Care* 25(11):1983–1986.

223 Richardson J, Ashton-Miller J, Lee S and Jacobs K (1996). Moderate peripheral neuropathy impairs weight transfer and unipedal balance in the elderly. *Archives of Physical Medicine and Rehabilitation* 77(11):1152–1156.

224 Richardson J and Hurvitz E (1995). Peripheral neuropathy: a true risk factor for falls. *Journal of Gerontology* 50(4):M211–215.

225 Balanowski K and Flynn L (2005). Effect of painful keratoses debridement on foot pain, balance and function in older adults. *Gait & Posture* 22(4):302–307.

226 Menz H and Hill K (2007). Podiatric involvement in multidisciplinary fall-prevention clinics in Australia. *Journal of the American Podiatric Medical Association* 97(5):377–384.

227 Munro B and Steele J (1998). Foot-care awareness — a survey of persons aged 65 years and older. *Journal of the American Podiatric Medical Association* 88(5):242–248.

228 Menz H and Sherrington C (2000). The footwear assessment form: a reliable clinical tool to assess footwear characteristics of relevance to postural stability in older adults. *Clinical Rehabilitation* 14(6):657.

229 Richardson J and Ashton-Miller J (1996). Peripheral neuropathy: an often-overlooked cause of falls in the elderly. *Postgraduate Medicine* 99(6):161–172.

230 Menz H (2008). *Foot Problems in Older People: Assessment and Management*, Churchill Livingstone / Elsevier, London.

231 Menz H (2009). Assessment of the older person. In: *Merriman's Assessment of the Lower Limb*, 3rd edition, Yates B (ed), Churchill Livingstone / Elsevier, London, 443–468.

232 Kobayashi R, Hosoda M, Minematsu A, Sasaki H, Maejima H, Tanaka S, Kanemura N, Matsuo A, Shirahama K, Ueda T, Kamoda C and Yoshimura O (1999). Effects of toe grasp training for the aged on spontaneous postural sway. *Journal of Physical Therapy Science* 11(1):31–34.

233 Richardson J, Thies S, DeMott T and Ashton-Miller J (2004). Interventions improve gait regularity in patients with peripheral neuropathy while walking on an irregular surface under low light. *Journal of the American Geriatrics Society* 52(4):510–515.

234 Maki B, Perry S, Norrie R and McIlroy W (1999). Effect of facilitation of sensation from plantar foot-surface boundaries on postural stabilization in young and older adults. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 54(6):M281–287.

235 Tan M and Parry S (2008). Vasovagal syncope in the older patient. *Journal of the American College of Cardiology* 51(6):599–606.

236 Brignole M, Alboni P, Benditt D, Bergfeldt L, Blanc J, Thomsen P and Task Force on Syncope — European Society of Cardiology (2004). Guidelines on management (diagnosis and treatment) of syncope (update 2004). *European Heart Journal* 25(22):2054–2072.

237 Tan M and Parry S (2008). Vasovagal syncope in the other patient. *Journal of the American College of Cardiology* 51(6):599-606.

238 Chen-Scarabelli C and Scarabelli T (2004). Neurocardiogenic syncope. *British Medical Journal* 329(7461):336–341.

239 Davies A, Steen N and Kenny R (2001). Carotid sinus hypersensitivity is common in older patients presenting to an accident and emergency department with unexplained falls. *Age and Ageing* 30(4):289–293.

240 Kenny R (2002). Neurally mediated syncope. *Clinics in Geriatric Medicine* 18(2):191–210, vi.

241 Richardson DA, Bexton RS, Shaw FE and Kenny RA (1997). Prevalence of cardioinhibitory carotid sinus hypersensitivity in patients 50 years or over presenting to the accident and emergency department with 'unexplained' or 'recurrent' falls. *Pacing and clinical electrophysiology* 20(3 pt 2):820–823.

242 Gupta V and Lipsitz L (2007). Orthostatic hypotension in the elderly: diagnosis and treatment. *American Journal of Medicine* 120(10):841–847.

243 Maule S, Papotti C, Nason DMC, Testa E and Veglio F (2007). Orthostatic hypotension: evaluation and treatment. *Cardiovascular and Hematological Disorders Drug Targets* 7(1):63–70.

244 Sloane P, Coeytaux R, Beck R and Dallara J (2001). Dizziness: state of the science. *Annals of Internal Medicine* 134(9):823–832.

245 Colledge N, Barr Hamilton R, Lewis S, Sellar R and Wilson J (1996). Evaluation of investigations to diagnose the cause of dizziness in elderly people: a community-based controlled study. *British Medical Journal* 313(7075):788–792.

246 Jayrajan V and Rajenderkumar D (2003). A survey of dizziness management in general practice. *Journal of Laryngology & Otology* 117(8):599–604.

247 Tinetti M, Williams C and Gill T (2000). Dizziness among older adults: a possible geriatric syndrome. *Annals of Internal Medicine* 132(5):337–344.

248 Lord S and Dayhew J (2001). Visual risk factors for falls in older people. *Journal of the American Geriatrics Society* 49(5):508–515.

249 Baloh R, Jacobson K and Socotch T (1993). The effect of ageing on visual-vestibulo-ocular responses. *Experimental Brain Research* 95:509–516.

250 Kristinsdottir E, Nordell E, Jarnlo G, Tjader R, Thorngren K and Magnusson M (2001). Observation of vestibular asymmetry in a majority of patients over 50 years with fall related wrist fractures. *Acta Otolaryngology* 121(4):481–485.

251 Oghalai J, Manolidis S, Barth J, Stewart M and Jenkins H (2000). Unrecognised benign paroxysmal positional vertigo in elderly patients. *Otolaryngology Head and Neck Surgery* 122(5):630–634.

252 Waterston J (2000). Neurology. 3: Dizziness. *Medical Journal of Australia* 172(10):506–511.

253 Hamalgyi G and Curthoys I (1988). A clinical sign of canal paresis. *Archives of Neurology* 45(7):737–739.

254 Schubert M, Tusa R, Grine L and Herdman S (2004). Optimizing the sensitivity of the head thrust test for identifying vestibular hypofunction. *Physical Therapy* 84(2):151–158.

255 Maarsingh O, Dros J, van Weert H, Schellevis F, Bindels P and van der Horst H (2009). Development of a diagnostic protocol for dizziness in elderly patients in general practice: a Delphi procedure. *BMC Family Practice* 10:12.

256 Gordon C, Levite R, Joffe V and Gadoth N (2004). Is posttraumatic benign paroxysmal positional vertigo different from the idiopathic form? *Archives of Neurology* 61(10):1590–1593.

257 Fife T, Tusa R, Furman J, Zee D, Frohman E, Baloh R, Hain T, Goebel J, Demer J and Eviatar L (2000). Assessment: vestibular testing techniques in adults and children: report of the Neurology Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology* 55(10):1431–1441.

258 Strupp M, Zingler V, Arbusow V, Niklas D, Maag K, Dieterich M, Bense S, Theil D, Jahn K and Brandt T (2004). Methylprednisolone, valacyclovir, or the combination for vestibular neuritis. *New England Journal of Medicine* 351(4):354–361.

259 Lalwani A (2004). The aging inner ear. In: *Current Diagnosis and Treatment in Otolaryngology – Head and Neck Surgery*, Lalwani A (ed), McGraw Hill Professional, 735–742.

260 Brandt T and Daroff R (1980). Physical therapy for benign paroxysmal positional vertigo. *Archives of Otolaryngology* 106:484–485.

261 Epley J (1992). The canalith repositioning procedure for treatment of benign paroxysmal positional vertigo. *Otolaryngology Head and Neck Surgery* 107(3):399–404.

262 Woodworth B, Gillespie M, Boyd M and Lambert P (2004). The canalith repositioning procedure for benign positional vertigo: a meta-analysis. *Laryngoscope* 114(7):1143–1146.

263 Lea P, Kushnir M, Shpirer Y, Zomer Y and Flechter S (2005). Approach to benign paroxysmal positional vertigo in old age. *Israeli Medical Association Journal* 7(7):447–450.

264 Whitney S and Rossi M (2000). Efficacy of vestibular rehabilitation. *Otolaryngology Clinics of North America* 33(3):659–673.

265 Cohen H (1992). Vestibular rehabilitation reduces functional disability. *Otolaryngology Head and Neck Surgery* 107(5):638–643.

266 Swan L (2003). Facilitating psychological intervention for a patient with unilateral vestibular hypofunction. *Neurology Report* 27:54–60.

267 Hillier S and Hollahan V (2007). Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. *Cochrane Database of Systematic Reviews* (4) Art. No.: CD005397. DOI: 10.1002/14651858.CD005397.pub2.

268 Bamiou D, Davies R, McKee M and Luxon L (2000). Symptoms, disability and handicap in unilateral peripheral vestibular disorders. *Scandinavian Audiology* 29:238–244.

269 Whitney S, Wrisley D, Marchetti G and Furman J (2002). The effect of age on vestibular rehabilitation outcomes. *Laryngoscope* 112(10):1785–1790.

270 Hall C, Schubert M and Herdman S (2004). Prediction of falls risk reduction as measured by dynamic gait index in individuals with unilateral vestibular hypofunction. *Otology Neurotology* 25(5):746–751.

271 Macias J, Massingdale S and Gerkin R (2005). Efficacy of vestibular rehabilitation therapy in reducing falls. *Otolaryngology Head and Neck Surgery* 133(3):323–325.

272 Hansson E, Mansson N, Ringsberg K and Hakansson A (2008). Falls among dizzy patients in primary healthcare: an intervention study with control group. *International Journal of Rehabilitation Research* 31(1):51–57.

273 Whitney S (2000). Management of the elderly person with vestibular dysfunction. In: *Vestibular Rehabilitation*, Herdman S (ed), FA Davis Company, Philadelphia, 510–533.

274 Angeli S, Hawley R and Gomez O (2003). Systematic approach to benign paroxysmal positional vertigo in the elderly. *Otolaryngology Head and Neck Surgery* 128:719–725.

275 Herdman S (ed) (2007). *Vestibular Rehabilitation*, *Contemporary Perspectives in Rehabilitation*, FA Davis Company, Philadelphia.

276 Cumming R, Miller J, Kelsey J, Davis P, Arfken C, Birge S and Peck W (1991). Medications and multiple falls in elderly people: the St Louis OASIS study. *Age and Ageing* 20(6):455–461.

277 Leipzig R, Cumming R and Tinetti M (1999). Drugs and falls in older people: a systematic review and meta-analysis I: psychotropic drugs. *Journal of the American Geriatrics Society* 47(1):30–39.

278 Hartikainen SL, E and Louhivuori K (2007). Medication as a risk factor for falls: critical systematic review. *Journal of Gerontology* 62A(10):1172–1181.

279 Lawlor D, Patel R and Ebrahim S (2003). Association between falls in elderly women and chronic diseases and drug use: cross sectional study. *British Medical Journal* 327(7417):712–717.

280 Iyer S, Naganathan V, McLachlan AJ and Le Couteur DG (2008). Medication withdrawal trials in people aged 65 years and older: a systematic review. *Drugs and Aging* 25(12):1021–1031.

281 Leipzig R, Cumming R and Tinetti M (1999). Drugs and falls in older people: a systematic review and meta-analysis II: cardiac and analgesic drugs. *Journal of the American Geriatrics Society* 47(1):40–50.

282 NICE (National Institute for Clinical Excellence) (2004). *Clinical Practice Guideline for the Assessment and Prevention of Falls in Older People*, NICE, London, UK.

283 APAC (Australian Pharmaceutical Advisory Council) (2002). *Guidelines for Medication Management in Residential Aged Care Facilities*, Australian Government Department of Health and Ageing, Canberra.

284 Lord S, Dayhew J and Howland A (2002). Multifocal glasses impair edge-contrast sensitivity and depth perception and increase the risk of falls in older people. *Journal of the American Geriatrics Society* 50(11):1760.

285 Wang J, Foran S and Mitchell P (2000). Age-specific prevalence and causes of bilateral and unilateral visual impairment in older Australians: the Blue Mountains Eye Study. *Clinical and Experimental Ophthalmology* 28(4):268–273.

286 Attebo K, Mitchell P and Smith W (1996). Visual acuity and the causes of visual loss in Australia: the Blue Mountains Eye Study. *Ophthalmology* 103(3):357–364.

287 Jack C, Smith T, Neoh C and Lye M (1995). Prevalence of low vision in elderly patients admitted to an acute geriatric unit in Liverpool: elderly people who fall are more likely to have low vision. *Gerontology* 41(5):280–285.

288 Klein R, Klein B and Lee K (1996). Changes in visual acuity in a population: the Beaver Dam Eye Study. *Ophthalmology* 103(8):1169–1178.

289 Liou H, McCarty C, Jin C and Taylor H (1999). Prevalence and predictors of undercorrected refractive errors in the Victorian population. *American Journal of Ophthalmology* 127(5):590–596.

290 Tielsch J, Sommer A, Witt K, Katz J and Royall R (1990). Blindness and visual impairment in an American urban population: the Baltimore Eye Survey. *Archives of Ophthalmology* 108(2):286–290.

291 Choy N and Brauer S (2003). Changes in postural stability in women aged 20 to 80 years. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 58(6):525–530.

292 Klein B, Klein R, Lee K and Cruickshanks K (1998). Performance-based and self-assessed measures of visual function as related to history of falls, hip fractures, and measured gait time. The Beaver Dam Eye Study. *Ophthalmology* 105(1):160–164.

293 Dargent-Molina P, Favier F, Grandjean H, Baudoin C, Schott A, Hausherr E, Meunier P and Bréart G (1996). Falls-related factors and risk of hip fracture: the EPIDOS prospective study. *Lancet* 348(9021):145–149.

294 de Boer M, Pluijm S, Lips P, Moll A, Volker-Dieben H, Deeg D and Van Rens G (2004). Different aspects of visual impairment as risk factors for falls and fractures in older men and women. *Journal of Bone and Mineral Research* 19(9):1539–1547.

295 Nevitt M, Cummings S, Kidd S and Black D (1989). Risk factors for recurrent non-syncopal falls: a prospective study. *Journal of the American Medical Association* 261(18):2663–2668.

296 Coleman A, Cummings S and Yu F (2007). Binocular visual-field loss increases the risk of future falls in older white women. *Journal of the American Geriatrics Society* 55(3):357–364.

297 Freeman E (2007). Visual field loss increases the risk of falls in older adults: the Salisbury Eye Evaluation. *Investigative Ophthalmology and Visual Science* 48(10):4445–4450.

298 Klein B, Moss S, Klein R, Lee K and Cruickshanks K (2003). Associations of visual function with physical outcomes and limitations 5 years later in an older population: the Beaver Dam Eye Study. *Ophthalmology* 110(4):644.

299 Ramrattan R, Wolfs R, Panda-Jonas S, Jonas J, Bakker D, Pols H, Hofman A and de Jong P (2001). Prevalence and causes of visual field loss in the elderly and associations with impairment in daily functioning: the Rotterdam Study. *Archives of Ophthalmology* 119(12):1788–1794.

300 Schwartz S and Segal O (2005). The effect of cataract surgery on postural control. *Investigative Ophthalmology and Visual Science* 46(3):920–924.

301 Ivers R, Cumming R, Mitchell P, Simpson J and Peduto A (2003). Visual risk factors for hip fracture in older people. *Journal of the American Geriatrics Society* 51(3):356–363.

302 Black A and Wood J (2008). Visual impairment and postural sway among older adults with glaucoma. *Ophthalmology and Visual Science* 85(6):489–497.

303 Dolinis J, Harrison J and Andrews G (1997). Factors associated with falling in older Adelaide residents. *Australian and New Zealand Journal of Public Health* 21(5):462–468.

304 Wood J, Lacherez P, Black A, Cole M, Boon M and Kerr G (2009). Postural stability and gait among older adults with age-related maculopathy. *Investigative Ophthalmology and Visual Science* 50(1):482–487.

305 Szabo S, Janssen P, Khan K, Potter M and Lord S (2008). Older women with age-related macular degeneration have an increased risk of falls: a Physiological Profile Assessment (PPA) study. *Journal of the American Geriatrics Society* 56(5):800–807.

306 Eperjesi F, Wolffsohn J, Bowden J, Napper G and Rubinstein M (2004). Normative contrast sensitivity values for the backlit Melbourne Edge Test and the effect of visual impairment. *Ophthalmic and Physiological Optics* 24(6):600–606.

307 Anderson A, Shuey N and Wall M (2009). Rapid confrontation screening for peripheral visual field defects and extinction. *Clinical and Experimental Optometry* 92(1):45–48.

308 Johnson L, Buckley J, Scally A and Elliot D (2007). Multifocal spectacles increase variability in toe clearance and risk of tripping in the elderly. *Investigative Ophthalmology and Visual Science* 48(4):1466–1471.

309 Johnson L, Elliot D and Buckley J (2009). Effects of gaze strategy on standing postural stability in older multifocal wearers. *Clinical and Experimental Optometry* 92(1):19–26.

310 Wildsoet C, Wood J and Hassan S (1998). Development and validation of a visual acuity chart for Australian Aborigines and Torres Strait Islanders. *Optometry and Vision Science* 75(11):806–812.

311 Sach T, Foss A, Gregson R, Zaman A, Osborn F, Masud T and Harwood R (2007). Falls and health status in elderly women following first eye cataract surgery: an economic evaluation conducted alongside a randomised controlled trial. *British Journal of Ophthalmology* 91(12):1675–1679.

312 Cumming R, Thomas M, Szonyi G, Frampton G, Salkeld G and Clemson L (2001). Adherence to occupational therapist recommendations for home modifications for falls prevention. *American Journal of Occupational Therapy* 55(6):641–648.

313 Tse T (2005). The environment and falls prevention: do environmental modifications make a difference? *Australian Occupational Therapy Journal* 52(4):271–281.

314 Pedretti L and Zolan B (1996). *Occupational Therapy Practice Skills for Physical Dysfunction*, Mosby, Missouri.

315 Peterson L and Clemson L (2008). Understanding the role of occupational therapy in fall prevention for community dwelling older adults. *OT Practice* 13(3):CE1–8.

316 Clemson L, Fitzgerald M and Heard R (1999). Content validity of an assessment tool to identify home fall hazards: the Westmead Home Safety Assessment. *British Journal of Occupational Therapy* 62(4):171–179.

317 Clemson L, Bundy A, Cumming R, Kay G and Luckett T (2008). Validating the falls behavioural (FaB) scale for older people: a Rasch analysis. *Disability and Rehabilitation* 30(7):498–506.

318 Tideiksaar R (2002). *Falls In Older People*, Health Professions Press Incorporated.

319 Mackenzie L, Byles J and Higganbotham N (2000). Designing the Home Falls and Accidents Screening Tool (HOME FAST): selecting the items. *British Journal of Occupational Therapy* 63(6):261–269.

320 Mahoney J, Sager M, Dunham N and Johnson J (1994). Risk of falls after hospital discharge. *Journal of the American Geriatrics Society* 42(3):269–274.

321 Salkeld G, Cumming R, O'Neill E, Thomas M, Szonyi G and Westbury C (2000). The cost effectiveness of a home hazard reduction program to reduce falls among older persons. *Australian and New Zealand Journal of Public Health* 24:265–271.

322 Smith R and Widiatmoko D (1998). The cost-effectiveness of home assessment and modification to reduce falls in the elderly. *Australian and New Zealand Journal of Public Health* 22:436–440.

323 Bradley C and Pointer S (2009). *Hospitalisations Due to Falls by Older People, 2005-06*, Australian Institute of Health and Welfare, Canberra.

324 Haines T, Bennell K, Osborne R and Hill K (2004). Effectiveness of targeted falls prevention programme in subacute hospital setting: randomised controlled trial. *British Medical Journal* 328(7441):676–679.

325 Boswell D, Ramsey J, Smith M and Wagers B (2001). The cost-effectiveness of a patient-sitter program in an acute care hospital: a test of the impact of sitters on the incidence of falls and patient satisfaction. *Quality Management in Health Care* 10(1):10–16.

326 Donoghue J, Graham J, Mitten-Lewis S, Murphy M and Gibbs J (2005). A volunteer companion-observer intervention reduces falls on an acute aged care ward. *International Journal of Health Care Quality Assurance Including Leadership in Health Services* 18(1):24–31.

327 Giles L, Bolch D, Rouvray R, McErlean B, Whitehead C, Phillips P and Crotty M (2006). Can volunteer companions prevent falls among inpatients? A feasibility study using a pre-post comparative design. *BMC Geriatrics* 6:11.

328 Fleming J and Brayne C (2008). Inability to get up after falling, subsequent time on floor, and summoning help: prospective cohort study in people over 90. *British Medical Journal* 337:A2227.

329 Shojania K, Duncan B and McDonald J (2001). *Making Health Care Safer: A Critical Analysis of Patient Safety Practices*, Agency for Healthcare Research and Quality, Rockville, Maryland.

330 Meyer G, Warnke A, Bender R and Muhlhauser I (2003). Effect on hip fractures of increased use of hip protectors in nursing homes: cluster randomised controlled trial. *British Medical Journal* 326(7380):76.

331 Parker M, Gillespie L and Gillespie W (2005). Hip protectors for preventing hip fractures in older people. *Cochrane Database of Systematic Reviews* (3) Art. No.: CD001255. DOI: 10.1002/14651858.CD001255.pub3.

332 Norton R, Campbell A, Lee-Joe T, Robinson E and Butler M (1997). Circumstances of falls resulting in hip fractures among older people. *Journal of the American Geriatrics Society* 45(9):1108–1112.

333 Cameron I (2004). Hip protectors: how the evidence says they should be used. Australian Falls Prevention Inaugural Conference, Manly, New South Wales.

334 Kannus P, Parkkari J and Poutala J (1999). Comparison of force attenuation properties of four different hip protectors under simulated falling conditions in the elderly: an in vitro biomechanical study. *Bone* 25(2):229–235.

335 Robinovitch S, Hayes W and McMahon T (1995). Energy-shunting hip padding system attenuates femoral impact force in a simulated fall. *Journal of Biomechanical Engineering* 117(4):409–413.

336 Cameron I, Cumming R, Kurrle S, Quine S, Lockwood K, Salkeld G and Finnegan T (2003). A randomised trial of hip protector use by frail older women living in their own homes. *Injury Prevention* 9(2):138–141.

337 Cameron I and Quine S (1994). Likely non compliance with external hip protectors: findings from focus groups. *Archives of Gerontology and Geriatrics* 19:273–281.

338 Cryer C, Knox A, Martin D and Barlow J (2002). Hip protector compliance among older people living in residential care homes. *Injury Prevention* 8(3):202–206.

339 Parkkari J, Heikkila J and Kannus I (1998). Acceptability and compliance with wearing energy-shunting hip protectors: a 6-month prospective follow-up in a Finnish nursing home. *Age and Ageing* 27(2):225–229.

340 Villar M, Hill P, Nskip H, Thompson P and Cooper C (1998). Will elderly rest home residents wear hip protectors? *Age and Ageing* 27:195–198.

341 Lachman M, Howland J, Tennstedt S, Jette A, Assmann S and Peterson E (1998). Fear of falling and activity restriction: the survey of activities and fear of falling in the elderly (SAFE). *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 53(1):P43–50.

342 Campbell A (2001). Purity, pragmatism and hip protector pads. *Age and Ageing* 30(6):431–432.

343 Lauritzen J, Petersen M and Lund B (1993). Effect of external hip protectors on hip fractures. *Lancet* 341(8836):11–13.

344 Cameron I, Kurrle S, Quine S, Lockwood K and Cumming R (2002). Hip protectors: promising but no panacea. *Australasian Journal on Ageing* 21:4–8.

345 Jensen J, Lundin-Olsson L, Nyberg L and Gustafson Y (2002). Fall and injury prevention in older people living in residential care facilities. A cluster randomized trial. *Annals of Internal Medicine* 136(10):733–741.

346 Queensland Health (2003). *Falls Prevention. Best Practice Guidelines for Public Hospitals and State Government Residential Aged Care Facilities Incorporating a Community Integration Supplement*, Queensland Health, Brisbane.

347 Kurrle S, Camerson I, Quine S and Cumming R (2004). Adherence with hip protectors: a proposal for standardised definitions. *Osteoporosis International* 15:1–4.

348 Horikawa E, Matsui T, Arai H, Seki T, Iwasaki K and Sasaki H (2005). Risk of falls in Alzheimer's disease: a prospective study. *Internal Medicine* 44(7):717–721.

349 Honkanen L, Mushlin A, Lachs M and Schackman B (2006). Can hip protector use cost-effectively prevent fractures in community-dwelling geriatric populations? *Journal of the American Geriatrics Society* 54(11):1658–1665.

350 Fleurence R (2004). Cost-effectiveness of fracture prevention treatments in the elderly. *International Journal of Technology Assessment in Health Care* 20(2):184–191.

351 Segui-Gomez M, Keuffel E and Frick K (2002). Cost and effectiveness of hip protectors among the elderly. *International Journal of Technology Assessment in Health Care* 18(1):55–66.

352 Kumar B and Parker J (2000). Are hip protectors cost effective? *Injury* 31:693–695.

353 Nowson C, Diamond T, Pasco J, Mason R, Sambrook P and Eisman J (2004). Vitamin D in Australia: issues and recommendations. *Australian Family Physician* 33(3):133–138.

354 Boland R (1986). Role of vitamin D in skeletal muscle function. *Endocrine Reviews* 7(4):434–448.

355 Dukas L, Bischoff H, Lindpaintner L, Schacht E, Birkner-Binder D and Damm T (2004). Alfacalcidol reduces the number of fallers in a community dwelling elderly population with a minimum calcium intake of more than 500 mg daily. *Journal of the American Geriatrics Society* 52(2):230–236.

356 Zeimer H, Hunter P and Agius S (2000). Association between vitamin D deficiency and dementia, residential care and non english speaking background. Australian Society for Geriatric Medicine Conference, Cairns, Queensland.

357 NHMRC (National Health and Medical Research Council) (1991). *Recommended dietary intakes for use in Australia*, NHMRC, Canberra.

358 HHS (US Department of Health and Human Services) (1994). *Consensus Development Conference Statement: Optimal Calcium Intake*, National Institute of Health, 12:1–31.

359 Pasco J, Henry M, Kotowicz M, Sanders K, Seeman E and Pasco J (2004). Seasonal periodicity of serum vitamin D and parathyroid hormone, bone resorption, and fractures: the Geelong Osteoporosis Study. *Journal of Bone and Mineral Research* 19(5):752–758.

360 Holick M (2003). Vitamin D: a millennium perspective. *Journal of Cellular Biochemistry* 88(2):296–307.

361 Gillespie W, Avenall A, Henry D, O'Connell D and Robertson J (2004). Vitamin D and vitamin D analogues for preventing fractures associated with involutional and post menopausal osteoporosis. *Cochrane Database of Systematic Reviews* (1) Art. No.: CD000227. DOI: 10.1002/14651858.CD000227.pub2.

362 Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia and Osteoporosis Australia (2005). Vitamin D and adult bone health in Australia and New Zealand: a position statement. *Medical Journal of Australia* 182(6):281–285.

363 Graham K (1998). *Ask me about nutrition—resource for general practice*, Darling Downs Public Health Unit, Toowoomba.

364 Cranney A, Guyatt GG, L, Wells G, Tugwell P and Rosen C (2002). Meta-analyses of therapies for postmenopausal osteoporosis. IX: Summary of meta-analyses of therapies for postmenopausal osteoporosis. *Endocrine Reviews* 23(5):570–578.

365 Nevitt M, Cummings S and Hudes E (1991). Risk factors for injurious falls: a prospective study. *Journal of Gerontology* 46(5):M164–170.

366 Nguyen T, Sambrook P, Kelly P, Jones G, Lord S, Freund J and Eisman J (1993). Prediction of osteoporotic fractures by postural instability and bone density. *British Medical Journal* 307(6912):1111–1115.

367 Ensrud K, Black D, Palermo L, Bauer D, Barrett-Connor E, Quandt S, Thompson D and Karpf D (1997). Treatment with alendronate prevents fractures in women at highest risk: results from the Fracture Intervention Trial. *Archives of Internal Medicine* 157(22):2617–2624.

368 Osteoporosis Australia. *Treatment for Osteoporosis*. http://www.osteoporosis.org.au/health_clinical.php (Accessed July 2007)

369 Klotzbuecher C, Ross P, Landsman P, Abbott T and Berger M (2000). Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis. *Journal of Bone and Mineral Research* 14(5):721–739.

370 Kamel H, Hussain M, Tariq S, Perry H and Morley J (2000). Failure to diagnose and treat osteoporosis in elderly patients hospitalized with hip fracture. *American Journal of Medicine* 109(4):326–328.

371 Zochling J, Schwarz J, March L and Sambrook P (2001). Is osteoporosis undertreated after minimal trauma fracture? *Medical Journal of Australia* 174(12):663–664.

372 Wells G, Cranney A, Peterson J, Boucher M, Shea B, Welch V, Coyle D and Tugwell P (2008). Risedronate for the primary and secondary prevention of osteoporotic fractures in postmenopausal women. *Cochrane Database of Systematic Reviews* (4) Art. No.: CD004523. DOI: 10.1002/14651858.CD004523.pub3.

373 Stevenson M, Jones M, De Nigris E, Brewer N, Davis S and Oakley J (2005). A systematic review and economic evaluation of alendronate, etidronate, risedronate, raloxifene and teriparatide for the prevention and treatment of postmenopausal osteoporosis. *Health Technology Assessment* 9(22):1–160.

374 Meunier P, Roux C, Seeman E, Ortolani S, Badurski J, Spector T, Cannata J, Balogh A, Lemmel E, Pors-Nielsen S, Rizzoli R, Genant H and Reginster J (2004). The effects of strontium ranelate on the risk of vertebral fracture in women with postmenopausal osteoporosis. *New England Journal of Medicine* 350(5):504–506.

375 Sambrook P, Ebeling P, Phillips S and Seeman E (2002). Preventing osteoporosis: outcomes of the Australian Fracture Prevention Summit. *Medical Journal of Australia* 176(S8):1–16.

376 Sambrook P, Olver I and Goss A (2006). Bisphosphonates and osteonecrosis of the jaw. *Australian Family Physician* 35(10):801–803.

377 O'Neill S, MacLennan A, Bass S, Diamond T, Ebeling P, Findlay D, Flicker L, Markwell A, Nowson C, Pocock N, Sambrook P and Singh M (2004). Guidelines for the management of post-menopausal osteoporosis for GPs. *Australian Family Physician* 33(11):910–919.

378 Khapra A and Rose S (2006). Drug injury in the upper gastrointestinal tract: effects of alendronate. *Gastrointestinal Endoscopy Clinics of North America* 16(1):99–110.

379 Barrett-Connor E, Mosca L, Collins P, Geiger MJ, Grady D, Kornitzer M, McNabb MA and Wenger NK (2006). Effects of raloxifene on cardiovascular events and breast cancer in postmenopausal women. *New England Journal of Medicine* 355(2):125–137.

380 Ashe M, Khan K and Guy P (2004). Wristwatch-distal radial fracture as a marker for osteoporosis investigation: a controlled trial of patient education and a physician alerting system. *Journal of Hand Therapy* 17:324–328.

381 Brown J and Josse R (2002). 2002 Clinical practice guidelines for the diagnosis and management of osteoporosis in Canada. *Canadian Medical Association Journal* 167:S1–34.

382 CERA (Centre for Education and Research on Ageing) (1998). *Putting your best foot forward. Preventing and managing falls in aged care facilities*, Australian Government, Canberra.

383 New South Wales Health (2005). *Fall Injury Among Older People — Management Policy to Reduce in NSW Health*, New South Wales Health, Sydney.

384 Mackintosh S, Hill K, Dodd K, Goldie P and Culham E (2005). Falls and injury prevention should be part of every stroke rehabilitation plan. *Clinical Rehabilitation* 19(4):441–451.

385 NCPS (National Center for Patient Safety) (2004). *National Centre for Patient Safety Falls Toolkit*, US Department of Veteran Affairs.

386 ASGM (Australian Society for Geriatric Medicine) (2004). The Kimberley Indigenous Cognitive Assessment (KICA): results of reliability and validity in an Indigenous population. Australian Society for Geriatric Medicine Conference, Fremantle, Western Australia.

387 Scheffer AC, Schuurmans MJ, van Dijk N, van der Hooft T and de Rooij SE (2008). Fear of falling: measurement strategy, prevalence, risk factors and consequences among older persons. *Age and Ageing* 37(1):19–24.

388 Zijstra G, van Haastregt J, van Rossum E, van Eijk J, Yardley L and Kempen G (2007). Interventions to reduce fear of falling in community-living older people: a systematic review. *Journal of the American Geriatrics Society* 55(4):603–615.

389 Jung D, Lee J and Lee S (2009). A meta-analysis of fear of falling treatment programs for the elderly. *Western Journal of Nursing Research* 31(1):6–16.

390 Hill K, Moore K, Dorevitch M and Day L (2008). Effectiveness of falls clinics: an evaluation of outcomes and client adherence to recommended interventions. *Journal of the American Geriatrics Society* 56(4):600–608.