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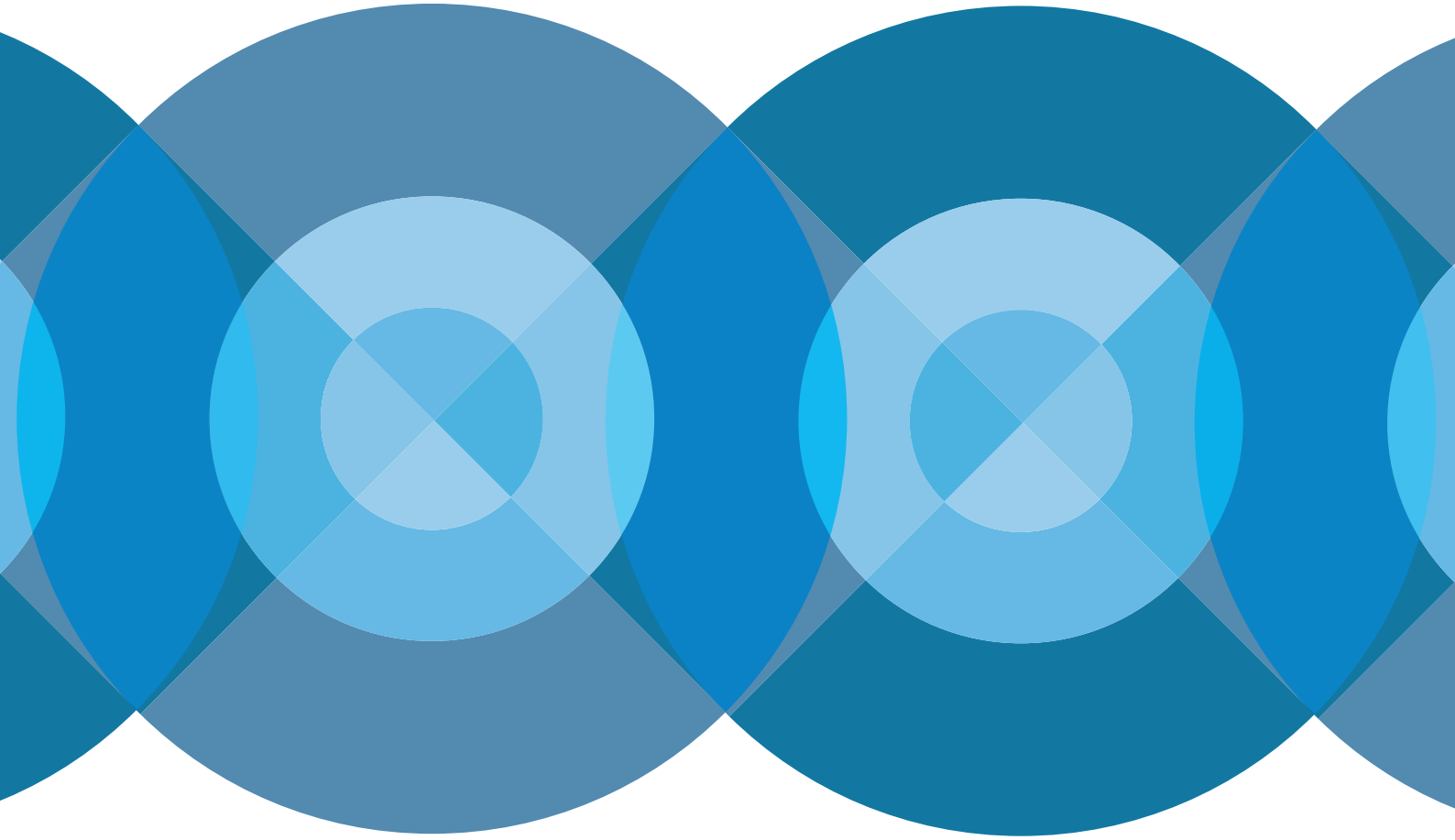

Preventing Falls and Harm from Falls in Older People

Best Practice Guidelines for Community Care in Australia

Reference Document

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Executive summary

Minimising falls, harm from falls and maximising mobility to prevent functional decline remain a key challenge for older people in the community. The incidence of falls in Australia is increasing and is expected to increase further as the population ages.

The human cost of falls for the older person, their carers and family may include extended hospitalisation, rehabilitation, increased care needs, fear of falling, potential entry into residential aged care service and death. By preventing falls, we can eliminate avoidable suffering, negative health outcomes and health system costs.[1]

Fortunately, many falls can be prevented with the systematic implementation of tailored falls and harm from falls prevention interventions.

Purpose and background

The *Preventing Falls and Harm from Falls in Older People: Best Practice Guidelines for Community Care in Australia* (the Falls Guidelines) provides best practice advice and supporting resources on preventing falls and harm from falls for health professionals, primary and community care providers and the aged care workforce delivering care to older people (relative to their scope of practice or role) in community settings in Australia.

The Falls Guidelines are made up of a suite of documents:

- *Reference Document* (this document): presents the international evidence on best practice, which informs the Falls Guidelines recommendations and good practice points.
- *Falls Guidelines:* a summary guide including the recommendations and good practice points designed for routine use in the community care setting.
- *Fact sheets:* an overview of the Falls Guidelines and the recommendations.

The Falls Guidelines have been developed by the Australian Commission on Safety and Quality in Health Care and offer a nationally consistent approach to preventing falls based on best practice recommendations.

The guidelines build on the previous Falls Guidelines published in 2005 and 2009, and include a review of international best practice, policies and procedures by experts from across Australia. Where evidence to support best practice falls management for older people living in the community does not exist, equivalent evidence for older people living in residential aged care services or hospitals has been used.

The guidelines seek to guide all aspects of care of older people in the community relevant to falls and fall injury prevention. This includes fall risk assessment, balance and mobility, cognitive impairment, medicines, continence, feet and footwear, syncope, dizziness and vertigo, vision, hearing, environment, monitoring and observation, restrictive practices, hip protectors, Vitamin D and calcium, osteoporosis, and post-fall management.

Separate Falls Guidelines have also been developed for residential aged care services and hospital settings.

Recommendations and Good Practice Points

The recommendations and good practice points listed in Chapter 2 are designed to guide health professionals in providing the best possible care to older people living in the community and prevent falls and harm from falls.

Recommendations are based on evidence from intervention trials in community care settings with falls and/or falls injuries outcomes. The associated level of evidence (see Appendix) is aligned to the modified GRADE approach used by the 2022 World Falls Guideline:[2]

- 1 indicates a strong recommendation
- 2 indicates a weak or conditional recommendation
- A-C indicates high, intermediate and low-quality evidence, respectively.

Good practice points should also be considered as they guide all aspects of care of older people in the community relevant to falls and fall injury prevention and are based on research and expert opinion on best practice.

Key messages of the Falls Guidelines

Fall prevention is everyone's responsibility

A fall is defined as:

> **'An event which results in a person coming to rest inadvertently on the ground or floor or other lower level.' World Health Organization.**[3]

Many falls can be prevented. Health professionals, primary and community care providers and the aged care workforce have a key role to play in preventing falls (relative to their scope of practice or role). Fall and injury prevention need to be addressed from a tailored, multidisciplinary perspective as well as through community-wide prevention strategies.

The Royal Commission into Aged Care Quality and Safety identified that improvements are required in the care of older people in Australia, including fall prevention.

Falls are a significant cause of harm to older people living in the community

The incidence of falls in Australia is increasing and is expected to increase further as the population ages. Falls are a common reason for older people to present to the emergency department and commencing residential care. Falls also occur after discharge from hospital.

Falls in the community can be prevented by implementing single interventions that target specific risk factors. For example, reducing medicines that increase fall risk, podiatry for foot pain and surgery for cataracts.

Fall prevention is effective when tailored

Effective fall prevention involves tailored interventions based on the older person's individual risk factors. Managing many of the risk factors for falls has wider health benefits for the older person beyond fall prevention.

Older people have the right to make decisions that affect their lives. Respecting these decisions is an important part of this right, even if there is some risk to themselves – this is called dignity of risk. To support dignity of risk, partner with the older person to:

- identify their goals of care
- share the decision making on fall prevention interventions
- maintain their independence and quality of life
- involve carers and family to the extent the older person chooses.

Provide education to older people, their carers and family about the older person's fall risk and any tailored fall prevention interventions.

Skill mix and education support good clinical care

A trained and skilled workforce supports good clinical care in the prevention of falls and harm from falls. Multidisciplinary collaboration by a range of skilled health professionals may be required to engage with the older person to address complex needs and optimise their quality of life. Changes to an older person's fall risk should be communicated with the older person, their carers and family and the multidisciplinary team.

Fall prevention interventions should be monitored and reviewed regularly for safety and effectiveness.

Key messages of the Falls Guidelines

Review and report every fall

Whether there is injury, minimal harm or no harm from a fall, all falls:

- must be taken seriously
- require an immediate response
- must be reviewed and reported in line with hospital requirements.

Falls may be the first indication of an underlying condition in an older person that may require assessment.

Determine how and why a fall may have occurred and reassess the older person to identify new fall risk factors. Implement tailored interventions to address risk factors and reduce the risk of another fall.

Results will come

The results of a fall prevention program may not be immediately clear. There may be a time lag between investment in a fall prevention program and measurable improvements in outcome measures related to falls and harm from falls. Outcome measurements may also include the tailored approach used with the older person in fall prevention.

Alignment with other prevention programs (e.g., delirium) may be useful for informing broader quality improvements.

1 Purpose and use of the guidelines

Falls are a significant cause of harm to older people living in the community. Many falls can be prevented. Fall and injury prevention is everyone's responsibility.

Falls as a national safety and quality priority

Minimising falls and harm from falls is part of providing comprehensive care. Planning and delivering comprehensive care is a critical component of national standards for safety and quality, including the National Primary and Community Health Care Standards which apply to services that deliver health care in a primary or community setting.

The Royal Commission into Aged Care Quality and Safety identified fall prevention and maintenance of mobility for older people receiving aged care services as significant priorities as part of a range of recommended reforms to Australia's aged care system.[4]

The *Aged Care Quality Standards* were strengthened in response to the Royal Commission's recommendations and include falls as a key clinical safety topic. All Australian Government-funded aged care providers must meet the requirements detailed in the Aged Care Quality Standards. Aged care providers who are registered to provide clinical care to older people in the community are expected to implement systems and processes that minimise falls and harm from falls and support older people to maximise their mobility to prevent functional decline in line with the Aged Care Quality Standards.

1.1 About the guidelines

The *Preventing Falls and Harm from Falls in Older People – Best Practice Guidelines for Community Care in Australia* aims to improve the safety and quality of care for older people and offer a nationally consistent approach to preventing falls in the community care setting.

The Falls Guidelines are made up of a suite of documents:

- *Reference Document* (this document): presents the international evidence on best practice which informs the Falls Guidelines recommendations and good practice points.
- *Falls Guidelines:* a summary guide including the recommendations and good practice points designed for routine use in the community care setting.
- *Fact sheets:* an overview of the Falls Guidelines and the recommendations.

In developing these guidelines, the Australian Commission on Safety and Quality in Health Care has built on the previous guidelines published in 2005 and 2009, and reviewed international best practice, policy and procedures.[5, 6]

Separate Falls Guidelines have been developed for the hospital and residential aged care settings.

1.2 Scope of the guidelines

1.2.1 Targeting older Australians

Falls can occur at all ages, but the frequency and severity of fall-related injury increase with age.[7] The Falls Guidelines focus on older people aged 65 and over. A broader age group is used for older Aboriginal and Torres Strait Islander people, aged 50 years and over.[8]

People outside these age groups at risk of falling may share the risk factors identified in the Falls Guidelines, such as those with a history of falls, mobility or cognitive disability, or other conditions that alter functional ability. Care should be taken to ensure any fall prevention interventions and strategies are appropriate for the person receiving them.

1 Purpose and use of the guidelines

As part of a life course approach to maximising functional ability with increased age, as recommended by the World Health Organization,[9] community-based fall prevention initiatives, such as exercise and management of individual risk factors, should be encouraged throughout life.

1.2.2 Specific to the Australian community

The Falls Guidelines have been developed for health professionals, primary and community providers and the aged care workforce providing care in community settings (relative to their scope of practice or role). Community settings are older people's homes and places where community care is provided.

Recommendations have been tailored to account for the diversity of community settings in Australia.

1.2.3 Relevant to all members of the multidisciplinary team

All members of the multidisciplinary team – including general practitioners, nurse practitioners, registered nurses, allied health professionals, aged care providers, older people and carers – have an important role to play in preventing falls. This includes care workers, support services as well as clinical, management and corporate staff.

Fall prevention in the community may involve interventions provided by one or more health providers and workers. Health professionals and aged care providers should work collaboratively and partner with the older person and their carers to understand and agree arrangements for care that they will provide (within their scope of practice or role), and care provided by others.

1.2.4 Context of care

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 still 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.

The Falls Guidelines recognise the important role that an older person's carers, family and substitute decision makers can play in fall prevention. Carers may provide comfort, encouragement, reassurance and support to the person that they care for and should be included as partners in facilitating fall prevention.

Terminology

1.2.5 Suitably qualified health professional

The Falls Guidelines are designed to guide health professionals, primary and community care providers and the aged care workforce delivering care to older people (relative to their scope of practice or role) in community settings in Australia. To accommodate the diversity of the workforce providing care to older people in the community, the guidelines use the phrase 'suitably qualified health professional' to recognise that health professionals have different scopes of clinical practice and roles.

1.2.6 Definition of a fall and fall risk

To ensure a nationally consistent approach to fall prevention within Australia, the Falls Guidelines use the World Health Organization's definition of a fall:

> 'A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level.'[10]

A fall resulting in major injury is a fall that meets the definition of a fall and results in one or more of the following:

- bone fractures
- joint dislocations
- closed head injuries with altered consciousness
- subdural haematoma.[11]

The following terms are used in the Falls Guidelines to classify an older person's fall risk:

- Low risk of falls: less than one fall a year
- Increased risk of falls: 1+ falls per year
- High risk of falls: 2+ falls per year.

1.2.7 Definition of assessment and risk assessment

In the Falls Guidelines, *assessment* is defined as an objective evaluation of the older person's functional level based on their ability to perform certain tasks and activities of daily living. This includes dressing, feeding, grooming and mobilising.

Fall risk assessment is a detailed and systematic process used to identify an older person's risk factors of falling. It is used to help identify which fall prevention interventions to implement.

Chapter 6 provides a list of validated fall risk assessment tools for use in the community setting.

1.2.8 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 medicines, surgery, early detection (screening), dietary supplements, education and minimisation of risk factors.

In fall prevention, interventions can be:

- **single interventions:** target specific fall risk factors, such as surgery for cataracts
- **multiple component interventions:** where everyone receives the same, fixed combination of fall prevention interventions, such as tailored ongoing exercise, education and medicines review
- **multifactorial interventions:** a combination of interventions tailored to the older person, based on an individual assessment.

Multifactorial fall and fall harm prevention programs, utilising a range of interventions as detailed in these guidelines, have been shown to be successful in reducing falls in older people living in the community and decreasing the number of people who fall.

1.3 Development of the guidelines

Experts from the Australian and New Zealand Falls Prevention Society oversaw the development of the Falls Guidelines, which involved:

- a search of the most recent literature for each risk factor or intervention
- inclusion of definitive fall risk factor and intervention studies irrespective of their date of publication
- the most recent Cochrane reviews[12-14] of fall prevention interventions in the community setting
- reference to the 2022 World Falls Guidelines for Fall Prevention and Management of Older Adults World Falls Guidelines[2]
- feedback from health professionals and policy staff implementing the 2009 guidelines
- clinical advice from the expert advisory group
- guidance from external expert reviewers
- guidance from international expert reviewers.

A systematic review of each aspect of fall prevention was beyond the capacity and timeframe of this update of the Falls Guidelines. The review of assessment and intervention recommendations was conducted with experts using the highest quality information for each intervention in line with recommended methods for evidence-based practice.

The Falls Guidelines were finalised with feedback from falls and fractures, aged care and policy experts as detailed in Appendix 1. Contributors to the 2009 guidelines are listed in Appendix 2. Further discussion of methodology and additional research are in Appendix 3.

1 Purpose and use of the guidelines

1.3.1 Levels of evidence

Table 1.1 outlines the modified GRADE system used in these guidelines to evaluate the strength of evidence of fall prevention interventions. This system is based on the 2022 World Falls Guidelines for Prevention and Management of Falls in Older Adults. [14]

Table 1.1: The modified GRADE system used in the Falls Guidelines for evaluating the strength of evidence of fall prevention interventions

Recommendations	**Strength of Recommendation**	**1**	**Strong:** benefits clearly outweigh undesirable effects.
		2	**Weak or conditional:** either lower quality evidence or desirable and undesirable effects are more closely balanced.
	Quality of evidence	**A**	**High:** further research is unlikely to change confidence in the estimate of effect.
		B	**Intermediate:** further research is likely to have an important impact on the confidence in the estimate of effect and may change the estimate.
		C	**Low:** further research is very likely to have an important impact on the confidence in the estimate of effect and is likely to change the estimate.
Good practice points	In cases where no quality studies are available for interventions likely to have benefits based on expert opinion, good practice points were formulated.		

1 Purpose and use of the guidelines

1.4 How to use the guidelines

The Falls Guidelines are designed to provide a nationally consistent approach to inform falls and harm from falls prevention programs in community care settings in Australia.

Information on how these guidelines relate to fall and fall injury prevention programs is provided in Table 1.2.

Table 1.2: How to use the Falls Guidelines

	Steps involved	**Chapter/s in Guidelines**
1	Plan and implement a fall and fall injury prevention program, which includes the ongoing evaluation of the effectiveness of that program.	Chapter 2: a summary of recommendations and good practice points Chapters 3-5: an overview of evidence
2	A falls program should start with an individualised assessment of the older person to determine if they are at risk of falling and at risk of harm from falling.	Chapter 6: discussion of screening and assessment
3	If the older person is at risk, targeted individualised interventions can be applied at the point of care. That is the site where the older person receives the intervention.	Chapters 7-17: individual risk factors for falls and related interventions. The order of interventions does not imply the importance of one intervention over another.
4	Additional interventions to minimise harm from falls should be considered.	Chapters 18-21: interventions to minimise harm from falls The order of interventions does not imply the importance of one intervention over another.
5	Providing post-fall response and assessment immediately after a fall is critical to delivering safe clinical care.	Chapter 22: post-fall management.

Health professionals, primary and community providers, and the aged care workforce (relative to their scope of practice or role) should, in partnership with the older person, consider the advantages and risks of using injury prevention strategies to minimise falls and harm from falls and support older people to exercise dignity of risk. These strategies can be used after a fall or applied systematically to the population at risk.

1 Purpose and use of the guidelines

Chapter layout

Chapters focused on fall risks and interventions begin with a set of evidence-based recommendations.

- **Recommendations** are based on evidence from intervention trials in community care settings with falls and/or falls injuries outcomes. The associated level of evidence (see Appendix) is aligned to the modified GRADE approach used by the 2022 World Falls Guidelines.

The supporting information for these recommendations and the related good practice points are 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
- **principles of care** – explains how to implement the intervention of interest
- **special considerations** – provides specific guidance relevant to fall prevention for older people with cognitive impairment.

Text boxes with important information

Points of interest and case studies are included throughout the guidelines to provide important additional information and illustrative examples.

Boxes containing useful websites, organisations or resources are also provided. References are listed at the end of each chapter.

2 Summary of recommendations and good practice points

This chapter contains a summary of the recommendations and good practice points from the *Preventing Falls and Harm from Falls in Older People: Best Practice Guidelines for Community Care in Australia*.

Recommendations

Fall Risk Assessment for Tailoring Interventions

Recommendations

Education and exercise: Provide older people at increased risk of falls (1+ falls per year) with home and community safety education in addition to exercise. (Level 1A)

Tailored multifactorial interventions: Provide older people at high risk of falls (2+ falls per year) with a fall risk assessment by a health professional to inform tailored fall prevention interventions. Interventions may include exercise, home safety, assistive devices, medication reviews, interventions to maximise vision, podiatry and strategies to address concerns about falling, anxiety, depression and cognitive impairment. (Level 1B)

Good practice points

Fall risk screening

- All members of the multidisciplinary team should ask the older person at least once every year about their experience of falls and how they proactively manage their fall risk.
- Screen all older people annually for their fall risk using a validated tool.
- Use fall risk screening to guide a detailed fall risk assessment to tailor intervention/s with the older person. Discuss the outcomes of assessment with the older person and their carers and family.
- Assess older people who have fallen in the past year with a simple, validated test of balance or gait on a fall risk screening tool. For older people who perform poorly, conduct a detailed assessment to identify contributory fall risk factors.

2 Summary of recommendations and good practice points

Fall risk assessment

- Engage with the older person to identify their fall risk, goals of care and fall prevention interventions. Managing risk factors, including delirium, balance problems, vision and medicines that increase the risk of falling, has benefits beyond fall prevention.
- Complete a comprehensive fall risk assessment of the older person to identify the factors contributing to an increased risk of falling, including cognitive impairment.
- Involve general practitioners or nurse practitioners in fall risk assessment, care coordination and multidisciplinary care planning.
- Develop a tailored fall prevention plan and ensure it is communicated to the older person, their carers and family, health professionals and workers.
- Implement interventions to systematically address the older person's fall risk factors identified through the fall risk assessment. Assessments are only effective when supported by appropriate interventions related to the risks identified.
- Review and evaluate fall prevention interventions for the older person to ensure they are tailored and effective, in partnership with the older person and their carers and family.
- Ensure all health professionals and aged care workers involved in the care of older people receive ongoing education about fall risk and fall prevention.
- Promote regular, proactive and effective communication with the multidisciplinary team, including at transitions of care. Involve the older person and their carers and family, and home and community services.

Person-centred care

- Facilitate access to appropriately qualified health professionals and evidence-based services for fall prevention that support the older person in maintaining their independence and undertaking reablement.
- Facilitate access for older people with a fear of falling or loss of confidence with mobility, to prescribed exercise, cognitive behavioural therapy and occupational therapy as part of a multidisciplinary approach to reduce the risk of falls.
- Support the use of virtual care (e.g. telehealth) to facilitate fall prevention interventions for older people when appropriate and available.
- Support the older person in choosing a nutritious diet that contains sufficient protein to maintain muscle mass, includes potassium, calcium, vitamin D, dietary fibre and vitamin B12, and contains little to no added sugar, saturated fats and sodium. Facilitate access to a dietitian where required.
- Facilitate access to meal support for older people who request or require help with eating and drinking to support nutritional intake and hydration.
- Support behavioural strategies and sleep hygiene to help regulate sleep-wakefulness cycles of the older person and improve their sleep quality.
- Partner with older people to reduce the risks of alcohol-related harm. See the Australian guidelines to reduce health risks from drinking alcohol.

Balance and Mobility

Recommendations

Ongoing exercise for all: Support all older people to undertake 2 to 3 hours of exercise per week on an ongoing basis to prevent falls. Primarily target balance and mobility and include strength training. Ensure health professionals (e.g. physiotherapists or exercise physiologists) or appropriately trained instructors design and deliver exercise programs. (Level 1A)

Cognitive impairment: Support older people with mild cognitive impairment or mild to moderate dementia to undertake exercise to prevent falls if they choose to do so. (Level 1B)

Low risk of falls: Support older people at low risk of falls (less than one fall a year) to attend community exercise or safely undertake home exercise. (Level 1A)

Increased risk of falls: Provide older people at increased risk of falls (1+ falls per year) with tailored exercise programs. Supervision or assistance from a health professional (e.g. physiotherapists or exercise physiologists) or an appropriately trained instructor may be required to ensure the older person exercises safely and effectively. (Level 1A)

Good practice points

- Use assessment tools to:
  - ☐ assess whether the older person is at high risk of falling
  - ☐ quantify the extent of the older person's balance and mobility limitations and muscle weakness
  - ☐ guide the prescription of exercise, mobility aids and equipment for the older person
  - ☐ measure improvements in the older person's balance, mobility and strength.
- Partner with the older person to develop tailored exercises that focus on maintaining the balance and movement required for functional tasks in their environment. This includes sit-to-stand movements, squats, reaching while standing, standing with a narrower base of support, stepping and walking in different directions, at various speeds, and in different environments while dual-tasking. Weights can be added to some exercises to increase difficulty.
- Support older people in exercising choice and dignity of risk to achieve their mobility and functional goals and maintain independence and quality of life.
- Support older people to consider participating in exercise programs to prevent falls, such as group exercise classes, tai chi, and strength and balance training at home.
- Include reactive balance training in fall prevention exercise programs for older people where possible, as it is highly task-specific in preventing falls. Cognitive-motor training, such as exergames, is also beneficial.
- Ensure exercises prescribed for the older person are challenging (to enhance neural, muscular and skeletal function), safe (to prevent injuries) and achievable (for sufficient dose and sense of mastery). Review and progress the older person's exercises regularly to ensure that an optimal level of difficulty is maintained.
- Facilitate access to online tailored balance and strength training for older people who are unable to access a health professional, such as people living in rural and remote areas.
- Consider a life-course approach to physical activity and encourage activities that build strength and balance, particularly among people in middle age.

Cognitive Impairment

Good practice points

- Ensure people with cognitive impairment receive a comprehensive fall risk assessment on commencement of care.
- Modify fall and fall injury prevention interventions as appropriate for people with cognitive impairment to maximise the intervention's feasibility and efficacy for the individual.
- Regularly reassess the cognitive status of older people, including when there is a change in their condition and after a fall.
- Use a validated tool to assess older people for delirium, particularly when there is an acute change in cognitive function. Start treatment based on the cause when it can be identified. Consider sepsis as a cause of delirium (see the Sepsis Clinical Care Standard).
- When delirium has been identified in an older person, ensure that the multiple-component interventions recommended for preventing and managing delirium are in place, including involving the older person's substitute decision-maker, carers or family, and modifying the older person's environment. Use the Australian Clinical Practice Guidelines for the Management of Delirium in Older People. See the Delirium Clinical Care Standard.
- Assess older people with gradual-onset, progressive cognitive impairment to determine a diagnosis. Identify and address reversible causes where possible. Use the Australian Clinical Practice Guidelines and Principles of Care for People with Dementia
- Involve older people with cognitive impairment and their substitute decision-makers in supported decision-making about fall prevention interventions. Carers and family who know the older person may suggest ways to support them.
- For people with cognitive impairment, use reasonable adjustments to implement the *Falls Guidelines for Community Care*. Reasonable adjustments should include (but are not limited to):
  - ☐ employing dementia-enabling techniques to create a physical environment that facilitates people living with dementia to feel supported and engaged
  - ☐ using tailored communication approaches to encourage the person's participation in decision-making and care planning
  - ☐ involving the person's carers and family in the assessment and design of fall prevention interventions.

Medicine and medicines review

Recommendation

Medicines review: Facilitate access to collaborative medicines reviews by a general practitioner and pharmacist, in partnership with the older person to minimise the use of psychotropic medicines and other medicines that increase the risk of falls. (Level 2B)

Good practice points

- Facilitate access to a medical practitioner, nurse practitioner and a pharmacist or credentialled pharmacist to take a best possible medication history and review of all the older person's medicines:
  - ☐ at least yearly
  - ☐ after a fall
  - ☐ after initiating a new medicine
  - ☐ after a change in the older person's health status
  - ☐ after a dose or regimen change of a medicine
  - ☐ after admission to hospital or a rehabilitation service.
- When medicines that increase fall risk are prescribed, medical or nurse practitioners should document the purpose of the medicine, consider comorbidities, ensure commencement at an age-appropriate dose, adjust doses slowly based on regular monitoring for efficacy and emergence of adverse effects, and document the plan for review.
- Advise older people who are taking medicines that increase fall risk about ways to reduce their likelihood of falling. This includes discussing the risks when the older person starts a new medicine or when the dose of an existing medicine is increased. Encourage the older person to report symptoms such as dizziness and use strategies to minimise fall risk, such as getting up slowly from a chair or bed.
- Facilitate access to a home medicines review by a credentialled pharmacist that includes an accurate history, reconciliation and review of the older person's medicines, with a particular focus on those that impact cognition, falls and osteoporosis. Consider options to deprescribe and, if feasible, adjust, taper or cease medicines that increase fall risk (sometimes referred to as fall-risk-increasing drugs).
- Support health professionals to provide and discuss medicines-related information with the person and their carer and/or family when treatment options are being considered (including the review of and/or deprescribing medicines) and when treatment decisions have been made.
- Facilitate access for the older person to relevant health professionals to implement non-medicine strategies for behaviour support planning, promoting sleep and addressing anxiety, depression and pain when indicated. Psychotropic medicines should only be considered when the changed behaviours are causing significant distress or risk of harm to the person or others. If prescribed, document the purpose of the psychotropic medicine and the plan for review. See Psychotropic Medicines in Cognitive Disability or Impairment Clinical Care Standard.
- Communicate any recent or proposed changes to an older person's medicine regime to the multidisciplinary team at transitions of care.

Continence

Good practice points

- Complete a continence assessment with the older person to identify and treat factors that can cause or contribute to incontinence. Implement interventions to minimise fall risk related to incontinence and facilitate access by the older person to a specialist continence service when required.
- Develop a plan with the older person that addresses their needs and preferences for toileting. This may include continence aids.
- Proactively identify and manage an older person's nocturia, frequency, difficulties mobilising to the toilet and issues with urinary tract function as part of a multifactorial approach to care. Escalate to a medical practitioner when required.
- Manage symptomatic bacteriuria and reduce inappropriate use of screening and treatment with antimicrobials. Asymptomatic bacteriuria does not require treatment.
- Facilitate access to an occupational therapist (when required) to assess the older person's ability to sit and stand from the toilet and determine the need for equipment or modifications, such as handrails.

Feet and Footwear

Recommendation

Podiatry: Provide older people with foot problems or disabling foot pain with access to a tailored podiatry intervention. (Level 1A)

Good practice points

- Assess whether the older person has any foot pain or problems and if their footwear is safe and well-fitted.
- Provide older people with education and information on safe shoes, managing foot problems and improving foot care. Facilitate access to a podiatrist when required.
- Encourage the use of safe, well-fitting footwear that includes:
  - ☐ heels that are low and square to improve stability
  - ☐ a supporting ankle collar to improve stability
  - ☐ soles with tread to prevent slips
  - ☐ easy fastening and only including laces if the person can tie them
  - ☐ firm soles to optimise foot position sense.

Syncope

Recommendation

Pacemakers: Facilitate access to a medical practitioner to consider treatment options for older people diagnosed with the cardio-inhibitory form of carotid sinus hypersensitivity and fit a dual-chamber cardiac pacemaker. (Level 2B)

Good practice points

- Ensure that older people who experience unexplained falls or episodes of collapse, including presyncopal or syncopal episodes (including postural hypotension), are urgently assessed by a medical practitioner to establish the underlying cause.
- Facilitate a medication review of the older person to identify medicines that may cause postural hypotension.

Dizziness and Vertigo

Good practice points

- Assess older people complaining of dizziness and vertigo for vestibular dysfunction (balance problems), gait problems, postural hypotension and anxiety.
- Assess the older person for postural hypotension with tests of lying and standing blood pressure.
- Facilitate access for a review of the older person's medicines regimen to identify any medicines contributing to dizziness or postural hypotension, including antihypertensives, antidepressants, anticholinergics and hypoglycaemics.
- Facilitate access to an appropriately trained medical practitioner or physiotherapist who can assess and manage vestibular-related balance problems in the older person. Implement interventions for benign paroxysmal positional vertigo and vestibular rehabilitation when indicated.

Vision

Recommendations

Cataract surgery: For older people with clinically significant visual impairment primarily due to cataracts, facilitate timely referral to a medical practitioner for cataract surgery in both eyes (unless contraindicated). (Level 1A).

Eyewear prescription: Advise active older people to use single-lens distance glasses (rather than bifocal, multifocal or progressive lenses) when active outdoors. (Level 2B). When updating the older person's glasses prescription, limit the change in prescription where possible. (Level 2B)

Good practice points

- Include a vision test as part of an older person's fall risk assessment.
- Encourage older people to have annual eye examinations with an optometrist to maximise vision. Facilitate access to the optometrist when support is required.
- Advise older people and carers that extra care is needed when new glasses (lenses) are prescribed.
- Support older people who use glasses to have accessible, clean glasses and to wear them. If the older person has different glasses for reading and distance, encourage them to wear distance glasses when mobilising.
- Implement strategies to maximise independence for older people who have visual impairment.
- If the older person has fallen, facilitate access to an optometrist or orthoptist for a detailed assessment and a fall-specific eye examination.

Hearing

Good practice points

- Encourage older people to have an annual hearing assessment and management with an audiologist to maximise hearing. Support the older person in accessing an audiologist when required.
- Encourage older people to wear their hearing aids when mobilising. Ensure that the hearing aids are working.
- Implement strategies to maximise independence with older people with hearing impairment. If the older person has fallen, facilitate access to an audiologist for a detailed assessment and fall-specific hearing examination.
- Use hearing devices (such as a pocket talker that amplifies sound closest to the listener while reducing background noise) or a hearing loop (a sound system that can broadcast to hearing aids) to communicate with an older person with a hearing impairment, as required and in line with the older person's preferences.

Environment

Recommendation

Home safety: Following a home safety assessment, provide tailored home safety interventions, delivered by an occupational therapist, for older people at increased risk of falls, including those:

- with severe visual impairment
- who have fallen in the past year
- who need help with everyday activities
- who have mobility impairment or use a mobility aid
- who have recently been discharged from hospital. (Level 1A)

Good practice points

- Facilitate access to an occupational therapist to assess older people at increased risk of falling and recommend modifications to the environment, equipment or aids and training to maximise safety.
- Identify how an older person navigates their environment as part of an environmental assessment and to inform fall prevention interventions.
- Work collaboratively with the older person to identify environmental hazards and develop and implement acceptable environmental modifications inside and outside their home.
- Talk with the older person about strategies, equipment, aids and devices that they could use to encourage safety, detect falls and minimise a long lie on the floor following a fall.

Monitoring and Observation

Good practice points

- Identify the monitoring and observation needs of older people living with dementia or delirium. Engage with the older person, their carers and family, and other health and aged care providers who are involved to develop a care plan to manage the older person's risk of falls.
- Discuss the options of electronic devices, sensors, and video or audio monitoring/ communication systems with the older person.

Restrictive Practices

Good practice points

- When an older person exhibits changed behaviours (i.e. agitation or aggression), assess and respond to any immediate risks to the person or others, including an increased risk of falls.
- Conduct a comprehensive assessment of the older person to identify possible causes of changed behaviours. Treat and manage any causes of these behaviours, such as delirium or unmet needs, including pain, thirst, hunger or feeling hot or cold. Non-medication strategies should be used as the primary strategies for managing changed behaviours. See the Delirium Clinical Care Standard.
- Ensure that a person-centred, effective behaviour support planning is developed in partnership with the older person and their substitute decision-makers, carers and family to manage changed behaviours associated with cognitive impairment, including delirium. Focus on caring for the older person by understanding the cause of the behaviour and treating reversible causes.
- Restrictive practices must only be used as a last resort, in the least restrictive form and for the shortest possible time necessary to prevent harm to the older person or others. Follow Commonwealth aged care legislation on the use of restrictive practices and relevant national, local or state policies, procedures and regulations. See the Psychotropic Medicines in Cognitive Disability or Impairment Clinical Care Standard.
- If alternatives to restrictive practices have been exhausted in addressing the changed behaviours, discuss options with the older person or substitute decision maker, explain the benefits and risks of the restrictive practice to be used, and document informed consent if use is agreed upon. In an emergency, if consent is not obtained, follow appropriate regulations. Document the rationale for using restrictive practices and the anticipated duration and criteria for cessation agreed upon by the health practitioner and the multidisciplinary team.
- Continue non-medicine behaviour support strategies in the event a restrictive practice is used.

Hip Protectors

Good practice points

- Prioritise older people who fall frequently, have osteoporosis or a low body mass index for consideration of using hip protectors to reduce the risk of fall-related fractures as part of a multifactorial approach.
- Understand the preferences of the older person, their mobility, cognition and functional skills, including their dexterity with dressing, to determine whether they can use hip protectors independently.
- Provide information to older people, their carers, family and substitute decision makers to support informed decision-making about the use of hip protectors.
- Provide training to the workforce, the older person, their carers and family in the correct use and care of hip protectors.
- When using hip protectors as part of a fall prevention strategy, regularly check that the:
  - ☐ older person is wearing their hip protectors
  - ☐ hip protectors are in the correct position on the older person
  - ☐ hip protectors are not causing pressure on the older person's skin that may contribute to pressure injuries
  - ☐ hip protectors do not affect the ability of the older person to toilet independently
  - ☐ older person has not stopped wearing the hip protectors because of discomfort, inconvenience or another reason.

Vitamin D and Calcium

Recommendation

Vitamin D supplementation: Support access to recommended doses of daily or weekly vitamin D supplements for older people deficient in vitamin D or with little sunlight exposure (i.e., less than 5 to 15 minutes of exposure, four to six times per week) unless contraindicated. (Level 1B) Avoid high monthly or yearly mega doses of vitamin D as these can increase the risk of falls. (Level 1A)

Good practice points

- Assess the adequacy of vitamin D and calcium in an older person's diet as part of a fall risk assessment.
- Encourage the older person to choose high-calcium foods in their diet and exclude foods that limit calcium absorption where this is their choice.
- For older people with cognitive impairment who have difficulties taking a daily dose of vitamin D, facilitate access to a medical practitioner who can prescribe a weekly dose preparation of vitamin D if appropriate.
- Facilitate access to a medical practitioner if an older person's dietary calcium intake is insufficient. Calcium supplementation for older people should be restricted to a maximum dose of 500 to 600 mg of elemental calcium per day. There is concern that calcium supplementation increases the risk of cardiovascular events.
- Review the older person's medicines regimen when commencing calcium supplementation, as calcium has the potential to interact with certain medicines, and several medicines may adversely affect calcium levels.

Osteoporosis

Recommendation

Osteoporosis medicines: Facilitate access to prescribed osteoporosis medicines for older people with diagnosed osteoporosis or a history of minimal trauma fractures, unless contraindicated. (Level 1A).

Good practice points

- Facilitate access to an osteoporosis assessment for all older people. Do not wait for a fracture to check for osteoporosis.
- Develop strategies for strengthening and protecting the older person's bones to reduce bone injuries from falls. This includes improving muscle strength, optimising functional capacity and improving the safety of the older person's environment.
- For older people who are at risk of falls or who have sustained a minimal trauma fracture, facilitate access to a medical practitioner for osteoporosis treatment.
- For older people with a history of recurrent falls, facilitate access to a bone mineral densitometry assessment/Dual Energy X-ray (DXA) scan to identify possible osteoporosis.
- For older people who have difficulties following the correct and safe manner of taking some oral bisphosphonates, facilitate access to a medical practitioner to assess the appropriateness of a long-acting injectable medicine for the treatment of osteoporosis.
- For older people who are using medicines to treat osteoporosis, facilitate access to co-prescribed vitamin D with calcium, as directed by a medical practitioner.
- Encourage bone health management in younger age groups by providing information and education about a life-course approach to bone density management.

Post-fall Management

Good practice points

- Immediately after a fall, provide a post-fall response, clinical care and escalation where required. In collaboration with the older person and their carer, assess whether basic life support is needed and provide as required.
- Identify, investigate and report the cause and the consequences of the fall.
- Facilitate a comprehensive assessment for every older person who falls and implement immediate actions such as a medication review.
- Conduct a post-fall analysis to inform the evaluation of the older person's multidisciplinary care plan, including fall prevention interventions. Address any comorbidities and fall risk factors to reduce the risk of another fall and update the plan.
- Support more mobile older people to improve their ability to rise from the floor after a fall unassisted to reduce the risk of a 'long-lie' occurring.
- At transitions of care for the older person, ensure communication of any falls or identification of fall risk with all relevant members of the older person's multidisciplinary team. See Principles for safe and high-quality transitions of care.
- Analyse falls data and delirium data to inform how improvements in practices and policies can prevent falls.
- If an older person has suffered a serious injury or death following a fall, conduct an in-depth analysis of the fall event.

3 Falls and falls injuries in Australia

Falls without injury in the home are under-reported, with less than half of older people who fall in the community estimated to report the fall to a health professional. Older people receiving community services are at an increased risk of falling, and health professionals delivering community-based services are ideally placed to play a role in fall prevention.

3.1 Characteristics of falls

The definitive studies on the incidence of falls in older people found that fall rates in older people living in the community are approximately 30 to 40% each year.[15-19]

3.1.1 Location of falls

About 50% of falls by older people in the community occur within their homes and immediate home surroundings.[7, 20] 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. Falls often involve a hazard such as a loose rug or a slippery floor, although many falls do not involve obvious environmental hazards.[7]

Falls in public places and other people's homes account for the remaining 50% of falls. 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 living in the community, the number of falls occurring outside the home decreases with age, while the number of falls occurring inside the home on a level surface increases.[15] One study found that fewer men than women fell inside the home (44% versus 65%), and more men fell in the garden (25% versus 11%).[20] Frailer groups with limited mobility experience most falls within the home.

Nighttime falls are less prevalent but more serious, and they predominantly occur in the bathroom or on poorly lit stairs, where harder surfaces and longer falls increase the risk of injury.[7]

These findings indicate that falls occur in situations where older people engage in their usual daily activities.

3.1.2 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[21] and 4% of all hospital admissions in this age group.[22]

Hospital admissions resulting from falls increase at an exponential rate with advancing age. For older people, the admission rate due to falls increases rapidly for both sexes, with a ninefold increase in the rate in males and females between the ages of 65 and 85 years.[23] Falls also account for 40% of injury-related deaths and 1% of total deaths in this age group.[21]

Between 22% and 60% of older people sustain injuries from falls: 10-15% sustain serious injuries, 2-6% sustain fractures, and 0.2 to 1.5% sustain hip fractures. The most common self-reported injuries include superficial cuts and abrasions, bruises and sprains. The most common injuries requiring hospitalisation are hip fractures, pelvic fractures, fractures of the leg, fractures of the radius, ulna and humerus, and fractures of the neck and trunk.[22, 23]

Hip fractures

In terms of morbidity and mortality, one of the most serious fall-related injuries are hip fractures. Older 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. One study of older people who had suffered a hip fracture showed that before their fractures, 86% of participants could dress independently, 75% could walk independently, and 63% could climb a flight of stairs.[24] Six months after their injuries, these percentages had fallen to 49%, 15% and 8%, respectively.

The 'long lie'

Another consequence of falling is when the person remains on the ground or floor for more than one hour after a fall. This is known as a 'long lie' and 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 a fear of falling, muscle damage, pneumonia, pressure sores, dehydration and hypothermia.[25, 26] Half of people who lie on the floor for one hour or longer die within six months, even if there is no direct injury from the fall.[27] More than 20% of people admitted to hospital due to a fall had been on the ground for one hour or more.[28] Up to 47% of older people who fell without injury were unable to get up off the floor without assistance.[29]

Fear of falling

Falls can lead to a significant fear of falling, sometimes referred to as the 'post-fall syndrome', which can manifest as a loss of confidence, hesitancy, and tentativeness, resulting in a loss of mobility and independence. After falling, many older people report a fear of falling[30] and curtailing activities due to a fear of further falls.[30, 31]

Impact of falls on activities of daily living

Falls can result in an older person restricting their activity, reducing their quality of life and losing independence. Older people who fall (particularly recurrently) are at greater risk of reporting subsequent difficulties with activities of daily living and more physically demanding activities.[32]

Both non-injurious and injurious falls are associated with declines in basic and instrumental activities of daily living in older people. Those who suffered two or more non-injurious falls reported declines in social activities, and those who suffered one or more injurious falls reported reduced physical activity levels.[32]

Falls can lead to disability and decreased mobility, which often results in dependency on others and an increased probability of requiring residential care.[33]

3.2 Risk factors for falling

A person's risk of falling increases with age, degree of frailty, acute or chronic medical conditions and a history of falls.[34] For those older people living in the community, low levels of physical activity, depression, poor oral health, a fear of falling and being female are also risk factors for falls.

A person's risk of falling increases as the number of risk factors increases.[18] For older people receiving home and community care services, the location of a fall is often related to age, sex and degree of frailty.

Most fall risk factors can be addressed systematically to help prevent falls and associated harm. Fall risk factors include:

- intrinsic risk factors: those that relate to a person's behaviour or condition, and
- extrinsic risk factors: those that relate to a person's environment or their interaction with the environment.

3 Falls and falls injuries in Australia

It is important that health professionals, primary and community providers and the aged care workforce engage with older people to identify and address fall risk factors to support safe, routine and person-centred care for older people living in the community.

Fall risk after discharge from hospital

Older people have a high risk of falls and falls with serious injury in the first month after being discharged from hospital.

Best practice supports the coordination and continuity of care between the hospital, the older person, their carers and family and the older person's general practitioner. By working in an integrated manner, the needs of the older person across the broader spectrum of health service delivery are more likely to be achieved.

4 Involving older people in fall prevention

It is critical that people are supported to exercise choice and that care is tailored to their different needs. Good clinical care can optimise a person's quality of life, reablement and maintenance of function. Improved health and wellbeing support older people to continue to participate in activities that are enjoyable and give life meaning.

Carers, family and substitute decision makers may play an important role in the life of the older person, and these relationships should be recognised and respected. Carers may provide comfort, encouragement, reassurance and support to the person that they care for and should be included as partners in facilitating fall prevention.

Communication with and between the multidisciplinary team, including the older person, their carers and family, is critical to effectively preventing and responding to falls. Risks, change or deterioration in the older person's condition should be escalated and communicated as appropriate.

Older people in Australia may experience challenges in accessing care due to geographical location and limitations in the availability of services and workforce. Virtual care strategies (e.g. telehealth) should be supported to facilitate fall prevention interventions when appropriate and available.

4.1 Best practice approach

Best practice approaches to partnering with older people in fall prevention include:

- Present the fall prevention message in the context of staying independent for longer.[34]
- Be aware that the term 'fall prevention' may be unfamiliar or difficult to understand for many people, and support their understanding through tailored communication.[35]
- Identify the older person's health literacy and individual communication needs and preferences, taking into account any impairments in their cognitive function.
- Provide information in a way the older person can understand. This may include providing information in the person's own language, using alternative communication approaches such as written formats (e.g. easy read, easy English and accessible formats), multimedia (e.g. images, animation and video), and offering and facilitating access to interpreters and translations.
- Identify the older person's needs, goals and preferences, and support the older person, their carers and family to engage in discussions about preventing falls.
- Find out what personal changes the older person can make to prevent falls and support shared and supported decision making. This may include changes to the older person's behaviour, environment, clothing and footwear.
- Explore the older person's concerns about what makes it difficult for them to take action to reduce their risk of falls (such as fear of falling, loss of confidence or concern about the stigma associated with using mobility aids) and provide support to overcome these issues.
- Develop fall prevention programs that are flexible and tailored to the older person's individual needs, goals, circumstances and interests.
- Trial a range of fall prevention interventions and review their effectiveness in partnership with the older person, their carers and family.
- Support older people in discussing their ongoing care needs and future medical treatment, including fall risk, and help them develop or review advance care planning documents (if and when they choose).
- Ensure that the older person in hospital and their carers, family and substitute decision-makers are aware of the mechanisms to provide feedback about fall prevention and how to raise concerns.

4 Involving older people in fall prevention

Additional information

- What is person-centred care, Aged Care Quality and Safety Commission
- Supported decision-making, Older Persons Advocacy Network
- Resources, training and webinars developed by the Centre for Cultural Diversity in Ageing
- Aged Care Diversity Framework action plans, Australian Government Department of Health and Aged Care.
- Further information about person-centred care, Australian Commission on Safety and Quality in Health Care.

5 Preventing falls and harm from falls

Preventing falls and harm from falls in older people is an important public health priority.

This chapter overviews findings presented in the book *Falls in Older People: Risk Factors, Strategies for Prevention and Implications for Practice*.[7]

5.1 Background and evidence

Falls occur due to a mismatch between a person's physiological function, environmental requirements, psychological function and behaviour.[7] Falls are more common with increased age due to a combination of physiological ageing and deconditioning, as well as the increased prevalence of health conditions and medicine use.

As with other aspects of ageing, the key issue is the older person's loss of intrinsic capacity and functional ability rather than chronological age.[36]

5.1.1 Physiological function[7]

A range of body structures and functions are involved in maintaining the body in an upright position to undertake daily tasks without falling. The appropriate coordination of these structures and functions is crucial for safe balance and mobility.

To avoid falling, a person needs:

- adequate vision to observe environmental challenges such as uneven or slippery surfaces
- adequate proprioception (awareness of where body parts are in space)
- adequate reaction time to respond to unexpected perturbations, and
- adequate muscle strength to extend their legs against gravity, with spare capacity to enable a stronger activation to regain an upright position in case of a trip.

Adequate coordination of these functions enables the correct muscles to be activated at the correct times with the appropriate amount of force, allowing for successful tasks such as walking and stair climbing. Postural control (balance) reflects the successful coordination of these functions, so the role of the brain is crucial.

Adequate cardiovascular and respiratory function ensures that oxygen is transported to the muscles and the brain, enabling these functions to occur.

Diseases and medicines can affect physiological function

Diseases and medicines may affect cardiovascular and respiratory function.

Balance control can be adversely affected by acute medical problems such as infections, chronic conditions such as diabetes, and progressive conditions such as Parkinson's disease.

The impact of medicines on successful balance control and falls varies according to dose, interactions, and metabolism. Psychotropic medicines are particularly associated with falls.

5.1.2 Environmental context[7]

The interaction between the environment in which a person undertakes tasks and the person's physiological functioning is an important consideration in managing fall risk.

A high level of function in the physiological systems is crucial to fall avoidance. An older person with impaired physiology may fall in an unchallenging environment, such as walking across a room.

Health professionals should seek to understand the context of falls reported by their older patients.

Aids and appliances

The use of aids and appliances can improve the older person's interaction with their environment and address impairments in one or more body systems. For example, the use of a cane for those with visual impairments or walking aids for those with insufficient leg muscle strength or poor postural control.

5.1.3 Behavioural context[7]

An older person's cognition, psychological state and behaviour are crucial contributors to their risk of falling.

Behaviour is influenced by cognitive ability, insight, and level of support available.

Increased awareness of high physiological risk among older people and the use of assistance, when required, may mitigate falls.

Individual variations in attitudes and behaviour may explain differences between measured fall risk and actual falls experienced.[37]

5.2 Preventing falls in the community

Fall prevention is part of routine care in the community care setting and should be addressed in the older person's care plan.

A fall risk screening and assessment of the older person will identify the individual fall risk factors and help determine the most appropriate and effective fall prevention interventions for the older person.

5.2.1 Fall risk screening and assessment[7]

Fall risk screening and assessment tools can:

- help predict who will fall
- understand the likely causes of a person's fall, and
- guide the implementation of evidence-based fall prevention interventions.

Chapter 6 provides further information on fall risk screening and assessment, including details about the validated fall risk assessment tools for use in community care.

5.2.2 Fall prevention interventions

Fall prevention interventions are therapeutic procedures or treatment strategies designed to prevent falls and associated harm. Interventions can be in the form of exercise, early detection (assessment), dietary supplements, deprescribing of medicines, environmental reviews, education and the minimisation of risk factors.

Fall prevention interventions can be:

- **single interventions:** target specific fall risk factors, such as surgery for cataracts
- **multiple component interventions:** where everyone receives the same, fixed combination of fall prevention interventions, such as tailored ongoing exercise, education and medication review
- **multifactorial interventions:** a combination of interventions tailored to the older person based on an individual assessment.

Appendix 3 outlines the systematic review that identified evidence of best practice prevention of falls and associated harm, which informs the Falls Guidelines.

Single fall prevention interventions

Exercise as a fall prevention intervention

Exercise is the most studied single fall prevention intervention. It has been shown to reduce the rate of falls in the community and the number of people experiencing one or more falls per year.[13] See Chapter 7.

The following forms of exercise are known to be effective in preventing falls:

- exercise that primarily targets functional abilities or balance
- exercise with multiple components such as function, balance and strength
- Tai Chi.

There is no evidence that strength training or walking, as stand-alone exercises, prevent falls, nor does dancing.

Exergame training as a fall prevention intervention

Exergames are interactive video games that can improve physical and cognitive factors associated with falls in older people.[38] Exergames can be used to promote exercise by requiring a person to produce physical body movements to complete set tasks or actions, usually in response to visual cues.[38] Exergames also involve interactive cognitive-motor training, as participants are required to interact with a computer interface via gross motor movements.[39]

Exergame step training for older people in the community has demonstrated effectiveness as a fall prevention strategy by challenging the older person's speed, accuracy and motor control, and targeting specific cognitive functions, such as working memory, visuospatial skills, dual-tasking, inhibition and attention.[40]

Non-exercise interventions as single interventions

Environmental fall prevention interventions have been shown to reduce falls in high-risk older people, and hip protectors can prevent hip fractures in older people if worn at the time of the fall.

Other non-exercise interventions implemented for older people with particular fall risk factors have been found to prevent falls as single-targeted interventions, as presented in Table 5.1.

Table 5.1: Fall risk factors benefiting from single fall prevention interventions

Fall risk factor	Single intervention
Disabling foot pain	A multi-faceted podiatry intervention
Cardio-inhibitory carotid sinus hypersensitivity	Insertion of a cardiac pacemaker
Operable cataracts	Cataract removal
Psychotropic medicines	Gradual reduction in psychotropic medicines
Low vitamin D levels	Daily or weekly doses of vitamin D supplements (but not in an unselected population
Medicines	General practitioner-based medicines review
Multi-focal glasses for older people who regularly walk outdoors	Replace multi-focal glasses with single-lens glasses

Multifactorial fall prevention interventions

The value of a multifactorial fall prevention intervention lies in its ability to provide older persons with a range of tailored fall prevention interventions based on their specific fall risk assessment.

Targeting an older person's fall risk factors systematically, including medicines adjustment, behavioural instructions, and exercise, has been shown to lower the fall rate of older people in the community by 30%. The WHO Physical Activity Guidelines recommend multifactorial exercise interventions for all older people.[41]

A detailed medical and occupational therapy assessment of older people living in the community who presented to the Emergency Department with a fall revealed a marked reduction in the older people's risk of falling and recurrent falls, as well as significantly lower risks of hospitalisation and functional decline.[42]

There is some evidence that interventions provided as part of research studies have a greater impact than referral-based programs, due to better adherence to the interventions.[43]

5.2.3 Population-level fall prevention interventions

Some single interventions are as effective as multiple interventions at a population level and are cheaper to deliver.[44] Multiple interventions, where more than one intervention is delivered to groups of people without screening and targeting, can also be successful.[45]

Given the importance of physical function as a risk factor for falls, a suggested approach is to start with exercise prescription for everyone and include additional interventions targeted at the individual or the group where identified risk factors are not amenable to exercise intervention.

Exergame step training on a computerised mat can be conducted at home and requires only minimal equipment, making it a potentially scalable public health intervention to address the increasing problem of falls and fall-related injuries.[38]

5.3 Special considerations for cognitive impairment

Falls and cognitive impairment are key concerns for both older people and healthcare workers. Cognitive impairment has a dedicated chapter (Chapter 8) and is included as an area for special consideration in each chapter.

Cognitive impairment, including agitation, delirium and dementia, is a major risk factor for falls.

There is consistent evidence that older people with cognitive impairment living in the community can participate effectively in fall prevention programs.[2, 38, 46, 47] Some older people with cognitive impairment will likely require individually tailored interventions.

Exercise as a single fall prevention intervention has been shown to reduce the rate of falls in community-dwelling older people with cognitive impairment by approximately 30%.[2]

In addition, home hazard reduction, combined with exercise, has been shown to significantly decrease the risk of multiple falls for older people with cognitive impairment, although not the rate of falls.[47]

6 Fall risk assessment for tailoring interventions

Recommendations

Education and exercise: Provide older people at increased risk of falls (1+ falls per year) home and community safety education in addition to exercise. (Level 1A)

Tailored multifactorial interventions: Provide older people at high risk of falls (e.g. 2+ falls per year) with an individualised assessment from a health professional to inform tailored fall prevention interventions. Interventions include exercise, home safety, assistive devices, medicines reviews, interventions to maximise vision, podiatry and strategies to address concerns about falling, anxiety, depression and cognitive impairments. (Level 1B)

6.1 Background and evidence

Fall risk screening and *fall risk assessment* are separate but related processes and are defined as follows:

Fall risk screening is a quick process that aims to identify people at increased risk of falling and helps determine if a more detailed fall risk assessment is required.

Fall risk assessments aim to identify factors that increase a person's risk of falling, which may be addressed through a fall prevention intervention.

Even where risk factors for falling cannot be reversed, strategies can be implemented to minimise the risk of falling or to prevent harm from falling if an increased fall risk is identified.

A range of fall risk screening and assessment tools have been developed for use in the community setting. The tools presented in these guidelines are recommended for use in the community setting in Australia as they are known to be sufficiently accurate in predicting both people who fall and those who do not fall.

Screening and assessment are not stand-alone actions in fall prevention. Screening and assessment need to be linked to addressing any modifiable fall risk factors identified.

6.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

History of falls in the past 12 months

At least once a year, general practitioners (GP) should ask all older people (or their carers) in their care about any falls they have experienced and take a detailed history of the events surrounding the fall(s).[48]

This role could be supported by other health professionals who provide care to older people living at home.

Older people who report one or more falls in the preceding year should be assessed on balance and mobility.

6.2.1 Fall risk screening

Fall risk screening is a quick process of estimating an older person's risk of falling and classifying them as being at either low or high risk. Although not designed as comprehensive assessments, screening on certain screen items can provide information about intervention strategies. Staff training is required to ensure appropriate and consistent administration of fall risk screens.

The simplest fall 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. Chapter 7 details the commonly used balance and mobility fall risk screens that have demonstrated validity, reliability and feasibility in the community setting.[49]

6 Fall risk assessment for tailoring interventions

[Point of Interest] Timed Up and Go test

Even though the Timed Up and Go test has been widely used as a simple screening test,[50-52] the Timed-Up and Go Test in healthy, high-functioning older people is not useful for distinguishing between people who have fallen from people who have not fallen.[53] The test is more useful in less healthy older people with lower levels of function. If the older person takes more than 15 seconds to complete the test, they should be considered at an increased risk of falls.[2]

Multiple-item screening tools

The best practice approach for screening older people living in the community for fall risk recommends using a multiple-item screening tool.48

The FROP-Com (Fall Risk for Older People - Community Version) fall screening test can identify with reasonable accuracy older people who are at an increased risk of falling.54, 55 The FROP-Com contains three common fall risk factors that are used in combination by a health professional to determine an older person's fall risk score, as detailed in Table 6.1.

Table 6.1: Screening fall risk for older people in the community

Fall Risk for Older People - community version (FROP-Com) Screen[54]	
Description	A three-item fall 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 greater than 3 indicates an increased risk of falling.

While an overall score of two on the FROP-Com Screen indicates a low risk of falling (e.g. a score of zero for a previous fall, two for balance and mobility impairment, and zero for a change in activities of daily living), a score of two on balance and mobility impairment may indicate the need for an exercise program to address the balance impairment.

6.2.2 Fall risk assessment

Assessing fall risk involves either:

- **multifactorial assessment tools** that cover a wide range of fall risk factors, or
- **functional mobility assessments** that focus on the physiological and functional domains of postural stability, including vision, strength, coordination, balance and gait.

Most falls occur as a result of an interaction between intrinsic and extrinsic factors, and multiple factors increase the risk of falls.[56] Many disease processes that are more common in older people increase the risk of falls, mainly through impairing postural stability.

Fall risk assessment tools

Several fall risk assessment tools are now available for use in community settings, providing detailed information on the underlying deficits that contribute to overall risk. Most fall risk assessments classify older people into low- and high-risk fall groups. A fall risk assessment should be used to inform the management of the identified deficits and implementation of fall prevention interventions.

Fall risk a GP or other suitably qualified health professional can perform assessments. Based on the assessment outcome, these assessors might refer to specialist 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 older people with impaired vision or a referral to a physiotherapist or exercise physiologist for a more thorough assessment of balance and mobility if the older person scores poorly in these areas.

Table 6.2 details two recommended fall risk assessment tools that have been prospectively validated and demonstrated applicability in Australian community settings. Both the FROP-Com and QuickScreen fall risk assessment tools were validated with assessments conducted by GPs, physiotherapists, occupational therapists and nurses (practice, regional and remote).[55] A trained member of the multidisciplinary team can administer these assessments.

6 Fall risk assessment for tailoring interventions

Table 6.2: Tools to assess the fall risk of older people in the community

QuickScreen[2, 49]	
Description	QuickScreen is a risk assessment tool designed for use by practice and rural nurses, allied health workers and general practitioners (GPs). It is based on the sensorimotor functional model for fall prediction. It enables health professionals to estimate the level of increased fall risk and 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 ■ medicines use ■ vision ■ peripheral sensation ■ lower limb strength ■ balance; and ■ coordination. The fall assessment requires a low-contrast eye chart, a filament for measuring touch sensation and a small step. QuickScreen has a purchase price.
Time needed	10 minutes
Criterion	A score of four or more indicates an increased risk of falling.
FROP-Com (Fall Risk for Older People — community version)[54]	
Description	FROP-Com is a detailed fall risk factor assessment tool. It includes 13 risk factors, assessed through 26 questions with either dichotomous (0–1) or ordinal (0–3) scoring. A total of these item scores provides a fall risk score (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.
Time needed	10–15 minutes
Criterion	A score above 18 indicates a high risk of falls.

Environmental assessment

Most risk-assessment tools focus on person-related fall risk factors only, so a separate environmental assessment may be indicated (see Chapter 16 on environment).

Outcome of fall risk assessment

The outcomes of the fall risk assessment, together with the recommended strategies to address identified risk factors, need to be documented and reported to other health professionals, providers and aged care workers involved in the older person's care, and discussed with the older person and their carers, in line with the older person's preferences.

As outlined in subsequent chapters, more specific assessments may be indicated for some risk factors, including visual impairment, muscle weakness, dizziness, syncope, incontinence, cognitive impairment, concern about falling, feet and footwear issues and osteoporosis.

Case study

Ms D went to see her 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 Ms D confirmed. The GP discussed the circumstances of Ms D's falls, which included several trips both inside and outside the home, and a sense that her balance had progressively worsened.

The practice nurse administered the QuickScreen assessment, which revealed Ms D was taking a benzodiazepine medicine, and she performed poorly in the Sit-to-Stand Test and Alternate Step Test.

The GP reviewed and modified Ms D's medicines (including weaning her off the use of benzodiazepine) and referred her for a physiotherapy assessment to prescribe an exercise program. An occupational therapy assessment was organised to review home safety and consider functional needs at home.

Six months later, Ms D was taking part in a community strength and balance exercise program and had resumed her previous activities. She had regained confidence in her outdoor mobility and experienced no further falls.

6.3 Special considerations for cognitive impairment

Cognitive impairment is an independent risk factor for falls (see Chapter 8). Up to 80% of older people who live in the community and have cognitive impairment sustain a fall in a 12-month period.[57] Identifying cognitive impairment should form part of the fall risk assessment process.[54]

Identified fall risk factors should be incorporated into a management plan for all older people, including older people with cognitive impairment, although they may need to be modified.[58] Carers and family members may take on more active roles in supporting the implementation of interventions for older people with cognitive impairment.

7 Balance and mobility

Recommendations

Ongoing exercise for all: Support all older people to undertake 2 to 3 hours of exercise per week on a continuing basis to prevent falls. Primarily target balance and mobility and include strength training. Ensure health professionals (e.g. physiotherapists or exercise physiologists) or appropriately trained instructors design and deliver exercise programs. (Level 1A)

Cognitive impairment: Support older people with mild cognitive impairment or mild to moderate dementia in engaging in exercise to prevent falls if they choose to do so. (Level 1B)

Low risk of falls: Support older people at low risk of falls (less than one fall a year) to attend community exercise or safely undertake home exercise. (Level 1A)

Increased risk of falls: Provide older people at increased risk of falls (1+ falls per year) with tailored exercise programs. Supervision or assistance from a health professional (e.g. physiotherapist or exercise physiologist) or an appropriately trained instructor may be required to ensure the older person exercises safely and effectively. (Level 1A)

7.1 Background and evidence

Balance is a complex skill in which the body's centre of mass is controlled within the limits of stability. This requires the integration of accurate sensory information, such as vision, proprioception, and vestibular input, along with a well-functioning musculoskeletal system, to execute appropriate movements.

Coordinated muscle activity, strength, and movements are required to maintain balance and play an essential role in tasks such as moving from a sitting to a standing position, standing, stepping, walking, reacting to external disturbances, and performing many activities of daily living.[59, 60] Increasing age, inactivity, disease processes and muscle weakness can impair balance abilities.[61]

Well-designed exercise interventions that target balance, gait and muscle strength are effective in preventing falls in older people.[13, 62-65]

7.1.1 Fall risk factors related to balance, mobility and strength

Fall risk factors related to balance, mobility and strength for older people living in the community include:

- **Walking:** between 50% and 70% of falls among older people living in the community occur while walking. Slower walking speed and greater variability in step timing and step length increase the risk of falls.66, 67 Which is compounded when older people who are at increased risk of falling walk more slowly and adopt a conservative gait pattern to compensate for their fall risk.68
- **Muscle weakness:** increases the risk of falls, independent of poor balance.69 Muscle strength is required to safely perform tasks such as getting up from a chair, climbing stairs and responding to unexpected events such as tripping or being knocked off balance.
- **Physiological abilities:** such as poor vision, reduced proprioception and slow reaction time, are predictors of falls.69 These abilities are required for a person to maintain an upright position during a range of tasks.

A physiological profiling approach can be used to identify sensory and motor impairments in older people at risk of falls as well as older people with a range of disorders such as Parkinson's disease, multiple sclerosis, stroke, cognitive impairment, depressed mood, macular degeneration, lower limb osteoarthritis and a history of polio.[70]

Poor performance in various balance tests is associated with an increased risk of falls in older people living in the community. The selection of the most appropriate test to use depends on the characteristics of the population and the purpose of testing, such as predicting falls, measuring improvement or helping with exercise prescription.

7 Balance and mobility

7.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

7.2.1 Assessing balance, mobility and strength

Assessing an older person's balance, mobility, and strength is a key element in understanding their fall risk and forms part of the fall risk assessment process.

The different clinical assessment tools listed in Table 7.1 for assessing an older person's balance, mobility and muscle strength have been evaluated according to their reliability, validity and responsiveness to change. The choice of tool depends on the time and equipment available, as well as the level of ability of the older people being assessed.[13, 60-66, 71-76]

These tools are for use in the general older population,[77] in older people who have suffered a hip fracture [21] and those undergoing rehabilitation.[77]

Table 7.1: Tools for assessing balance, mobility, strength and gait

Tools for assessing balance	
Postural Sway and Leaning Balance Tests[69]	
Description	As part of the Physiological Profile Assessment, sway is measured using a sway meter that measures displacement of the body at waist level. During standing balance tests, the person stands as still as possible for 30 seconds, with eyes open and then closed, once on the floor and once on a piece of medium-density foam rubber (15 cm thick). During leaning balance tests, the person leans forward and backward as far as possible or to follow a track.
Time needed	5–10 minutes
Level that is predictive of a fall	Part of the Physiological Profile Assessment [12]
Functional reach[78]	
Description	The Functional Reach is a measure of balance, representing the difference between a person's arm length and their maximal forward reach while maintaining a fixed base of support.
Time needed	1–2 minutes
Level that is predictive of a fall	≤ 25 cm: 2x greater than normal risk of falling ≤ 15 cm: 4x greater than normal risk of falling Unwilling to reach: 8x greater than normal risk of falling

7 Balance and mobility

Alternate Step Test[49]	
Description	The Alternate Step Test 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.
Time needed	1–2 minutes
Level that is predictive of a fall	> 10 seconds
Tools for assessing mobility	
Six-Metre Walk Test[49]	
Description	The Six-Metre Walk Test measures a person's gait speed in seconds along a corridor (over a distance of six metres) at their normal walking speed.
Time needed	1–2 minutes
Level that is predictive of a fall	>6 seconds
Timed Up and Go Test (TUG) [79, 80]	
Description	The TUG measures the time taken for a person to rise from a chair, walk three metres at a normal pace with their usual assistive device, turn, return to the chair and sit down.
Time needed	1–2 minutes
Level that is predictive of a fall	>15 seconds
Short Physical Performance Battery (SPPB)[75]	
Description	The SPPB is calculated from three components: the ability to stand up to 10 seconds in three ways time to complete a 3-metre or 4-metre walk, and time to rise from a chair five times.
Time needed	5 minutes
Level that is predictive of a fall	Score ≤ 6 points For scoring: https://sppbguide.com/

7 Balance and mobility

Tools for assessing strength	
Sit-to-Stand Test[81, 82]	
Description	The Sit-to-Stand test measures lower limb strength. It is the number of stands a person can complete in 30 seconds (rather than the time it takes to complete a pre-determined number of repetitions). That way, it is possible to assess a wide variety of ability levels, with scores ranging from 0 for those who cannot complete 1 stand to greater than 20 for more fit individuals.
Time needed	1–2 minutes
Level that is predictive of a fall	A below-average number of stands for the patient's age group indicates a high risk of falls: Women +65 years, below average ≤11 Men +65 years, below average ≤12
Spring gauge[69]	
Description	As part of the short-form PPA, the strength of the knee extensors is measured while participants are seated. Three trials are conducted, and the greatest force is recorded.
Time needed	5 minutes
Level that is predictive of a fall	Part of the PPA[69]
Scales for assessing balance and gait	
Berg Balance Scale[83]	
Description	The Berg Balance Scale is a 14-item scale designed to measure the balance of the older person in a clinical setting, with a maximum total score of 56 points.
Time needed	15–20 minutes
Level that is predictive of a fall	A score of ≤20= high risk of falls A score of ≤40 = moderate risk of falls (potential ceiling effect with less frail people)
Tinetti Performance-Oriented Mobility Assessment Tool (POMA)[84]	
Description	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.
Time needed	10–15 minutes
Level that is predictive of a fall	A score of ≤19 = high risk of falls A score of ≤24 = moderate risk of falls

Mini Balance Evaluation Systems Test (Mini BESTest)[85, 86]	
Description	Mini BESTest is a shortened version of the Balance Evaluations Systems Test to rate dynamic balance. It consists of 14 items to identify deficits in anticipatory postural adjustments, reactive postural control, sensory orientation and dynamic gait for which sub-scores can be calculated. Items are scored on a 3-level ordinal scale (0-2) with a maximum score of 28.
Time needed	10-15 minutes
Level that is predictive of a fall	< 16 points
Confidence and falls efficacy scale	
Falls Efficacy Scale - International (FES-I)[87, 88]	
Description	FES-I provides information on the level of concern on a four-point scale (1 = not at all concerned to 4 = very concerned) across 16 activities of daily living (e.g. cleaning the house, simple shopping, walking on uneven surfaces).
Time needed	5 minutes
Level that is predictive of a fall	A score of ≤22 = low to moderate level of concern A score of ≥23 = high level of concern

7.2.2 Providing exercise interventions

Effective exercise programs for preventing falls in older people focus on challenging and progressive balance exercises. Exercise programs should be developed by a suitably qualified health professional who can tailor the exercise program to the older person's existing levels of fitness and target their particular deficits, goals and lifestyle. For optimal benefit, exercises should be conducted while standing, if possible.

Table 7.2 outlines the elements of an effective exercise program to support older people in improving their balance, mobility and strength and reducing their risk of falls and associated harm.

Table 7.2: Elements of an effective exercise program for older people

Challenging balance safely[13]
Exercises that challenge balance could lead to falls themselves; therefore, exercises need to be: ■ carefully prescribed by a suitably qualified health professional such as a physiotherapist ■ set up in a safe way, such as next to a wall or counter for hand support as required, and ■ supervised, if necessary. This is particularly important for older people who are more frail.

7 Balance and mobility

Dose of exercise

Exercise programs are more effective in preventing falls if they include three or more hours of exercise each week.[13] An effective balance training protocol for healthy older people could look like:

- a training period of 11 to 12 weeks, with a frequency of 3 sessions per week
- a single training session duration of 31-45 minutes with a total duration of 91-120 minutes of balance training per week.[89]

Ongoing exercise is required to help address fall rates, as the effects of exercise are lost once it stops.[90] Research into other benefits of exercise has found that there is a dose-response relationship where greater effects are seen with more exercise.[90, 91] This may also be the case for fall prevention.

Walking programs and fall prevention

Walking is a popular form of exercise and can provide many health benefits associated with increased physical activity levels.[90] Walking training may be included in a falls prevention program in addition to balance training.

People at high risk of falls should not be prescribed brisk walking programs.[13]

Reactive balance training

Reactive balance training is a task-specific approach that uses repeated, externally applied mechanical perturbations to trigger rapid reactions to regain postural stability in a safe and controlled environment.[92, 93] Reactive balance training aims to specifically target and improve the reactive balance and stepping required in daily-life situations that can lead to falls (e.g., tripping over an object).

Where possible, reactive balance training programs should incorporate:

- pre-perturbation activities, such as walking and standing
- perturbations, such as trips, slips and a push, and
- target reaction, including reactive stepping, feet-in-place balance and grasping as relevant for the older person.

The fall prevention effects of reactive balance training can last from 3 months[94] to up to 12 months[95], and booster sessions are likely required for long-term benefit.[96]

Cognitive-motor interventions and fall prevention

Interactive cognitive-motor training, where participants interact with a computer interface via gross motor movements, such as exergames, can improve physical and cognitive factors associated with falls in older people.[39]

Step exergame training that challenged speed, accuracy and motor control, and targeted specific cognitive functions, including working memory, visuospatial skills, dual-tasking, inhibition and attention, significantly reduced fall rates by 26%.[38]

Resistance, coordination and multimodal training exercises have been shown to have a clinically meaningful increase in gait speed in healthy older people.[97]

7.2.3 Core features of an exercise program

Table 7.3 lists the features that an exercise program should include to be effective in reducing falls in older people in the community.[74]

Table 7.3: Features that should be included in exercise programs[13, 74]

Feature	Description
Program	The core of the exercise program should involve balance and functional exercises. To provide a high challenge to balance, choose exercises that involve safely: ■ reducing the base of support ■ moving the centre of gravity and controlling body position while standing ■ standing without using the arms for support or reducing reliance on the upper limbs. 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).
Dose	At least 3 hours of exercise each week.
Modalities	Exercise programs should be designed or delivered by a suitably qualified health professional (e.g., physiotherapist or exercise physiologist) to ensure the exercises are challenging yet safe.
Intensity	Exercise should be individually prescribed and progressive. The instructor must be sensitive to the fatigue levels of individual participants and tailor the program's intensity accordingly.
Setting	Individual or group. Home-based or in the community, depending on the older person's preferences.
Duration of program	Ongoing exercise, with regular reviews of the older person's progress and introduction of new or a refresh of exercises included in the program.

7.2.4 Including all older people

Appropriate, tailored exercise is generally safe and beneficial for older people, even those with chronic health problems. However, some forms of exercise may be unsafe for older people with particular medical conditions. Before starting an exercise program, older people should be screened to assess whether medical clearance is required before exercising.[63]

Older people with health problems that affect their ability to exercise safely may require guidance from a health professional or other qualified exercise leader when starting a new exercise program.

Case study

Ms 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 occurred when Ms T tripped while outside. As a result, Ms T goes outside far less frequently. The GP observed some unsteadiness in Ms T's walking and turning and referred Ms T to a physiotherapist for a balance assessment.

The physiotherapist assessed Ms T using the Timed Up and Go Test and alternate step test and assessed that she was at high risk of falls. The physiotherapist explained to Ms T how she would benefit from a well-designed exercise program to improve her balance and general wellbeing and to reduce her risk of falls.

The physiotherapist initially referred Ms T to a supervised group balance and functional exercise program. Ms T later progressed to self-directed exercise, although she also continues to exercise with other people, which she enjoys and which supports her in maintaining motivation.

7.3 Special considerations for cognitive impairment

Risk factors for falls, such as gait and balance problems, are more prevalent in older people with cognitive impairment than in those without cognitive impairment.[71, 73, 98, 99] Older people with cognitive impairment should, therefore, have their fall risk investigated comprehensively.

Interventions that are effective for older people without cognitive impairment should not be withheld from older people with cognitive impairment unless the person is unable to follow or comply with instructions or chooses not to participate (see Chapter 8 on cognitive impairment).

For some older people with dementia, exercise may improve their executive functioning[100-102] and their ability to perform activities of daily living.[103]

Simplifying instructions and using picture boards and demonstrations are strategies that may improve the quality of exercise for older people with cognitive impairment. Carers, family members of the older person, or volunteers may be able to help supervise and motivate older people with cognitive impairment who are participating in exercise programs.

7 Balance and mobility

Additional information

- The Physiotherapy Evidence Database (PEDro) provides evidence-based information from randomised controlled trials, systematic reviews and evidence-based guidelines in physiotherapy.
- NSW Fall Prevention & Healthy Ageing Network leads initiatives on fall prevention and health ageing
- KeepAble is a digital platform that supports community aged care providers with free evidence-based resources on reablement delivery.
- Safe exercise at home provides information on physical activity and exercise for older people.
- Physiotherapy exercises support physiotherapists in developing exercise programs for people with injuries and disabilities.
- The Stepping On at Home video provides an introduction to simple balance exercises for older people.
- The Otago Exercise Programme is designed to prevent falls in older people living in the community.
- Hill KD, Miller K, Denisenko S, Clements T and Batchelor F (2011). Manual for Clinical Outcome Measurement in Adult Neurological Physiotherapy, 4th edition, APA Neurology Special Group (Vic).
- Chartered Society of Physiotherapy (United Kingdom) provides information about outcome measures for physiotherapy practice and an online database.

9 Cognitive impairment

8.1 Background and evidence

Cognitive impairment affects approximately 6 to 10% of older people living in the community.[104] Although cognitive impairment is strongly 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 medical conditions.

Cognitive impairment implies a deficit in one or more cognitive domains such as memory, attention, orientation, language, visuospatial skills or executive function, but is not synonymous with dementia.

Dementia

Dementia is a major neurocognitive disorder.[105] Features include significant cognitive decline from a previous level of performance in one or more cognitive domains that affect a person's ability to independently undertake everyday activities. Another disorder, such as delirium or depression, must not better explain the cognitive deficits.[105]

Dementia is one of the most common forms of cognitive impairment in older people, with approximately 450,000 Australians estimated to be living with dementia.[106]

Dementia often has a gradual onset with progressive decline in a range of cognitive abilities. Changes in personality, behaviour and social cognition commonly accompany dementia.[104]

Delirium

Delirium is a syndrome characterised by the rapid onset of variable and fluctuating changes in mental status. Delirium is a serious condition associated with increased mortality, which is often underrecognised.[107]

Delirium is a medical emergency that may need a period of hospitalisation to manage both the underlying precipitant and the manifestations of 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 orientation, mood, perceptions, psychomotor activity and the sleep-wake cycle.[108]

Dementia or delirium

Differentiating between dementia and delirium can be difficult, and the two conditions can coexist. Older people with existing cognitive impairment are more likely to develop delirium associated with an acute illness.[109]

It is crucial that delirium is diagnosed rapidly and treated early. Prevention of delirium may be more effective than early detection and treatment.[104, 110] Delirium is almost always due to a treatable underlying cause and should be addressed as soon as possible.

9 Cognitive impairment

8.1.1 Cognitive impairment associated with increased fall risk

Older people with cognitive impairment have an increased risk of falls and an increased risk of fall-related fractures like hip fractures.[111-113] The annual incidence of falls in this group ranges between 40% and 80%.[17, 114-117]

Older people with dementia in the community experience nearly 10 times more falls compared to older people without dementia.[117]

Older people with cognitive impairment who fall are five times more likely to be admitted to residential aged care services (RACS) than older people with cognitive impairment who do not fall.[118]

Cognitive impairment may increase the risk of falling by directly affecting an older person's ability to assess and respond to their environment and safely perform everyday activities.

Fall risk factors

Fall risk factors related to cognitive impairment include:

- reduced problem-solving ability
- reduced processing speed and visuospatial ability
- increased impulsiveness
- anxiety and depression
- poor gait, mobility and balance[115, 116, 71, 119, 120]
- reduced dual-task ability[121]
- for some with greater cognitive decline and preserved mobility, an increased tendency to wander[122-124]
- fear of falling, with some studies reporting a prevalence of fear of falling in older people with cognitive impairment of more than 50%.[125]

Table 8.1 details the fall risk factors associated with cognitive impairment.

Table 8.1: Fall risk factors associated with cognitive impairment

Fall risks associated with cognitive impairment	
Unmet need	The behavioural and psychological changes often associated with dementia are commonly a sign of unmet need. For example, thirst, hunger, pain, and the need to use the bathroom.[126]
Changes in Environment	Changes in the environment can contribute to changed behaviours such as confusion and agitation.[127] These behaviours may subsequently increase the risk of falls.[126] Changes in the environment include transitions between: ■ home and hospital ■ hospital and home or a RACS ■ home and another location where the older person will spend an extended period of time.
Medicines	Psychotropic medicines are more commonly prescribed in older people with cognitive impairment and have been associated with an increased fall and fracture risk.[17, 115, 128, 129]
Orthostatic hypotension	Orthostatic hypotension is more prevalent in older people with cognitive impairment. Note: Older people with cognitive impairment may not report symptoms associated with their blood pressure dropping following lying to standing blood pressure assessments, which increases the risk of falls.[130, 131]
Depression	Depressive symptoms have been independently associated with falls in community-dwelling older people with cognitive impairment.[115, 117, 119]

9 Cognitive impairment

Fall risks associated with cognitive impairment	
Specific types of cognitive impairment	Specific types of cognitive impairment appear to affect fall risk through different mechanisms.[132-134] For example: ■ People with Vascular and Lewy body dementia have significantly poorer gait and functional performance compared to older people with Alzheimer's disease.[132] ■ Vascular dementia is associated with a higher incidence of orthostatic hypotension.[135] ■ Lewy body dementia is associated with symptomatic postural hypotension and a higher incidence of orthostatic hypotension.[135]
Global cognition	Even though global cognition does not appear to be associated with fall status among older people with cognitive impairment,[119] it confers a moderate to high risk of serious fall-related injury.[136]
Executive function	Executive function impairment, slower processing speed and poorer visuospatial ability should be included as part of a fall risk assessment in older people with cognitive impairment.[115, 120]
Balance, mobility and gait	As with cognitively healthy older people, impairments in balance, mobility and gait,[99, 115, 119, 137] and lower levels of physical activity[115-117] have been associated with falls in older people with cognitive impairment.

8.1.2 Behaviour support plans

In Australia, RACS providers are required to have a behaviour support plan in place for older people in the RACS who require or may require the use of restrictive practices as part of their care.[138] This includes older people with cognitive impairment.

If relevant, the behaviour support plan will include information on how best to manage fall risk for the older person, considering their individual needs and circumstances.

Behaviour support plans are designed to inform the older person's ongoing care needs. Behaviour support plans must be reviewed and updated as behaviour changes are observed or occur and to reflect any new information received about the older person.

8.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

8.2.1 Assessing cognitive impairment

One of the most important initial steps in preventing falls in older people is to assess them for cognitive impairment. Generally, a general practitioner (GP) is responsible for assessing cognitive impairment and may be supported by other health professionals:

- **Assess for the presence of dementia or delirium**, as the rapid diagnosis and treatment of delirium and its underlying precipitant (e.g. infection, dehydration, constipation, pain) are crucial.[104]
- **Review the older person's medicines** for combinations that may contribute to an alteration in cognitive status.
- **Treat medical conditions** that may contribute to an alteration in cognitive status.
- **Conduct a detailed assessment** of older people who have a decline in cognition to determine the diagnosis and, when possible, treat reversible causes.[104] Referring the older person to a specialist memory service can be helpful in diagnosing cognitive impairment and developing an appropriate management plan.
- **Assess fall risk factors** for an older person with cognitive impairment and identify appropriate fall risk interventions to reduce the older person's fall risk.

9 Cognitive impairment

Some interventions, such as exercise, require the older person to be able to follow instructions or participate in a program. Where the older person has difficulty following instructions safely, an individualised assessment should be conducted and a fall prevention plan developed. Carers and family who know the older person may suggest ways to support them. This plan should be shared with the older person's substitute decision maker, carers and family (to the extent the older person chooses).

Tools for assessing cognitive impairment

The commonly used cognitive screens used for fall risk screening are summarised in Table 8.2.

The Rowland Universal Dementia Scale (RUDAS) is designed for use in multicultural populations like Australia.[139, 140]

For remote living Aboriginal and Torres Strait Islander peoples, the Dementia Guidelines recommends the use of the Kimberley Indigenous Cognitive Assessment, an assessment of cognitive function developed specifically for Aboriginal and Torres Strait Islander peoples.[141] However, the quality of evidence is low.

Further information about tools to assess a person's cognitive status is provided in the Clinical Practice Guidelines and Principles of Care for Older People with Dementia.

Table 8.2: Tools for screening and assessing cognitive status

Dementia screening	
Psychogeriatric Assessment Scales (PAS)	
Description	PAS assesses the clinical changes seen in dementia and depression. Three scales are derived from a face-to-face interview with the person (cognitive impairment, depression, stroke), and three scales are derived from a face-to-face interview with an informant, such as a carer (cognitive decline, behaviour change, stroke). The PAS is easy to administer and score and can be used by lay interviewers.
Time needed	20 minutes
Criterion	A score of 0–3: no or minimal cognitive impairment A score of 4–9: mild cognitive impairment A score of 10–15: moderate cognitive impairment A score of 16–21: severe cognitive impairment
Folstein Mini-Mental State Examination (MMSE)[139]	
Description	The MMSE 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.
Limitations	Significant limitations when used for Aboriginal and Torres Strait Islander peoples and culturally and linguistically diverse and poorly educated populations.
Time needed	5–10 minutes
Criterion	A score ≤23 indicates mild cognitive impairment. A score ≤18 indicates moderately severe cognitive impairment.
Accuracy	Score ≤23 to detect dementia[142, 143] 85-89% sensitivity 89-90% specificity

9 Cognitive impairment

Rowland Universal Dementia Scale (RUDAS)[140, 144]	
Description	The RUDAS is a simple method for detecting cognitive impairment and dementia in culturally and linguistically diverse persons and in those with limited education. RUDAS is valid across cultures, portable, and easily administered by primary health professionals. The test uses six items to assess multiple cognitive domains: memory, praxis, language, judgment, drawing and body orientation.
Time needed	10 minutes
Criterion	A score <23 suggests dementia (maximum score is 30).
Accuracy	89% sensitivity 98% specificity
General Practitioner Assessment of Cognition (GPCOG)[145]	
Description	GPCOG is a valid, reliable, quick-to-administer and easy-to-use cognitive assessment tool for use by general practitioners to detect dementia in Australian primary care settings. It consists of two sections: 1. Nine cognitive test items (patient section) and 2. Six historical questions (informant section).
Time needed	Patient section: 4 minutes Informant section: 2 minutes
Criterion	<u>Patient section:</u> A score of 9 indicates no significant cognitive impairment. A score between 5 and 8 out of 9 indicates that the informant interview should be conducted. A score of 0 to 4 out of 9 indicates cognitive impairment. <u>Informant section:</u> A score of 6 or more indicates less impairment. A score of 0 to 3 out of 6 indicates cognitive impairment.
Accuracy	Score <5 patient section, or if patient section score is 5-8 and informant section <4[145, 146] 80-85% sensitivity 86-91% specificity

9 Cognitive impairment

Abbreviated Mental Test Score (AMTS)[47]	
Description	The AMTS is a brief, easily administered assessment to test for the possibility of dementia and mental confusion. It does not require the person to read, write or draw anything. It is suitable for hospital or care settings where people may have limited mobility or visual impairments. The maximum score is 10.
Time needed	5 minutes
Criterion	A score ≤ 6 indicates delirium or dementia.
Accuracy	Score ≤6:[142, 147] 81-100% sensitivity 84-87% specificity Score ≤7:[142, 148] 81-100% sensitivity 83-95% specificity
The Short Portable Mental Status Questionnaire (SPMSQ)[149, 150]	
Description	SPMSQ is a short, easily administered instrument for use by health professionals in office-based or hospital settings. It consists of 10 items.
Time needed	5 minutes
Criterion	0-2 errors indicate intact intellectual functioning 3-4 errors indicate mild intellectual impairment 5-7 errors indicate moderate intellectual impairment 8-10 errors indicate severe intellectual impairment
Accuracy	Score ≤7[142] 92-100% sensitivity 89-100% specificity

9 Cognitive impairment

Montreal Cognitive Assessment (MoCA)[151]	
Description	MoCA is a brief cognitive screening tool for mild cognitive impairment and is also highly sensitive to dementia. It consists of 30 questions and assesses several cognitive domains: orientation, attention, memory, visuospatial abilities, language and executive function. There are adapted versions for people who are not literate or have limited years of education and those who are visually impaired. The maximum score is 30.
Time needed	10 minutes
Criterion	A score of 18-25 indicates mild cognitive impairment A score of 10-17 indicates moderate cognitive impairment A score of < 10 indicates severe cognitive impairment
Accuracy	Score ≤25 to detect mild cognitive impairment:[151, 152] 80-95% sensitivity 76-87% specificity Score ≤25 to detect Alzheimer's disease [151, 152] 100% sensitivity 76-87% specificity
Addenbrooke's Cognitive Examination-III (ACE-III)[153]	
Description	ACE-III is a comprehensive cognitive screening tool recommended for use by health practitioners and researchers for people over 50 years of age with suspected dementia. It was developed as an extension of the MMSE. ACE-III has a maximum score out of 100 and assesses five cognitive domains: attention, memory, fluency, language, and visuospatial abilities.
Time needed	15 minutes administration 5 minutes scoring
Criterion	A score ≤88 indicates MCI A score ≤82 indicates dementia
Accuracy	Score ≤88 to detect MCI:[154, 155] 75-100% sensitivity 89-96% specificity Score ≤82 to detect dementia:[154] 93% sensitivity 100% specificity The Mini-ACE is a briefer version of the ACE that evaluates four cognitive domains: orientation, memory, language and visuospatial function. It has a maximum score of 30 points and a five-minute administration time.

8.2.2 Fall prevention for people with cognitive impairment

Exercise has been shown to reduce the rate of falls in community-dwelling older people with cognitive impairment by approximately 30%, particularly when the exercise program has a strong focus on balance and involves more than 50 hours of exercise.[156-158]

Home hazard reduction, together with exercise, has demonstrated a significant decrease in the risk of multiple falls in older people with cognitive impairment living in the community, although not in the rate of falls.[47, 159]

Physical activity and aerobic exercise training benefit the cognition of older people with mild cognitive impairment,[160] at varying levels of dementia,[161] and with Alzheimer's disease.[162-168]

Fall prevention interventions that include exercise can also be effective in decreasing the fear of falling and improving balance, gait speed and control, and functional mobility in older people with cognitive impairment in a community-based setting.[167, 169-171]

[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 to maintain oral hydration in older people in residential aged care services (RACS).[172, 173] Although adherence was problematic, the following recommended strategies may also be beneficial for older people living in the community:

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

Case study

Mr F is a 72-year-old man living at home with his partner. He has recently been diagnosed with Alzheimer's disease. In the afternoon, Mr F walks around in the garden, which is accessed from the house by two steps. Mr F has fallen down the steps on several occasions, and his partner has had to ask their neighbour for help to get Mr F up.

The community nurse suggested referring him to an occupational therapist (OT) to complete a home environment assessment. Mr F agreed, and the OT recommended installing an anti-slip ramp with a rail. Mr F can now safely get in and out of the house without having to negotiate the steps.

9 Cognitive impairment

Additional information

A range of resources are available from associations and websites:

- Dementia Australia provides information, counselling and support for older people with dementia, their families and carers.
- Cognitive impairment program resources from the Australian Commission on Safety and Quality in Health Care.
- The Delirium Clinical Care Standard was developed by the Australian Commission on Safety and Quality in Health Care.
- Australian Clinical Practice Guidelines and Principles of Care for People with Dementia developed by the Cognitive Decline Partnership Centre.
- Clinical Practice Guidelines for the Management of Delirium in Older People.
- The Clinical Practice Guidelines for the Appropriate Use of Psychotropic Medications in People Living with Dementia and in Residential Aged Care, developed by Monash University, may be relevant to people receiving high-level care in the community.
- Kimberley Indigenous Cognitive Assessment, University of Western Australia.
- Allies in Dementia Health Care Project has a number of resources for allied health professionals supporting people with dementia.
- Understanding Dementia is a Massive Open Online Course (MOOC) that is freely available from the Wicking Dementia Research and Education Centre at the University of Tasmania.
- The Dementia Outcomes Measurement Suite is a compendium of validated tools for assessing various aspects of dementia by health professionals as part of the Dementia Centre for Research Collaboration.
- Dementia Training Australia provides resources for consumers and health professionals on dementia, helping to translate dementia research into practice.
- Cognitive impairment and dementia care for Aboriginal and Torres Strait Islander people in primary care webinar, Dementia Training Australia.
- Montreal Cognitive Assessment.

9 Medicine and medicines review

Recommendation

Medicines review: Facilitate access to collaborative medicines reviews by a general practitioner and pharmacist, in partnership with the older person to minimise the use of psychotropic medicines and other medicines that increase the risk of falls. (Level 2B)

9.1 Background and evidence

Epidemiological studies have shown an association between medicines use and falls in older people.[62, 174-178] The risk of falls can be increased by medicines interaction, unwanted side effects (such as dizziness) and the desired effects of medicines (such as sedation).

It is important that the whole multidisciplinary team recognises that older people can have different or unexpected responses to medicines, which can lead to potentially avoidable events, such as falls and fractures, and monitor for any behaviour changes that need to be assessed.

9.1.1 Medicine use and increased fall risk

Factors affecting an older person's ability to deal with and respond to medicines, which can lead to an increased risk of falls, include:[179]

- the ageing process and disease
- changes in pharmacokinetics: the time course by which the body absorbs, distributes, metabolises and excretes medicines
- changes in pharmacodynamics: the effect of medicines on cellular and organ function
- Not adhering to medicine therapy: including medicines misuse, underuse, overuse, or inappropriate prescribing. Poor medicine adherence has been associated with a 50% increased rate of falls in older people.

Classes of medicines

Medicine classes that increase the risk of falling in people aged 60 years and over include opioids, sedatives and hypnotics, neuroleptics and antipsychotics, antidepressants, benzodiazepines and certain classes of cardiovascular medicines.[180-182]

Certain classes of medicines may have a protective effect on fall risk.

Table 9.1 presents the various classes of medicines and discusses their relationship with fall risk.

9 Medicine and medicines review

Table 9.1: Medicines classes and relationship to fall risk

Psychotropic Medicines	
Centrally acting or psychotropic medicines	Centrally acting or psychotropic medicines are likely to contribute to falls and are associated with an increased risk of a fracture from a fall.[183-185] There is an increased risk of falling while taking these medicines, compared with not taking them, of between 25% and 90%.[180]
Benzodiazepines	Benzodiazepines are strongly associated with falls.[186, 187] Older people using other medicines, particularly antidepressants, are more likely to start using benzodiazepines.[188]
Antidepressants	Antidepressants are associated with higher fall risk, .[186, 187] in particular selective serotonin reuptake inhibitors (SSRIs) and tricyclic antidepressants (TCAs). .[186, 187] There is also a significant association between fragility fractures (fractures occurring due to minimal trauma, e.g. falling from a bed or chair) and the use of SSRIs, serotonin and noradrenaline reuptake inhibitors (SNRIs).[189]
Antipsychotic	Antipsychotic use is associated with an increased risk of falls.[186] Despite fewer extrapyramidal side effects, fall risk is still associated with the atypical antipsychotic agents (risperidone and olanzapine).
Cardiovascular Medicines	
Type 1A anti-arrhythmic medicines and digoxin	Type 1A anti-arrhythmic medicines and digoxin have been identified among the anti-arrhythmic class to increase fall risk.[182] However, the effect size for falls is likely to be modest, given the inconsistencies in the association between medicines and falls. [182]
Beta-blocking agents	Beta-blocking agents have demonstrated mixed results regarding fall risk, with both a potential protective effect and an increase in fall risk. [182]
Loop diuretics	Loop diuretics are significantly associated with an increased risk of falls, likely due to their rapid diuretic effect compared to other diuretics. [182]
Antihypertensive medicines	Antihypertensive medicines have been associated with an increased risk of serious fall injuries, particularly in those people with previous injurious falls.[189] Thiazides have been found to increase fall risk, particularly in the 3 weeks following the first prescription.[190] The risk of hip fracture may also be increased with the use of antihypertensives in the first 7-45 days following prescription.[191, 192]

9 Medicine and medicines review

Other Medicines	
Opioid	Opioid use is associated with an increased risk of falls as well as fall injuries and fractures among older people.[193, 194] Side effects of opioids, such as sedation, dizziness and cognitive impairment, may account for this association. [193]
Anticonvulsant medicines	Anticonvulsant medicines are associated with an increased risk of falls. [193]
Anticholinergic medicines	There is conflicting evidence for the risk of falls and the cumulative effects of anticholinergic medicines.[195-197]
Nonsteroidal anti-inflammatory drug (NSAID)	Adverse effects of certain non-steroidal anti-inflammatory drugs (NSAIDs) include confusion, dizziness or light-headedness, drowsiness and vision impairments. The evidence for increased risk of falls in NSAID users is inconsistent, and studies remain limited. The most recent and comprehensive systematic review found that NSAID use did not increase fall risk in an adjusted analysis. [193]
Rivastigmine	Preliminary evidence from a phase 2 trial indicates that the acetylcholinesterase inhibitor rivastigmine can improve gait stability and might reduce the frequency of falls for older people with Parkinson's Disease.[198]
Other	Other types of cardiac medicines, antacid medicines[199] and analgesic agents[193] are not consistently associated with an increased risk of falls.

Polypharmacy

Polypharmacy is the use of multiple medicines to prevent or treat medical conditions. It is commonly defined as the concurrent use of five or more medicines by the same person.[200] Medicines include prescription, complementary and non-prescription medicines.

Taking multiple medicines has been associated with an increased risk of falls and an increased risk of fall-related fractures in older people. [2,5,8,28,29] This may be the result of adverse reactions to one or more of the medicines, detrimental medicine interactions, or incorrect use of some or all the medicines.

The relative risk of falling for older people using only one medicine (compared with older people not taking any medicine) can be as high as 1.4, increasing to 2.2 for older people using two medicines and 2.4 for older people using three or more medicines.[177] Taking five or more medicines is associated with adverse effects on frailty, disability, mortality and falls.[197]

For each additional medicine, the potential reduction in fall risk for the older person should be balanced against the benefits of the medicine.

9.1.2 Evidence for interventions

A medicines review is a core part of the health assessment for an older person and should be completed regularly for those with repeat prescriptions. A medicines review should focus on appropriate prescribing, that is, checking that medicines are used safely and effectively and that other forms of treatment or management are considered as alternatives, if possible. For community-dwelling older people, their general practitioner (GP) is best placed to undertake a medicines review. See 9.2.1 below for further information.

9 Medicine and medicines review

Medicines adherence

Strategies to improve medicines adherence are beneficial in addressing the 50% increase in fall risk rate associated with poor medicine adherence.[201]

Deprescribing medicines

Studies evaluating medicines review interventions, which included deprescribing medicines that increase fall risk, such as cardiovascular and psychotropic medicines, have published mixed results on the effect of fall rates.[175, 202-204] Therefore, strategies to prevent the initial uptake of psychoactive medicines are encouraged to minimise any detrimental effects on an older person's fall risk.[204]

Management of insomnia

The prescription of benzodiazepines, z-drugs or other psychotropic medicine for the management of insomnia in older persons should be avoided unless there is a clear pattern of addiction or inability to complete a withdrawal program. Non-pharmacological approaches to the management of insomnia should be considered.

9.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

9.2.1 Reviewing medicines

Older people should have all their medicines, including prescription and non-prescription medicines and supplements, reviewed by a pharmacist and/or a GP at least yearly and after:

- after the initiation of a new medicine
- after a change in the older person's health status
- after a dose or regimen change of a medicine
- after admission to hospital or a rehabilitation service.

Home Medicines Review

Older people who live in the community are eligible for a home medicines review (HMR).

An HMR involves a credentialed pharmacist conducting a medicines review in the older person's home to help them better understand and manage their medicines. An HMR results in a report from the pharmacist to the referring GP, along with a medicine management plan agreed upon between the GP and the older person and their carers.

A home medicines review may be of benefit to older people:

- who take multiple medicines
- who have recently been discharged from hospital
- with recent and significant changes to their medicines
- who are seeing multiple GPs and specialists.

A member of the multidisciplinary team can use the checklist in Table 9.2 to determine whether an older person requires an HMR from a pharmacist or GP.[203] For more information, see the Home Medicines Review Program.

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Table 9.2: Checklist for a Home Medicines Review

Checklist for Home Medicines Review
A medicines review is needed if the older person:
is taking four or more different types of medicines
is taking more than 12 doses of medicines a day
is taking one or more psychotropic medicines
has three or more concurrent medical conditions
was discharged from hospital in the past four weeks
has significant changes made to their medicines regime in the past three months
is taking medicine with a narrow therapeutic index or requiring therapeutic monitoring (such as warfarin)
shows symptoms that suggest an adverse medicines reaction (e.g. confusion, dizziness, reduced balance)
is responding sub-therapeutically to treatment
is suspected of not adhering to their medicine regime or has problems with managing medicines-related devices
is self-managing their own medicine and is at risk due to literacy or language difficulties, dexterity problems, impaired vision or cognitive impairment
is attending a number of different medical practitioners, both GPs and specialists
has increased frailty
has experienced changes in health status or abilities (including falls, cognition, physical function, and a new diagnosis of a condition that impacts fall risk, such as rheumatoid arthritis).

9.2.2 Quality use of medicines

The World Falls Guidelines recommend assessing an older person's fall history and their fall risk before prescribing potential medicines that increase fall risk.[156]

The use of a validated, structured screening and assessment tool is recommended to identify medicines that increase fall risk when conducting a general review or medicines review targeted at falls prevention.[156]

The Fit fOR the Aged (FORTA) list is a medicines classification clinical tool used by suitably qualified health professionals to evaluate the appropriateness of medicines for older people and may improve medicines quality prescribing and reduce the risk of falling.[205, 206]

Good practice to ensure quality use of medicines

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

- Review medicines as part of a comprehensive assessment of an older person's risk of falling.
- Provide the older person and their carers with information about newly prescribed medicines or changes to prescriptions.
- Support the older person in following their medicines regime on discharge from a hospital or an acute care facility as part of a safe and high-quality transition of care.
- Polypharmacy should be limited to reduce adverse effects and interactions.
- Prescribe the lowest effective dosage of a medicine specific to the symptoms.
- Medicines that act on the central nervous system, especially psychotropic ones, are associated with an increased risk of falls and should be used with caution and only after weighing up their risks and benefits to the older person.
- Provide support and reassurance to older people who are gradually stopping the use of psychotropic medicines.
- If the older person needs to take medicines known to be implicated in increasing the risk of falls, try to minimise the troublesome effects (e.g. drowsiness, dizziness, confusion and gait disturbance).
- Increase awareness of medicines associated with an increased risk of falls with the multidisciplinary team, older person and their carers.
- Ensure accurate and timely documentation when implementing, evaluating, intervening, reviewing, educating and making recommendations about medicines use.

Case study

Mr P is an 80-year-old man who is taking nine different medicines. He felt unsteady and had several falls, mainly during the night. During a routine check-up, his GP assessed Mr P's need for a home medicines review.

The GP referred Mr P to his community pharmacist. The community pharmacist coordinated the review and made an appointment for a credentialled pharmacist to meet Mr P in his home. The credentialled pharmacist asked Mr P about all his medicines and gathered additional information from Mr P's carer, community nurse, community pharmacist and other members of the multidisciplinary team (with Mr P's consent).

The credentialled pharmacist clinically assessed the information gathered about Mr P's medicines and prepared a report for the GP.

The home medicines review report recommended that Mr P 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. Mr P and his GP discussed the home medicines review and agreed on a medicines management plan. Mr P slowly reduced the use of both medicines without adverse effects. He felt much more alert and confident while mobilising and steadier when getting up at night.

9.3 Special considerations for cognitive impairment

People with cognitive impairment may have difficulty taking medicine, and some older people will require medicine supervision. Blister packs and other technical prompts can be used as an aid. Prescribers should aim to keep drug regimens simple and, where possible, limit the frequency of medicines intake to a maximum of once or twice daily.

People with cognitive impairment may have trouble understanding information, instructions or communicating. This can affect the reliability of subjective assessments of an older person's ability to manage their medicines regime. The multidisciplinary team should pay special attention to changed behaviours and nonverbal cues in people with cognitive impairment.

Dementia medicines

There is evidence that dementia medicines, including cholinesterase inhibitors and memantine, do not significantly increase the risk of falls in older people with cognitive impairment; however, cholinesterase inhibitors may increase the risk of syncope.[207]

9 Medicine and medicines review

Additional information

- National Medicines Policy and Resources, Australian Government Department of Health and Aged Care
- Psychotropic Medicines in Cognitive Disability or Impairment Clinical Care Standard, Australian Commission on Safety and Quality in Health Care
- Guidelines for pharmacists providing Home Medicines Review (HMR) services, Pharmaceutical Society of Australia
- Standards of Practice for Clinical Pharmacy published by Advanced Pharmacy Australia.
- Australian Pharmaceutical Formulary and Handbook, 26th edition, the Pharmaceutical Society of Australia provides guidelines and practice standards for medicines management review.
- MIMS medicines database includes full and abbreviated information and over-the-counter information

10 Continence

10.1 Background and evidence

While urinary and faecal incontinence affect both males and females, it is not usually considered to be part of the normal ageing process.[208] However, age-related changes within the urinary tract do predispose older people toward urinary incontinence.[7]

Approximately 35% of older men and between 37% and 55% of older women in the community experience urinary incontinence.[208, 209] Urinary incontinence in older people is caused by multiple risk factors.[208]

Managing incontinence appropriately has been shown to improve urinary incontinence symptoms in older people and may improve overall care.[210]

10.1.1 Incontinence associated with increased fall risk

There is a significant association between urinary incontinence and falls in older people. However, the relationship between incontinence and falls is not straightforward and is likely to be confounded by impairments of mobility and cognition.[211-213]

Incontinence-assisted toileting[33, 209, 214] and symptoms of overactive bladder[33, 215] have been identified as risk factors for falls in older people who live in the community.[208, 216]t Nocturia (urge to urinate at night) is associated with an approximately 1.2-fold increased risk of falls and a 1.3-fold increased risk of fall-related fractures.[217]

Older people are often reluctant or embarrassed to discuss issues around incontinence. Older people may make extraordinary efforts to avoid an incontinent episode, which may place them at increased risk of falling.[218]

Bladder and bowel symptoms as fall risk factors

Different types and presentations of bladder and bowel symptoms are associated with an increased risk of falling and harm from falling. These are presented in Table 10.1.

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Table 10.1: Bowel and bladder symptoms and their relationship to fall risk

Bladder symptoms:
Nocturia
Nocturia is defined as being woken at night by the desire to void.[219] Nocturia is common and is significantly associated with an increased risk of falls and fall-related fractures among older people.[217]
Nocturia is one of the most common causes of poor sleep and can be particularly problematic when lighting is poor or when the older person is not fully awake.[220]
Urge (urinary) incontinence
Urge (urinary) incontinence is defined as involuntary urine leakage accompanied or immediately preceded by urgency.[219]
Urinary incontinence is associated with an increased risk of falls,[209, 211, 221-223] and fractures.[223] A larger volume of urine lost through incontinence is also associated with a greater risk of falls.[222]
Regardless of continence status, the walking speed and stride width of older women are reduced when they experience a strong desire to void.[218] The need to concentrate on getting to the toilet while walking, akin to dual tasking, is a contributing mechanism to fall risk.[212]
Poor motor and balance skills are strongly associated with urinary incontinence in older women in the community, proportional to the severity of incontinence and related specifically to urge incontinence. [20] Therefore, dysfunctional balance, gait and mobility may be potential mediators between urinary incontinence and falls.[218, 224, 225]
Lower Urinary Tract symptoms
Lower Urinary Tract symptoms refer to a group of clinical symptoms involving the bladder, urinary sphincter, urethra and, in men, the prostate.
Moderate and severe lower urinary tract symptoms (including urinary urgency and nocturia) in community-dwelling older men independently increase their risk of falls.[226]
Poorer functional mobility in older women has been related to lower urinary track symptoms, increasing their fall risk.[227]
Bowel symptoms:
Constipation
Constipation may cause delirium and agitation, which may, in turn, predispose an older person to falling.
Constipation is a common problem in older people and is related to decreased mobility, reduced fluid intake and the use of high-risk medicines.
Urinary incontinence is significantly associated with constipation in older Australian women who live in the community.[228]
Straining during defecation may also shunt blood away from the cerebral circulation, leading to dizziness or syncope (temporary loss of consciousness) due to the vasovagal phenomenon.[229] Relieving constipation improves lower urinary tract symptoms, including urinary incontinence.[230]
Diarrhoea
Diarrhoea may cause agitation as well as metabolic disturbance, which may, in turn, predispose an older person to falling.

10 Continence

Incontinence falls risk factors

While many falls in institutional care occur when going to or returning from the toilet, [27] few falls in older people who live in the community involve toileting.[7]

The strong associations reported between incontinence, dementia, depression, falls and level of mobility suggest shared risk factors rather than causal connections.[33, 231]

Urinary and faecal incontinence can predispose an older person to falls in the following ways:

- An incontinence episode increases the risk of a slip on the soiled or wet floor surface.[232]
- Urinary tract infections can cause delirium, drowsiness, hypotension and urinary frequency.
- Urinary or faecal urgency is associated with frequent and rushed trips to the toilet.
- Urinary incontinence is a significant risk factor for falls in older people who cannot stand unaided.[215]
- Medicines used to treat incontinence, such as anticholinergics or alpha-blockers, can cause postural hypotension and falls. Anticholinergics can also cause acute confusion and constipation.
- Medicines such as diuretics, used predominantly to manage heart failure, can potentially increase the risk of falls through increased urinary frequency or hypovolaemia (low blood volume).
- Poor vision and balance are common conditions in older people and are strongly associated with falls, perhaps adding to the likelihood of falls associated with nocturia and getting out of bed at night.[233]

10.1.2 Incontinence and fall prevention

There is limited evidence that continence care directly prevents falls in older people. However, the following interventions, when included in multifactorial fall prevention programs for older people in hospital and residential aged care services, have been shown to reduce the risk of falls and harm from falls. It is reasonable to extend the association of these interventions and a reduced risk of falls to older people living in the community.

Pelvic floor muscle training

The most recommended and most effective intervention for women with stress incontinence is pelvic floor muscle training. Men can also benefit from pelvic floor muscle training. A continence adviser, gynaecologist or physiotherapist can assist older people in the treatment of mixed and urge incontinence, faecal incontinence and in managing overactive bladder symptoms.

Toileting assistance programs

Toileting assistance programs are an important and practical approach to maintaining continence for many older people and may reduce the risk of falls.[234] The three types of toileting assistance programs – timed voiding, habit retraining and prompted voiding – are outlined in Section 10.2.2.

Continence management

A pelvic floor muscle training program combined with a balance and mobility exercise training program is effective at improving urinary incontinence symptoms as well as balance and gait in older women with urge urinary incontinence.[235]

Community-based group incontinence self-management workshops have been effective in improving symptoms in older women with urinary incontinence.[210] In the primary care setting, multiple-component interventions for addressing urinary incontinence and preventing falls have improved the quality of care.[236, 237]

10 Continence

10.2 Principles of care

Older people are often reluctant or embarrassed to discuss issues around continence. Health professionals and aged care workers should enquire openly and routinely about incontinence symptoms rather than rely on the older person to mention it during a consultation.

Continence care involves intimate personal care and treatment. At all times, continence care should be person-centred and respect the personal privacy, dignity and comfort of the person.

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

Aboriginal and Torres Strait Islander peoples

Falls, urinary incontinence and pain are common in Aboriginal and Torres Strait Islander peoples aged 45 years and over living in remote regions.[34] Incontinence is not a condition that is well understood by Aboriginal and Torres Strait Islander peoples, and it causes shame for many.

Using a person-centred, culturally safe approach to discussing incontinence is critical. Discuss the person's preferences for who they would like to speak with as Aboriginal or Torres Strait Islander men and women will generally only discuss this matter with a worker of the same sex as the person.[238]

Specific resources for Aboriginal and Torres Strait Islander peoples can be accessed from the Continence Foundation of Australia (see Additional Information below).

10.2.1 Assessing continence

The cause of an older person's incontinence should be established through a thorough assessment.

Older people may have more than one type of incontinence, which can make assessment findings difficult to interpret.[239] The following strategies can be used to assess and interpret the older person's continence status:

- Obtain a continence history from the older person to help with assessment and diagnosis. This may include a bladder chart (a frequency/volume chart) or a continence diary. Continence history should be recorded for a minimum of two days to provide a valid assessment.[240]
- Use simple, validated questions with the older person to help differentiate the type of urinary incontinence they have.[241]
- A bowel assessment may be required to determine the older person's normal bowel habits and any significant change because constipation can affect bladder function.
- Diagnostic physical investigations may be suitable and should be considered on an individual basis. Consent must be obtained from the older person before the physical examination, which should be conducted by a suitably qualified health professional.
- Post-void residuals should be checked in older people with incontinence.[233]
- Functional considerations, such as reduced dexterity or mobility of the older person, can affect toileting and should be assessed and addressed.
- A toilet assessment should consider accessibility, especially if the older person uses a walking aid, as well as proximity, height and the number of household members using the same toilet (see Chapter 16 on environment for more information).
- An assessment of fall risk factors related to incontinence needs to be considered, along with the symptoms and signs of bladder and bowel dysfunction.

10 Continence

Abrams et al. provide a comprehensive list of definitions for the symptoms, signs, urodynamics, observations, and conditions associated with lower urinary tract dysfunction, as well as revised explanations of recommended terminology for use in all age groups.[242]

10.2.2 Strategies to promote continence

There is limited evidence on the effectiveness of specific incontinence strategies as part of successful fall prevention programs in community settings. However, the principles of best practice care support managing incontinence as a fall risk factor, which will likely have wider health benefits for the older person.[213]

The suggested strategies below are adapted from those recommended by the 6th International Consultation on Incontinence 2018[243] and should be used to promote continence in the community setting:

- Ensure the older person has access to a comprehensive and individualised continence assessment that identifies and treats reversible causes, including constipation and the side effects of medicines.
- Use an adequate trial of conservative therapy (lifestyle factors) 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 the factors causing incontinence and to improve the continence status of the older person. Management of incontinence is a multidisciplinary task that ideally involves all suitably qualified health professionals involved in the care of the older person.
- 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 recognise their continence status and respond appropriately.
  - ☐ Timed voiding is characterised by a fixed schedule of toileting.
- Reducing an older person's intake of caffeine and carbonated drinks 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 the risk of 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 advisor if the usual continence management methods described above are not working or if the older person is interested in learning 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 using continence aids as a trial management strategy.

Case study

Ms 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 Ms U had reduced bladder capacity and detrusor instability from chronic constipation.

The constipation was treated, and Ms 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 fall risk assessment and ensure that targeted interventions were implemented accordingly.

10.3 Special considerations for cognitive impairment

Both urinary and gastrointestinal problems can cause acute delirium. Cognitive impairment and dementia can also lead to problems with both urinary and faecal continence. Urinary incontinence has been identified as an independent risk factor for falls in community-dwelling older people with dementia.[244]

Involve the older person with cognitive impairment and their carers in identifying strategies to support the older person in managing their continence issues, including strategies to remind older people with severe dementia of the location of the bathroom if necessary.

Regular, proactive toileting is recommended for older people with cognitive impairment. Partner with the older person and their carers to identify the older person's toileting times and develop strategies to prompt them to go at those times. Older people with cognitive impairment may benefit from prompted voiding,[245] scheduled toileting and attention to behaviour signals indicating the desire to void.

10 Continence

Additional information

- The National Continence Helpline (1800 33 00 66) is a free service provided by the Continence Foundation of Australia. The helpline is staffed by nurse continence advisers who provide confidential information on incontinence, continence products and local services. A range of resources on continence-related topics are available, including resources for Aboriginal and Torres Strait Islander peoples and translations into 14 languages.
- 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.
- The Continence: Caring for Someone with Dementia fact sheet was developed by Dementia Australia.
- Evidence-based guidelines on managing urinary incontinence, developed by the United Kingdom's National Institute for Health and Clinical Excellence (NICE).
- Guidance on the management of asymptomatic bacteriuria to reduce inappropriate antimicrobial prescribing in RACS is provided by the Australian Commission on Safety and Quality in Health Care.
- Aged Care Quality and Safety Commission resources on urinary tract infections.
- Australin Government Department of Health, Disability and Aged Care, Pelvic Floor Muscle Training for Men.

11 Feet and footwear

Recommendation

Podiatry: Provide older people with foot problems or disabling foot pain with access to a tailored podiatry intervention. (Level 1A)

11.1 Background and evidence

Foot problems are a contributing factor to mobility impairment and are directly associated with an increased risk of falling and fractures in older people.[246]

Inappropriate footwear is also a contributing factor to falls[247] and fractures in older people.[248] Wearing incorrectly fitting shoes and shoes with unsafe features is common among older people.

Many older people wearing inappropriate footwear believe the footwear to be adequate.[249] However, about 75% of older 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.[248]

Feet and footwear assessment is a common and effective fall prevention strategy.

Multifactorial fall prevention interventions that incorporate appropriately fitted and safe shoes or footwear for the older person result in a demonstrable reduction in falls.[248]

Footwear associated with increased fall risk

Footwear can increase the risk of falls in different settings for a range of reasons:

- Poorly fitting footwear or footwear inappropriate for the environmental conditions impairs foot position sense.[250]
- Wearing shoes with inadequate fixation (i.e. shoes without laces, buckles or Velcro fastenings) is associated with an increased risk of tripping.[248]
- Wearing high-heeled shoes impairs balance compared with low-heeled shoes[251-253] or being barefoot.[254]
- Medium or high-heeled shoes and shoes with a narrow heel significantly increase the likelihood of sustaining all types of fractures.[255]
- Slip-on shoes and sandals increase the risk of foot fractures because of a fall.[255]
- Slippers are often the indoor footwear of choice for many older people but are associated with an increased risk of injurious falls.[256]
- Walking barefoot or in socks is associated with a significantly increased risk of falling.[257, 258]

11.1.1 Appropriate footwear to reduce fall risk

Older people should be encouraged to wear appropriately fitted shoes, both inside and outside the home. Appropriate footwear can improve an older person's mobility, balance and gait and reduce the risk of falling.

Table 11.1 outlines the shoe characteristics recommended as safe for older people to prevent falls and associated harm.[259]

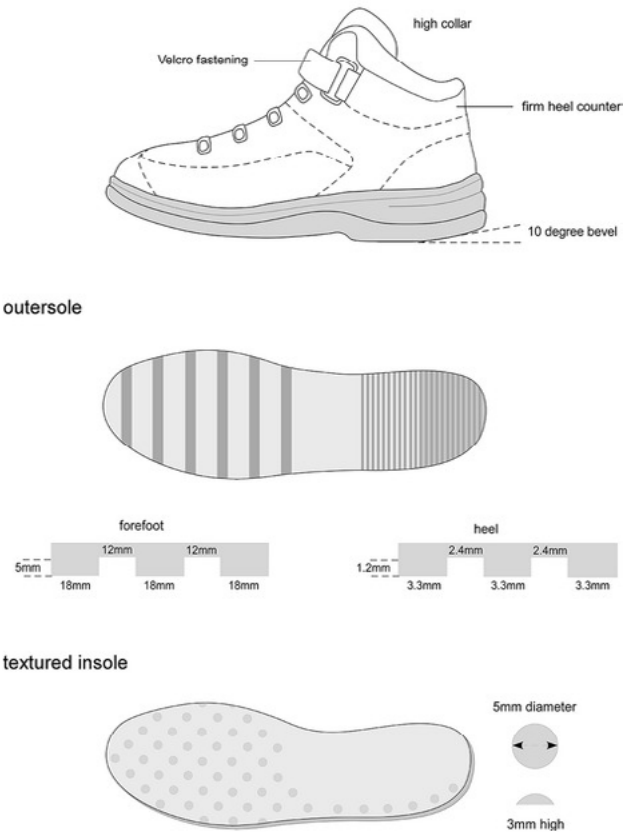
Table 11.1: Characteristics of best footwear for preventing falls

Characteristic	Rationale
Soles	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.

Theoretical 'safe' shoe

Figure 11.1 depicts a theoretical 'safe' shoe to optimise balance in older people. Feedback from older people using the 'safe' shoe has focused on improving the aesthetics and comfort of the 'safe' shoe, with further testing to be done to assess the possible relationship between the 'safe' shoe and an older person's fall risk.

Figure 11.1: The theoretical optimal 'safe' shoe[260]



Other footwear that has been shown to be beneficial in reducing the risk of falls in older people:

- Athletic shoes are associated with the lowest risk of falling.[257]
- High-collar shoes may be beneficial for balance during walking.[253, 261]
- Compared with wearing standard socks, wearing nonslip socks improves gait performance. It may be beneficial in reducing the risk of slipping in older people when walking on polished floorboards.[262]
- Subsensory vibratory noise applied to the sole of the foot can improve measures of balance and gait that are associated with falls.[263, 264]
- A rocker-shaped shoe sole (up to 15° angle) can increase toe clearance during walking without compromising measures of walking stability in older people.[265]

11.1.2 Foot problems and increased fall risk

Foot problems affect 60 to 80% of older people living in the community.[266, 267]

Foot problems are well recognised as a contributing factor to mobility impairment in older people, with fall risk increasing as the number of foot problems increases.[268] Women report a higher prevalence of foot problems than men, likely influenced by fashion footwear.[258]

For older people with diabetes, incorrect-fitting footwear is significantly associated with foot pain and the development of foot disorders such as corns, calluses and foot ulceration.[269]

The most commonly reported foot problems are:[267, 270, 271]

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

Key points on foot problems in older people which are associated with an increased risk of falls include:

- Older people with foot pain walk more slowly than those without foot pain and have more difficulty performing daily tasks.[266]
- 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, impairing balance and functional ability.[272-274 31-33] Podiatry may help manage these conditions.[275-277]
- Ageing is associated with reduced peripheral sensation, with older people who experience falls performing worse in tests of lower limb proprioception,[278] vibration sense[279] and tactile sensitivity.[278]
- Reduced plantar tactile sensitivity, particularly in older people with diabetes,[280] may be a risk factor for falls[271] because it might influence the ability to maintain postural control when walking, particularly on irregular surfaces.[281]
- People with diabetic neuropathy have impaired standing stability[282] and are at increased risk of falls and fractures.[283] Podiatry may help manage these conditions.[275-277]

- Cancer survivors with chemotherapy-induced peripheral neuropathy report impaired foot sensation. This, in turn, impairs their balance and stepping and increases their risk of falls.[284] There is growing evidence that exercise is an effective strategy for reducing symptoms and improving balance and mobility in this clinical group.[285]

11.1.3 Podiatry interventions to improve function and reduce falls

Multifaceted podiatry interventions and multifactorial interventions involving referral to podiatry as a fall prevention strategy have resulted in a significant reduction in fall rates in community-living older people.[286-288]

Multifaceted podiatry interventions can improve foot and ankle strength, range of motion, and balance and function ability. Podiatry interventions include:

- foot orthoses
- advice and provision of new footwear if required
- targeted foot and ankle exercises[289]
- fall prevention education and instructional leaflet.

Shoe insoles and foot orthoses can significantly facilitate improvements in balance and gait in older people through a combination of mechanical and sensorimotor mechanisms, which may translate to the prevention of falls.[290] Textured and vibration insoles appear to have the greatest effects.[291]

11.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

Assessing feet and footwear

An assessment of footwear and foot problems should be included as part of an individualised, multifactorial intervention for preventing falls and harm from falls for older people living in the community.[259, 292-294]

The following components of feet and footwear assessment are most relevant to this group of older people.

Assessment of footwear

A safe shoe checklist is a reliable tool for evaluating specific shoe features that can improve postural stability in older people.[295]

Assessment of foot problems

An older person should be assessed for foot pain and other foot problems regularly.

If any of the following conditions or clinical signs are evident in assessing the older person's feet, ensure the older person is referred to a podiatrist or other health professional skilled in the assessment of feet and footwear:

- foot pain
- foot problems, such as swelling, arthritis, corns, calluses, bunions, toe deformities, skin and nail problems or other foot abnormalities, such as 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.[296, 297]

Suspected distal sensory loss

If a foot assessment of an older person indicates suspected distal sensory loss, the older person should be referred to a suitably qualified health professional to look for potentially reversible or modifiable causes of the neuropathy.

Some of the more common causes of peripheral neuropathy include diabetes, vitamin B12 deficiency, peripheral vascular disease, alcohol misuse and adverse effects of some medicines.[283]

A recent study investigating the threshold for monofilament size in fall risk assessment among older people suggested that the 4.31 monofilament is the most effective for detecting the risk of falls among older people in terms of tactile sensory loss.[298]

A podiatrist assessment

A detailed assessment by a podiatrist for fall risk factors in an older person should include:[293, 297]

- a medicines and fall history: including foot pain and footwear use
- a dermatological assessment: skin and nail problems, infection status
- a vascular assessment: peripheral vascular status
- a neurological assessment: proprioception; balance and stability; sensory, motor and autonomic function
- a biomechanical assessment: posture, foot and lower limb joint range of motion testing, evaluation of foot deformity including hallux valgus, and gait analysis
- a footwear assessment: stability and balance features; prescription of footwear, footwear modifications, or foot orthoses based on the assessment of gait while wearing shoes
- education: to reinforce the link between poor footwear and foot problems and fall risk.

11.2.2 Strategies for improving foot condition and footwear

Health professionals providing care to older people living in the community can play an important role in addressing older people's feet and footwear problems. They should consider the following strategies which may help to prevent falls and harm from falls in older people:

Foot problems

- Debride calluses to improve functional ability.[275]
- Encourage toe-strengthening exercises to improve balance.[299]
- Investigate and treat the cause of peripheral neuropathy where possible.[300]
- For frailer older people who are most at risk of falling, develop personalised strategies to enhance adherence to podiatry fall prevention interventions.[301]

Footwear

- Use textured insoles to improve reactive stepping responses to perturbations.[260, 302]
- Use foot orthoses to improve posture and balance.[300]
- Consider aesthetics and comfort factors, including how easy the shoe is to put on, to encourage older people to adopt safe footwear-wearing habits.[249, 303]
- Use shoes with a high collar to improve balance when walking on uneven surfaces.[253, 261]
- Use nonslip socks or walk barefoot when walking on polished floorboards to reduce the risk of slipping.[262]
- Use a shoe with a sole rocker up to 15° to increase toe clearance during walking.[265]
- Use shoes with 10° bevelled heel to optimise slip resistance.[260]

Importance of education

Educating older people and their carers about basic foot care can empower the older person to help manage their health.

Older people may be reluctant to change their footwear for various reasons, including the real or perceived expense. Provide education to the older person and their carers on what adequate fitting, appropriate and safe footwear looks like and why safe footwear is important for good foot care and for managing fall risk.[269, 304]

General strategies for advising about safe footwear

General strategies for advising about safe footwear include:

- identifying ill-fitting or inappropriate footwear
- screening older people for foot pain or foot problems
- ensuring shoes are repaired when indicated
- recognising that older people who have a shuffling gait (e.g. due to Parkinson's disease) 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 older people from walking while wearing slippery socks and stockings
- referring the older person to a podiatrist for orthotics in cases of significantly deformed feet.

Case study

Mr R is 74 years old and visited his general practitioner (GP) for the 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 (specifically, loss of light-touch pressure sense) 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 purchase better-fitting footwear that improved his stability while still being safe for his neuropathic feet. Mr R's balance improved after he bought more appropriate footwear.

11.3 Special considerations for cognitive impairment

Older people with cognitive impairment may not reliably report discomfort. Therefore, when checking older people's footwear, the general practitioner or other members of the multidisciplinary team should check the older person's feet for lesions, deformity and pressure areas.

Footwear and foot care issues should also be discussed in detail with the older person's carers and family (to the extent the older person chooses).

11 Feet and footwear

Additional information

Footwear:

- Stay On Your Feet Program fall prevention resources, Queensland Government.

Foot care and ageing feet:

- American Podiatric Medical Association: brochures, fact sheets and other information on topics such as ageing feet
- Indigenous Diabetic Foot Program, SARRAH
- The Looking After Feet Project provides culturally appropriate resources developed for Aboriginal and Torres Strait Islander peoples as part of the Aboriginal and Torres Strait Islander Diabetes-Related Foot Complications Program.

Rural and regional Australia:

- The Australian Podiatry Association provides details of practitioners visiting rural and remote areas in each state and territory: http://www.podiatry.org.au/
- Resources that may assist rural and remote practitioners have been developed by Services for Australian Rural and Remote Allied Health (SARRAH): https://www.sarrah.org.au/

12 Syncope

Recommendation

- **Pacemakers:** Facilitate access to a medical practitioner to consider treatment options for older people diagnosed with the cardio-inhibitory form of carotid sinus hypersensitivity and to fit a dual-chamber cardiac pacemaker. (Level 2B)

12.1 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.

While several conditions can present with syncope, all share the final common pathway of cerebral hypoperfusion, leading to an alteration in consciousness. Older people are more likely to experience syncopal events due to age-related physiological changes that affect their ability to adapt to changes in cerebral perfusion.

The incidence of syncope in older people living in the community has been reported as 6.2 per 1,000 person-years.[305] 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, coughing and postprandial syncope.

Self-reported cardiovascular symptoms, including angina, heart failure, heart murmur, arrhythmia and myocardial infarction, are associated with syncope and a history of multiple falls in community-dwelling older people.[306]

The main types of syncope are outlined below.

12.1.1 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.[305]

Vasovagal syncope is often preceded by pallor, sweatiness, dizziness and abdominal discomfort, although these features are not always seen in older people. [305] Commonly reported precipitants of vasovagal syncope include prolonged standing (particularly in hot or confined conditions), fasting, dehydration, fatigue, alcohol consumption, acute febrile illnesses, pain, venepuncture and hyperventilation.

The diagnosis of vasovagal syncope is usually made clinically. However, formal assessment with non-invasive cardiac monitoring and prolonged tilting is possible.

Treatment is largely non-pharmacological 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. Older people also need to be reassured that vasovagal syncope is a benign condition.

12.1.2 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.[7, 307]

A formal diagnosis of orthostatic 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 lie still for at least five minutes before taking the initial lying blood pressure measurement.

Causes of orthostatic hypotension

Medicines and volume depletion are the two most common causes of orthostatic hypotension in older people. Medicines commonly associated with orthostatic hypotension include antihypertensive agents, antianginals, antidepressants, antipsychotics and antiparkinsonian medicines and diuretics. Diuretics can have a direct effect on blood pressure and can also cause volume depletion, which can cause orthostatic hypotension.

Certain diseases (e.g., Parkinson's disease, stroke and diabetes) can directly affect autonomic function and interfere with blood pressure regulation. Prolonged periods of immobility can disrupt postural control of blood pressure.

Treatment for orthostatic hypotension

Treatment of orthostatic hypotension involves identifying the precipitating cause and addressing it, including modifying medicines where possible. Maintaining adequate hydration, particularly during hot weather, is important for older people (see the point of interest box on maintaining hydration in Chapter 8 at 8.2.2).

Pharmacological intervention is necessary in a small number of cases to treat orthostatic hypotension. Medicines that might be used include fludrocortisone or midodrine (an alpha-agonist).

Orthostatic hypotension and fall risk

Orthostatic hypotension is associated with an increased risk of falls and harm from falls.[308-313]

Several mechanisms have been suggested for how orthostatic hypotension can predispose older people to falling:

- A direct pathway in which the decrease of postural blood pressure leads to fainting or syncope.
- Indirect pathways include:
  - ☐ Orthostatic hypotension impairing cognitive function
  - ☐ Impairments of balance and mobility due to presyncope
  - ☐ Medicines-induced increased magnitude and duration of orthostatic hypotension, often compounded by inappropriate polypharmacy.[308]

12.1.3 Carotid sinus hypersensitivity

Carotid sinus hypersensitivity is an abnormal haemodynamic response to carotid sinus stimulation. When associated with symptoms, it is referred to as 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 may include carotid massage, shaving, wearing tight collars or neckwear, or tumour compression.[314]

Three abnormal responses can be noted on direct massage of the carotid sinus:

- The cardio-inhibitory response is defined as a three-second period of asystole following massage of the carotid sinus.
- A vasodepressor response is defined by a 50 mmHg drop in blood pressure in the absence of significant cardiac inhibition.
- A combination of the vasodepressor and cardio-inhibitory response defines the mixed form of carotid sinus hypersensitivity.

12.1.4 Cardiac arrhythmias

Abnormal heart rhythms can lead to dizziness and syncope, with atrial fibrillation independently associated with falls and syncope in older people.[315]

Sick sinus syndrome is an abnormal slowing of the heart caused by degeneration of the cardiac conducting system. Sick sinus syndrome is managed by inserting a cardiac pacemaker.

Slowing of the heart rate can also be associated with certain medicines (beta-blockers and digoxin). The treatment in these cases is reducing or ceasing the prescription of these medicines.

Diagnosis of an abnormal heart rate requires that an older person be monitored at the time of the abnormal heart rate, which can often be challenging. Treatment depends on the nature of the abnormal rhythm.

12 Syncope

12.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

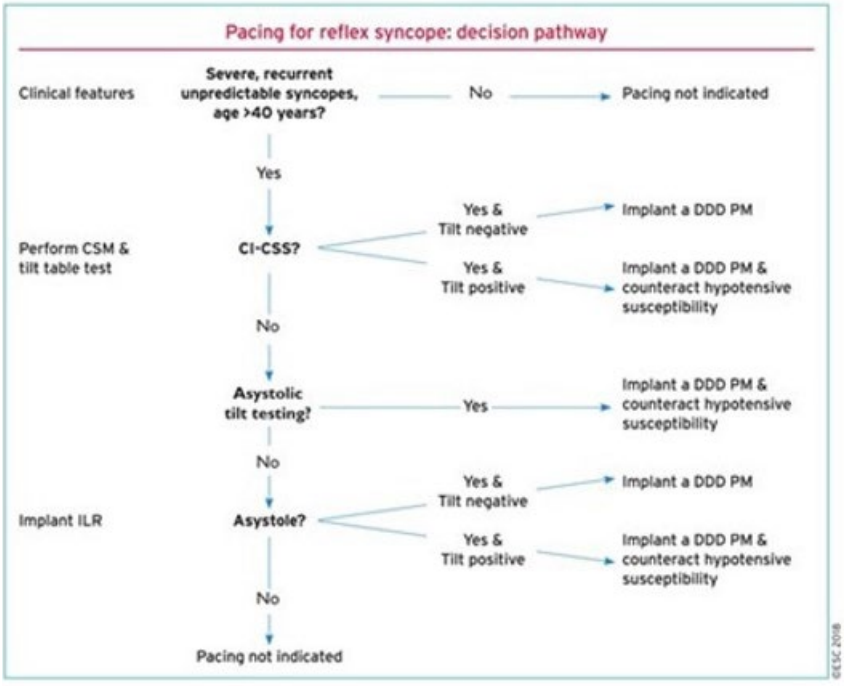
12.2.1 Assessing syncope

It is important to ensure that older people reporting presyncope or syncope undergo appropriate assessment and intervention, particularly if the cause is not obvious.

A general practitioner should evaluate the older person's symptoms and, depending on the history and results of the clinical examination, certain tests and investigations may be warranted. These include an electrocardiogram (ECG), echocardiography, tilt-table testing and carotid sinus massage,[316] continuous non-invasive orthostatic blood pressure measurement[317] and insertion of an implantable loop recorder.

The European Taskforce on Syncope has produced a simple algorithm for decision making.[307]

Figure 11: Descision pathway for cardiac pacing in patients with reflex syndrome. CI CSS = cardioinhibitory carotid sinus syndrome; CSM = carotid sinus massage; DDD PM = dual-chamber pacemaker; ILR = implantable loop recorder.



12.2.2 Treating syncope

Permanent cardiac pacing is successful in treating certain types of syncope. Pacemakers may reduce falls for older people with cardio-inhibitory carotid sinus hypersensitivity.

Successful multifactorial fall prevention strategies for older people with syncope have included assessments of blood pressure and orthostatic hypotension, and a medicines review and modification.[46, 174, 176, 214]

Strategies that have been suggested to reduce the symptoms of orthostatic hypotension include:

Ensure good hydration is maintained, particularly in hot weather. [318, 319]

- Encourage the older person to sit up slowly from a lying position, stand up slowly from a sitting position, and wait a short time before walking. [318, 319]
- Minimise exposure to high temperatures or other conditions that cause peripheral vasodilation, including hot baths. [319]
- 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 medicines that may cause hypotension.
- Provide appropriate peripheral compression devices, such as anti-embolic stockings, if indicated. [319]
- Monitor and record postural blood pressure.

Case study

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 because 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.

12.3 Special considerations for cognitive impairment

Older people with cognitive impairment may experience difficulty recalling the events surrounding a fall. It is also important to note that older people with dementia may not present with traditional symptoms of orthostatic hypotension, such as dizziness, and instead present with mental fluctuations and confusion, drowsiness and slow falls.[320] Orthostatic hypotension should, therefore, be considered as a differential diagnosis to ensure early diagnosis and treatment.

Orthostatic hypotension is common in older people with vascular dementia, and many older people with cognitive impairment and dementia may be taking medicines that are associated with orthostatic hypotension and cardiac arrhythmias, such as antihypertensives, antidepressants and antipsychotics.

Orthostatic hypotension is significantly associated with falls in older people with dementia.[117]

12 Syncope

Additional information

ACC/AHA/HRS versus ESC guidelines for the diagnosis and management of syncope: JACC guideline comparison. Journal of the American College of Cardiology 2019: 74(19), 2410-2423.

13 Dizziness and vertigo

13.1 Background and evidence

Dizziness is a term used to describe a range of sensations, including:

- Vertigo: the sensation of spinning
- Disequilibrium: a feeling of imbalance or being unsteady
- Light-headedness: the sensation of giddiness
- Presyncope: the sensation of feeling faint or foggy.

Dizziness is common in all age groups, but its prevalence increases markedly with age.[321, 322] Dizziness is a significant contributor to disability in middle-aged and older people.[323]

One in three older people living in the community report symptoms of dizziness;[324] however, very few of these people are likely to consult their general practitioner (GP) for a review of their symptoms.[325]

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

Dizziness in older people often presents a challenging diagnostic problem because it is a subjective sensation that may result from impairment or disease in multiple systems. [326] The underlying cause of dizziness is unknown in 8% to 23% of people.[327, 328] The most common diagnosis for dizziness is benign paroxysmal positional vertigo (BPPV).[329]

Dizziness is associated with an increased risk of falling in older people.[330, 331] Poor sensorimotor function, impaired balance control, anxiety and neck and back pain have been identified as mediators of the relationship between dizziness and falls.[332] Older people with dizziness are also at high risk of experiencing fall-related fractures.[332]

13.1.1 Vestibular disorders and falls

Vestibular dysfunction is the leading cause of dizziness in older people, with age-related changes in the vestibular system prevalent in people older than 70 years of age.[333] These changes include asymmetrical degenerative changes, which may contribute to fall risk by impairing balance control and providing inaccurate information to the brain about the direction and size of head or body movements.

Older people with vestibular dysfunction who are clinically symptomatic have a significantly increased risk of falling.[334-336] with vestibular dysfunction found to be more prevalent in fallers versus non-fallers in community-dwelling older people.[337]

Older people with BPPV often have balance problems. More research is needed to validate whether there is an association between older people with BPPV and their risk of falling, yet a cross-sectional study found that 1 in 10 older people presenting to an outpatient clinic with a range of chronic medical conditions had undiagnosed BPPV, and these older people were more likely to have sustained a fall in the previous three months.[338]

A higher incidence of falls is associated with older people who have increased variability in their perception of the postural vertical, as assessed using a tilt platform.[339] Poor perception of the postural vertical is an indicator of the vestibular (otolith) function without visual input and with reduced somatosensory feedback.

13 Dizziness and vertigo

13.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

13.2.1 Assessing vestibular function

An important step in minimising the risk of falls associated with dizziness is to assess an older person's vestibular function. A suitably qualified health professional should do this and should involve the following:

- **Ask the older person about their symptoms.** Dizziness is a general term used to describe a range of symptoms, including poor balance, that imply a sense of disorientation.[333] Vertigo, a subtype of dizziness, is highly characteristic of vestibular dysfunction and is generally described as a sensation of spinning.[340]
- **Conduct a medicines review,** as many medicines have dizziness-related side effects.
- **Focus on the timing and triggers of symptoms** and use simple eye movement assessments to help diagnose and treat common peripheral vestibular disorders. Put less emphasis on the type of dizziness, patient demographics and routine use of neuroimaging.[341]kerbe
- **Consider other causes of dizziness if symptoms are not improving,** such as migraine or Persistent Postural Perceptive Dizziness, and refer the older person to a specialist, such as an ear, nose and throat specialist or a neurologist if required.[340]

Table 13.1 outlines specific tests that can be used to assess vestibular function and will require referral to a suitably qualified health professional.

13 Dizziness and vertigo

Table 13.1: Specific tests that can be used to assess vestibular function

Clinical test	Use in assessing vestibular function
Halmagyi head thrust test	The Halmagyi head thrust test assesses peripheral vestibular function.[342] The head thrust test only has good sensitivity if the vestibular dysfunction is severe or complete.[343]
Audiology testing	Audiology testing can quantify the degree of hearing loss. The auditory and vestibular systems are closely connected; therefore, auditory symptoms, such as hearing loss and tinnitus, commonly occur in conjunction with symptoms of dizziness and vertigo.[344]
Dix–Hallpike manoeuvre	Use the Dix–Hallpike manoeuvre to diagnose BPPV.[345] 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. A Dix-Hallpike manoeuvre should be completed routinely for all older adults (in the absence of contraindications), given the increased prevalence of BPPV and underreporting of symptoms. This test is included in a diagnostic protocol for evaluating dizziness in older people in general practice and is considered mandatory in all people with dizziness and vertigo after head trauma.[344, 346] Note, Dix–Hallpike testing should not be used in people with an unstable cardiac condition or a history of severe neck disease.[347] Dix-Hallpike can be modified for older people with other comorbidities[348]
Vestibular function tests	Vestibular function tests evaluate the integrity of the peripheral (inner ear) and central vestibular structures.[349] These tests are available at some specialised audiology clinics and may be recommended if symptoms persist.[349]
Medical imaging	Computed tomography (CT) or magnetic resonance imaging (MRI) can identify an acoustic neuroma or central pathology.[340]

13.2.2 Assessing dizziness

To improve symptoms of dizziness in older people, a multifactorial approach that includes assessments of cardiovascular conditions and medicines use, benign paroxysmal positional vertigo, anxiety, and postural sway might assist in tailoring evidence-based therapies for the individual.[328]

There is insufficient evidence to validate the use of diagnostic tests for evaluating dizziness in the community care setting.[350]d The evidence presented below is from the primary care setting and is relevant to the community care setting.

Seven-item sum score as a predictor of dizziness-related impairment

One study found that by examining easily obtainable clinical information about seven factors over a 6-month period, researchers could predict which older people had persistent dizziness-related impairment.[350] These factors included:

1. chronic dizziness
2. standing still as a dizziness-provoking circumstance
3. trouble walking or (almost) falling as an associated symptom
4. polypharmacy
5. absence of diabetes mellitus
6. having an anxiety or depressive disorder
7. impaired functional mobility.

A simple sum score of these seven factors identified individuals with an unfavourable course of dizziness, especially for sum scores of 4 and higher. Treating factors amenable to intervention, including anxiety and depression, polypharmacy and functional mobility, may be most effective for clinical management.

Simultaneous diagnosis and prognosis approach

Even if a diagnosis is not available, a simultaneous diagnosis- and prognosis-oriented approach for older persons who experience dizziness may improve care for this group.[351] The Dizziness Handicap Inventory and seven-item sum score[352] could be used to identify patients at risk of persistent impairment and modifiable predictors that can be identified and treated. Table 13.2 provides some examples.

Table 13.2: Persistent impairment predictors for dizziness and their treatment options

Persistent impairment predictors	Treatment options
Impaired functional mobility	Physical exercise or physiotherapy
Comorbid anxiety	Psychotherapy and/or anxiolytics
Comorbid depression	Psychotherapy and/or antidepressants
Dizziness due to psychiatric cause	Psychotherapy and/or psychotropic medicines
Polypharmacy	Withdrawal of potentially inappropriate medicines
Avoidance of dizziness-inducing situations	Cognitive behaviour therapy.

13.2.3 Choosing interventions to reduce symptoms of dizziness

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

An example of a multifactorial tailored approach that has shown to be effective in treating dizziness-related impairment in older people was comprised of one or more of the following:

- a physiotherapist-led vestibular rehabilitation program
- an 8-week internet-based cognitive-behavioural therapy
- a 6-month home-based exercise program
- medicines management.[328]

Older people with symptoms of dizziness should undergo a medical review before any interventions are introduced or before starting a rehabilitation program.

Medical management

Vestibular neuritis

The treatment of vestibular neuritis (a viral infection of inner ear structures) with methylprednisolone within three days of acute onset has been shown to improve vestibular function at a 12-month follow-up, with complete or nearly complete recovery of vestibular function in 76% of the study population.[353]

Vertigo symptoms and balance

Anti-vertigo medicines combined with vestibular rehabilitation training are effective and safe. They can alleviate vertigo symptoms and improve balance in patients with vestibular neuronitis.[354]

Nausea and vomiting

Treatment with antiemetics and vestibular suppression medicines may be required to treat the unpleasant symptoms associated with nausea and vomiting.[355] These medicines 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.[340, 355]

Treating benign paroxysmal positional vertigo (BPPV)

It is important to diagnose and treat BPPV as soon as possible, as treatment reduces dizziness and improves general wellbeing.[356]

Older people with diagnosed BPPV respond as well to treatment as the general population, even though they require more canalith repositioning procedures to treat their BPPV.[357] However, poor outcomes, including poorer dynamic balance recovery and increased self-perceived level of handicap, are apparent in older people compared to younger people.[358]

Table 13.3 outlines the range of treatment options for BPPV.

Table 13.3: Treatment options for BPPV

Treatment	Process
Brandt and Daroff exercises	Brandt and Daroff exercises are simple exercises that can be done regularly and are designed to break up any material collecting in the ear canal that may be impacting a person's balance.359
The Epley manoeuvre	The Epley manoeuvre is highly successful for treating BPPV.360,361 It involves taking the older person slowly through a range of positions that aim to move the freely mobile otoconia back into the vestibule. A modified Epley manoeuvre is effective at treating posterior canal BPPV.362
BBQ Roll or Gufoni manoeuvre	The BBQ Roll or Gufoni manoeuvre should be used to treat older people with horizontal canal BPPV. These or other appropriate manoeuvres should only be undertaken by a vestibular physiotherapist.363
Vitamin D supplementation	A course of vitamin D supplementation has been shown to reduce the rate of annual recurrence of BPPV attacks by 24% in older people with frequent BPPV attacks.364

Symptoms of BPPV with the absence of nystagmus

Older people with symptoms on a Dix-Hallpike or BBQ Roll test in the absence of nystagmus should be treated sparingly using the appropriate manoeuvre.

If there is a continued absence of nystagmus and no improvement in symptoms over the course of two sessions, the older person should be referred onwards to a neurologist, as central vestibular impairments can present as BPPV.

If the older person is not improving after two to three treatments for BPPV, the clinician should refer them to a vestibular physiotherapist.

Vestibular rehabilitation

Vestibular rehabilitation is a multidisciplinary approach to treating stable vestibular dysfunction:

- **Physiotherapy intervention** 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.[365]
- **Occupational therapy intervention** involves incorporating the movements required to do these exercises into daily activities.[366]
- **Psychology input** addresses the emotional impact of vestibular dysfunction.[367]

The literature emphasises the following characteristics of vestibular rehabilitation:

- Vestibular rehabilitation is a safe, effective management for unilateral peripheral vestibular dysfunction.
- Vestibular rehabilitation is highly successful in treating stable vestibular problems in people of all ages.[368, 369]
- Delayed initiation of vestibular rehabilitation is a significant factor in predicting unsuccessful outcomes over time.[370]
- The success of vestibular rehabilitation in older people in the community is not influenced by age.[371]
- Group session vestibular rehabilitation for older people diagnosed with vestibular asymmetry had a positive effect on the occurrence of vestibular asymmetry.[372]
- Vestibular rehabilitation can improve measures of balance performance in older people in the community. [373, 374] However, a study of older people with multisensory dizziness found that the prevalence of falls over a 12-month period did not differ between those receiving vestibular dysfunction and a control group.[375]

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 https://australian.physio/.

Case study

Mr S is an 81-year-old man who presented to his 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 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 instructed to perform Brandt-Daroff exercises 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.

13.3 Special considerations for cognitive impairment

Alzheimer's Disease may involve impairments in the vestibular control of balance. Assessment of visual suppression may be useful in identifying older people with Alzheimer's Disease who are at risk of falling.[376]

Additional information

- The Vestibular Disorders Association website provides resources on vestibular impairments and their treatments.
- Physiotherapists who are trained to assess and manage dizziness can be found by contacting the Australian Physiotherapy Association.
- The Royal Australian College of General Practitioners has information on:
  - ☐ Brandt-Daroff Exercises for patients.
  - ☐ Epley Manoeuvre.

14 Vision

Recommendations

Cataract surgery: For older people with clinically significant visual impairment primarily due to cataracts, facilitate timely referral to a medical practitioner for cataract surgery in both eyes (unless contraindicated). (Level 1A).

Eyewear prescription: Advise active older people to use single-lens distance glasses (rather than bifocal, multifocal or progressive lenses) when active outdoors. (Level 2B). When updating the older person's glasses prescription, limit the change in prescription where possible. (Level 2B)

14.1 Background and evidence

Vision loss is a common chronic condition in older people.[377]r About 20% of people aged 70 years or older have impaired vision with a visual acuity of less than 6/12.[378]

Impaired vision is an important and independent risk factor for falls and fractures in older people who live in the community and is associated with increased frailty.[379-382]

Regular eye examinations to assess an older person's vision can prevent vision-related impairment and improve quality of life by ensuring the older person receives the correct prescription for glasses and is not wearing outdated prescriptions or no glasses when a glasses prescription is indicated.[383-387]

14.1.1 Visual functions associated with increased fall risk

Vision is a key sensory input for maintaining balance and avoiding falls related to environmental obstacles. Older people rely disproportionately more on visual information than on proprioceptive or vestibular input for balance control.[388]

Research in the community setting has shown that:

- Many older people wear outdated prescriptions or no glasses and would benefit from wearing new glasses with the correct prescription. [383-387]
- The risk of multiple falls increases 2.6 times if a person's visual acuity is worse than 6/7.5.[389]
- Visual acuity of 6/15 or worse almost doubles a person's risk of hip fracture, and this risk increases as visual acuity levels become worse.[390]
- Impaired visual acuity, reduced contrast sensitivity,[391, 392] poor depth perception[393, 394] and reduced visual field size.[389, 395-398] They are also associated with an increased risk of falling and an increased risk of low-fragility hip fractures.[399]
- Fear of falling is more frequently reported in older people with visual deficits.[377, 400, 401]
- Many medicines are associated with visual disturbances, which may contribute to falls. Medicine side effects include blurred vision, double vision, cycloplegia (loss of accommodation), changes in colour perception, lens opacities and halo vision. [377]
- Older people who wear bifocal or multifocal lenses when walking outside the home and on stairs have a decreased ability to negotiate steps safely[402] and a two-fold risk of falls from tripping.[393]

14.1.2 Eye conditions associated with an increased fall risk

Several eye conditions common in older people, which are associated with an increased risk of falling, are outlined below, along with corresponding simulations of the visual impairments in Figure 14.1.

Cataracts

Visual changes resulting from cataracts are associated with increased postural instability[403] and fall risk and injury in older people living in the community.[404, 405] There is a 2-3-fold increased risk of falls in older people with cataracts compared to those without.[406] Older people with cataracts have been found to show a high fear of falling, particularly in those with poorer physical function, more comorbidities and greater visual disability.[407]

14 Vision

Glaucoma

Older people with glaucoma can present with a range of loss of peripheral visual fields (side vision). Depending on disease severity, loss of visual fields can affect a person's postural stability[408] and their ability to detect obstacles and navigate through cluttered environments.[396, 409]

Several gait characteristics, including a broader base of support and greater variability in step length, stride length, and stride velocity, are associated with a higher risk of falling. These characteristics are also positively associated with glaucoma severity.[410]

Falls are common among older people with glaucoma and more frequent among those with greater visual impairment, particularly in the inferior field region.[411]

Macular degeneration

Macular degeneration can cause loss of central vision, depending on the disease severity, and is associated with impaired balance[412] and an increased risk of falls[413, 414] and injurious falls.[413, 414]

Diabetic retinopathy

Diabetic retinopathy can reduce visual field size and may increase the risk of falls.[379]

Figure 14.1: Visual changes compared with normal vision

Source: Courtesy of Vision 2020 Australia

Figure 14.1 Normal vision

Source: Courtesy of Vision 2020 Australia

Figure 14.2 Visual changes resulting from cataracts

Source: Courtesy of Vision 2020 Australia

Figure 14.3 Visual changes resulting from glaucoma

Source: Courtesy of Vision 2020 Australia

Figure 14.4 Visual changes resulting from macular degeneration

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14.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

14.2.1 Screening vision

Vision screening should be included in multifactorial fall prevention interventions as an important tool for preventing falls and associated harm in older people in the community.[415]

The following strategies can be used to assess 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 the older person's vision for signs of deterioration. This can include an inability to see detail in objects, an inability to read (including avoiding reading) or watch television, and a propensity to spill drinks or bump into objects.
- Use a standard eye chart to measure visual acuity (Snellen eye chart) or contrast sensitivity using a standard eye chart (Pelli-Robson Test). See Table 14.1.
- Check the older person's vision for signs of visual field loss using a confrontation test (see Table 14.1). Refer the older person for a full automated perimetry test by an optometrist or ophthalmologist if any defects are found. Falls are mostly associated with a loss of field of vision rather than a loss of visual acuity and contrast sensitivity.[395, 396]
- Arrange regular eye examinations for the older person to reduce the incidence of visual impairment,[383] which is associated with an increased risk of falls.[395]

Healthcare professionals should arrange for a general practitioner (GP) to refer the older person to an optometrist, orthoptist or ophthalmologist for a full vision assessment if a more detailed visual assessment is needed once the older person has been assessed using the visual screening methods described above and detailed below in Table 14.1, or if the older person scores poorly on these tests.

14 Vision

Table 14.1: 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. The participant is asked to read the chart from a distance of 6 metres 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 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 reading 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).
Pelli-Robson Test (for testing contrast sensitivity)[416]	
Description	The test presents 48 letters of the same size easily visible at the test distance of 1 metre. The letter sequences are organised into groups of three (triplets) with two triplets per line. Within each triplet, all letters have the same contrast. The contrast decreases from one triplet to the next. This test is useful for detecting early signs of glaucoma and cataracts.
Time needed	5 minutes
Criterion	Pelli-Robson contrast sensitivity scores of less than 1.5 indicate visual impairment, and a score of less than 1.0 indicates visual disability.
Confrontation Visual Field Test[417]	
Description	Crude test of visual fields. The 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 on either side of the vertical, 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 with the number of fingers extended in each hand changing. 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 and then recorded again. 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.

Confrontation Visual Field Test[417]	
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.

14.2.2 Choosing vision interventions

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

Cataract surgery

Cataract surgery has been shown to be effective in reducing falls in older people. Timely cataract surgery for each eye optimises vision in older people with cataracts, as well as reducing fall risk. [44-49] Cataract surgery has also been shown to significantly reduce the risk of hip fracture within one year after surgery.[418]

There is evidence that older people on waiting lists for cataract surgery are at an increased risk of falls and fractures.[419, 420] While waiting for surgery, these individuals may benefit from environmental safety interventions to address potential hazards, lack of equipment and risky behaviours that predispose older people with severe visual impairment to falls.

Health professionals should refer to the Cataract Clinical Care Standard, which outlines best practice guidelines for cataract care.

Referral to a vision specialist

Referring the older person to an ophthalmologist when a new visual problem is detected or if there is no known reason for poor vision can reduce the risk of falls.[421]

It is recommended that the older person see an optometrist if they have impaired visual acuity, wear glasses 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 glasses, their GP or other suitably qualified health professional should check their visual acuity with their current glasses and refer them for optometric assessment if it is worse than 6/7.5.

If an older person requires new glasses, it is recommended that optometrists gradually change the lens prescription and counsel the older person on the likely short-term risks associated with a new prescription, including an increased risk of falling.[422]

If an older person regularly goes outside, it is recommended that they wear tinted single-vision distance glasses when negotiating stairs or walking in unfamiliar surroundings, as bifocal and multifocal glasses are associated with an increased risk of falling outside and on stairs.[402, 423]

Domiciliary visits by optometrists or ophthalmologists may be necessary for housebound older people.

Home safety assessment and modification

A home safety program can prevent falls in visually impaired older people.[424] Interventions that improve visual cues and minimise environmental hazards should be used. This includes ensuring adequate lighting and contrast, which can be achieved by applying adhesive strips to steps or painting the edges of pathways white.[424, 425]

Occupational therapists can provide home visits to help older people modify their behaviours, allowing them to live more safely in both the home and external environments.[426] See Chapter 16 for environmental considerations.

Exercise-based fall prevention programs

Exercise programs adapted for older people with visual impairment, delivered by trained instructors, have been found to be feasible and acceptable in preventing falls and harm from falls in older people in the community.[427, 428]

However, older people with vision impairment may be reluctant to access exercise-based programs because of transport issues, competing priorities and a belief that fall prevention programs are not relevant to them.[427] Addressing barriers related to travel and support for program delivery needs to be considered to increase adherence to exercise-based fall prevention programs for this population.

Educating the older person and their multidisciplinary team

Ensuring the multidisciplinary team is aware of how older people with reduced visual function can be supported to manage their vision impairment may help reduce the risk of falls among older people.

Educating the older person and their carers and family (to the extent the older person chooses) about the benefits of wearing their glasses, having their vision assessed regularly by their GP and how to modify their home to minimise environmental hazards can help reduce an older person's fall risk.

Older people who wear multifocal and distance single-vision glasses should be encouraged to flex their heads rather than lowering their eyes to look downwards to avoid postural instability.[429, 430]

[Point of Interest] Mobility training

Vision Australia specialises in providing safe mobility training for visually impaired people.

Case study

Ms J is 75 years old and badly bruised her left arm after falling over a step.

Her 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 Ms J's right eye. Within the next month, she was scheduled for cataract extraction.

After the operation, Ms 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.

14.3 Special considerations for cognitive impairment

Where possible, older 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, Tumbling E chart or picture charts, none of which require letter recognition.

- **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 older person being tested must say which direction it faces.
- **The tumbling E chart** is similar but uses the letter E in different orientations.
- **Picture charts** present images of objects, such as a bird, cake, car or telephone, in diminishing sizes that may help provide an estimate of visual acuity for those with the capacity to undertake letter chart tests.

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.

14 Vision

Additional information

The following resources and professional associations may be helpful:

- Cataract Clinical Care Standard, Australian Commission on Safety and Quality in Health Care.
- Health professionals or carers can contact the 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 general practitioner or optometrist can provide a referral. Alternatively, contact the Royal Australian and New Zealand College of Ophthalmologists.
- Queensland University of Technology and Bradford University (UK) have published guidelines for optometrists to help prevent falls in older people.
- Vision Australia provides services for people with low vision and blindness across Australia, as well as a recommended Adult Referral Pathway for Blindness and Low Vision Services.
- Macular Degeneration Foundation promotes awareness of macular degeneration and provides resources and information:
- Guide dog 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.
- Optometry Australia published guidelines for optometrists to help prevent falls in older patients.

15 Hearing

15.1 Background and evidence

Hearing impairment is a common chronic condition in older adults in Australia, with prevalence rates ranging from 29% in those over 60 years to 72% in those over 70 years.[431-433] Hearing impairment has been associated with a decreased quality of life and is independently linked to walking difficulties, impaired cognition, functional decline and social isolation.[431, 434-438]

15.1.1 Hearing impairment as a risk factor for falls

Hearing impairment is known to contribute to falls in older people.

Older people with hearing impairments often experience balance problems, which can increase the risk of falls. However, it is difficult to differentiate whether these are due to hearing impairment or other concomitant intrinsic risk factors.

Factors why hearing impairment may lead to falls include:

- People with hearing impairments may fail to detect environmental hazards outside their line of sight, such as a broom falling, a wheeled toy approaching, spilling liquid, etc.[435, 439-441]
- People with hearing impairment require more attention to detect and process auditory cues, leaving reduced attentional resources for other tasks, such as balance control.
- Impaired hearing is a marker of vestibular impairment. The vestibular system, contained within the inner ear, detects head movements and accelerations and is important for head and neck stability and balance control.[342] Thus, if generalised inner ear dysfunction occurs due to disease or degeneration, both hearing and balance impairments would follow.
- Poor hearing may indirectly lead to falls by reducing a person's participation in activities, resulting in subsequent muscle deconditioning and a decreased health-related quality of life.[435]
- Hearing aid use is low (20%) in those classified as having hearing loss.[436]

15.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

15.2.1 Addressing hearing impairment

As part of routine care, health professionals providing care to older people living in the community should address an older person's hearing loss and ensure working hearing aids are within easy reach for a dependent older person.

The following strategies can be used to minimise hearing loss in older people in the community:

- Encourage older people to have annual hearing tests with an audiologist to maximise hearing. Facilitate access when support is required.
- Implement strategies to maximise the independence of older people with hearing impairment. Facilitate access to a detailed assessment by an audiologist for a fall-specific hearing examination if the older person has experienced a fall.
- Use a pocket talker (a device that amplifies sound closest to the listener while reducing background noise) to communicate with an older person with a hearing impairment, as required and in line with the older person's preferences.
- Encourage older people to wear their hearing aids when mobilising.

[Point of Interest] Hearing Support

Better Hearing Australia provides support and education to help people in Australia with hearing impairment to maximise their hearing and improve their quality of life. https://www.betterhearingaustralia.online.

15 Hearing

Case study

Ms M is 85 years old and finds it difficult to understand others when they speak to her, particularly in busy places with a lot of background noise. As a result, she feels less inclined to take part in social activities, even with her extended family.

Ms M's general practitioner arranged for her to see an audiologist, who diagnosed significant hearing impairment. Within a month, Ms M was fitted with hearing aids and was pleased to notice that her hearing had greatly improved. She now feels much more confident in social situations and has resumed taking part in community activities.

Additional information

Hearing Matters Australia.

Australian Government's Hearing Services Program fully and partially subsidises some hearing devices

16 Environment

Recommendation

Home safety: Following a home safety assessment, provide tailored home safety interventions delivered by an occupational therapist for older people at increased risk of falls, including those:

1. with severe visual impairment
2. who have fallen in the past year
3. who need help with everyday activities
4. who have mobility impairment or use a mobility aid
5. who have recently been discharged from hospital. (Level 1A)

16.1 Background and evidence

Approximately 50% of falls among older people living in the community occur within their homes and immediate surroundings.[19, 20] Approximately 70% of falls by older people who have recently been discharged from hospital occur within the home or immediate surroundings.[442]

Many falls involve poor lighting, clutter, uneven or slippery floors or risk-taking behaviour, such as using unstable furniture as a walking aid. The risk of falling increases by 19% for each environmental hazard identified in the home.[443]

Person-environment fit

Assessing the interaction between a person's functional capacity and environmental factors (known as the person-environment fit) is important in developing tailored environmental adaptations.[444, 445]

The older person-environment fit may be a stronger determinant of falls in the past year than the number of environmental hazards alone.[446] Older people with poor to fair mobility experience higher rates of recurrent falls,[444] with a 10% increase in environmental risk scores associated with a 23% increase in falls.

Frail, less active older people who sustain falls with injury are more likely to fall indoors, often in the hall and bathroom.[447] More active older people are more likely to fall during activities of daily living in other indoor areas. Outdoor falls with injury occur near the home, such as in the garden, on access paths, climbing ladders, or while walking, grocery shopping, or during vigorous activity.

Environmental hazard awareness and reduction

Environmental hazard assessment and reduction considers how the older person functions within their environment and what behavioural and environmental factors need to be addressed to reduce the risk of falls. It also involves improving the older person's awareness of what constitutes a fall risk hazard and how to minimise the fall risk.

Hazard reduction involves:

- an initial assessment of the older person's fall history and circumstances, and the older person's functional vision and mobility
- checking the older person's home and surrounding area, such as the garden, for hazards that might cause them to fall.
- modifying or rearranging the environment or adapting behaviours to remove or minimise these hazards.

Environmental hazards can occur:

- within the home, such as electrical cords running across floors, poor lighting, loose carpets or mats
- within the garden and outside the home, such as slippery grass, unsafe use of ladders or working at heights such as clearing roof gutters
- away from the home, such as public fall hazards like uneven footpaths, poor lighting in public areas or rushing for the bus.[448]

16 Environment

16.1.1 Hazard awareness and reduction as a single intervention

Assessment and modification of home hazards by a suitably qualified health professional, such as an occupational therapist, helps to reduce the risk of falls in older people, particularly those with a history of falls.[62, 449]

Comprehensive and focused home safety interventions are effective in reducing fall risk by approximately 21% compared to usual care, with the greatest effect observed in interventions targeting older people at high risk.

High-risk older people include those:[62, 449]

- with a history of falls and reduced physical function[450]
- who have fallen more than once
- who have been recently hospitalised
- who have fallen in the past year[426]
- who have demonstrated functional decline[451]
- who have a severe vision impairment.[424]

16.1.1 Hazard awareness and reduction as part of multifactorial interventions

Environmental review and modification have been shown to reduce fall risk and harm from falls in older people living in the community and should be part of a tailored fall prevention program. It is important to help the older person understand the identified hazards and the relevance of the modifications to address the hazard to improve the older person's adherence to the changes.[448]

Health professionals should develop strategies tailored to the older person to encourage adherence to any modifications.

Multifactorial fall prevention interventions that have demonstrated positive effects in reducing fall risk for older people in the community include:

- **Home-based programs include:**
  - ☐ a combination of home modifications, exercise and vision improvement
  - ☐ home modification and exercise [415]
  - ☐ a reduction of environmental hazards, balance training, muscle strengthening, education on how to get up from the floor, and equipment provision.[452]
- **Safe community mobility strategies:** where participants shared home safety tips and solutions and undertook an exercise program.
- **A medical assessment and home visit:** a medical assessment by a geriatrician for risk factors followed by a home visit by an occupational therapist for environmental hazard assessment and intervention.[174]
- **Post-hospital discharge:** a home visit to assess the home, recommendations and training in the use of mobility aids, with an occupational therapist and, if indicated, a physiotherapist.[451]

Fall prevention interventions to support older people with visual impairment

A successful home safety intervention program targeted at older people with visual impairment (acuity ≤ 6/24) consisted of an occupational therapy assessment of environmental and behavioural risks with joint agreement on recommendations, a follow-up letter outlining these, facilitation of equipment purchase and installation, and where appropriate a referral to low vision support services reduced fall risk by 41%.[424]

Government-provided home care packages

A New Zealand government support package to prevent injuries in the home, which provided low-cost home modifications and repairs, reduced the rate of injuries specific to the home modification intervention by 26%.[453] Modifications included handrails for outside steps, internal rails, grab rails for bathrooms, outside lighting, edging for outside steps, and slip-resistant surfaces for outside areas.

In Australia, My Aged Care provides information and support to older people living independently in their own homes, including subsidising or paying for low-cost home modifications. See 'Help at Home – What to Expect' | My Aged Care.

16.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

16.2.1 Assessing the older person in their environment

A home visit to assess an older person in their environment provides an opportunity to identify fall risks and educate the older person about their at-home fall risks. Interventions need to be tailored so that they are relevant and acceptable to the older person and target the specific behaviour for change.[450] It is important to follow up with the older person with a phone call or home visit to ensure adherence to the implemented fall prevention interventions.

A medicines review by the older person's pharmacist or general practitioner is always recommended as part of a fall risk assessment.

Environmental assessment

An environmental assessment should be undertaken by an occupational therapist or other suitably qualified health professional with experience and training in evaluating older people and their environment.[62, 454]

Criteria for assessment and intervention

Five criteria reflecting a quality intervention include:[449]

1. a comprehensive process of hazard identification and priority setting
2. using an assessment tool validated for the broad range of potential fall hazards
3. formal, observational evaluation of an older person's functional capacity within the context of their environment
4. providing adequate follow-up for adaptations and modifications
5. active involvement of the older person, their family, and carers (to the extent the older person chooses) in the assessment and priority setting.

Framework for assessment and intervention

Table 16.1 outlines the best-practice approach to assessing and intervening in environmental hazards to reduce fall risk. It is an interactive process with three main components.[455]

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Table 16.1: Framework for assessment and intervention of environmental hazards

Framework for assessment and intervention of environmental hazards	
1.	**Understanding the older person.**
	■ Engage with the older person to understand their history of falls and their perception of risk. ■ Assess their functional capacity, including (vision, mobility and cognition) to provide evidence of fall risk. ■ Identify family or carer supports and preferences (to the extent the older person chooses their family and carers to be involved) ■ Identify where relevant activities of daily living occur for the older person.
2.	**Move through the home environment to identify hazards and use collaborative problem-solving to reduce risk.**
	■ Use foundations of clinical reasoning, including person-environment fit, the meaning of home and the sense of control over the environment in partnering with the older person. ■ Using a validated tool (see below), the occupational therapist works with the older person to identify hazards and potential solutions and develop an action plan. Carers and family are involved (to the extent the older person chooses). ■ Support the older person in increasing their awareness and observation skills to identify fall hazards in other environments. ■ Consider and discuss any risk-taking behaviours and encourage protective adaptations, such as strategies to reduce rushing to answer the phone or cues to remember to turn the light on at the entranceways at night.
3.	**Develop an action plan and prioritise changes**
	■ Jointly develop an action plan based on the behavioural and environmental changes discussed in step 2. Prioritise the changes to be made. The plan may include: ■ **changing the home environment**, such as rearranging furniture, non-slip strips to step edges, moving electrical cords out of walkways, securing loose carpet ■ **purchasing items** such as a lightweight wide-based step ladder with high grab rail, replacing bathmats with non-slip mats, and using photosensitive plug-in LED lights for night-time ■ **changing habits,** such as keeping small pets confined during high-activity times, switching on stair lights when descending at night, keeping the entranceways to the home and paths clear of leaves, dirt and other natural debris ■ **referrals to home maintenance or community services** to install grab bars and sensor lights at entrances, fix uneven or broken pathways, help with decluttering ■ **mobility training and safety** when walking around in public places ■ **referral to a community exercise class** which has a strong focus on balance or functional exercise ■ **future recommendations** that are not for current action but may be considered in future, such as an alert system in case of a fall at home.

16.2.2 Fall prevention on returning home after discharge from hospital

Approximately 15% of older people fall soon after they are discharged from the hospital (for any condition).[456]

Home visits by occupational therapists for fall prevention, including assessments of the home and recommendations and training in the use of mobility aids, help prevent falls in older people who have been recently discharged from the hospital. This can be particularly effective for those with a history of falls.[457]

[Point of Interest] Engaging with the older person

An older person's characteristics, including their perception of the causes of falls, risky situations, habits, and behaviours, inform their safety level and fall risk.

Engaging the older person in the fall risk assessment process will raise their awareness about things in their familiar environment that they would not have 'seen' as a hazard, as well as personal habits and behaviours that may increase their fall risk.

Environmental hazards, such as slippery floor coverings or poor lighting, pose a particular risk when older people rush to the toilet, especially at night, when their balance may already be compromised.[458]

16.2.3 Home safety and fall hazard assessment tools

The assessment tool chosen should be comprehensive and valid for its intended purpose, used to inform a tailored and effective fall prevention program for the older person.[450]

For older people living in regional and rural Australia, videoconferencing, teleconferencing, and interagency collaboration may need to be part of the home safety risk assessment.

A photography-based home assessment may be a valid, feasible and cost-effective option for on-site home assessments.[459]

Table 16.2 provides a list of useful and validated fall assessment tools.

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Table 16.2: Useful and validated fall assessment tools

Useful and validated fall assessment tools	
The Falls Behavioural Scale for Older People[460]	A 29-item self-reporting assessment tool 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, thereby contributing to discussion and problem-solving.
The Westmead Home Safety Assessment (WeHSA)[455, 460]	Identifies 72 potential physical and environmental hazards in the home that put older people at risk of falling.[455, 461] Each item on the assessment form is rated as a 'hazard' or 'not a hazard', and information on all categorised hazards is identified and summarised so an action plan can be developed. The WeHSA short form (44 items) was developed through an expert review process as a briefer version, incorporating items deemed essential or important for fall prevention.
The Home Falls and Accidents Screening Tool (Home Fast)[462]	The Home Fast can be used by health professionals to screen older people who are at an increased risk of falling and refer them for a more detailed fall risk assessment. The Home Fast was developed by the University of Newcastle (Australia).
The Home Safety Self-Assessment Tool [463, 464]	A self-administered environment assessment tool (64 items) with content validity was developed through an expert panel.
Staying On Your Feet	Home safety checklists for older people on Staying on Your Feet (NSW Health) and How to Stay on Your Feet (Queensland Health).
Home Environment Assessment for the Visually Impaired[465]	For people with visual impairment.
Home Environmental Assessment Protocol[466]	Developed for individuals with dementia.

Case study

Ms H, who lives alone, was discharged from hospital following a fall. She was referred to the community team for a follow-up fall prevention home visit. The occupational therapist, along with Ms H's daughter, who joined them on the visit, worked together to identify fall hazards in the home environment and created a list of modifications that needed to be made to reduce Ms H's risk of falling again.

During the visit, the occupational therapist discussed with Ms H the importance of making these changes to reduce her risk of falling. She observed Ms H moving around the home, including how she reached into cupboards, and examined her footwear. They identified a list of behaviours that might increase Ms H's risk of falling, for example, using an unstable chair instead of a ladder to reach the top cupboard, shuffling when walking due to poor balance, and wearing poorly fitting house slippers.

The final agreed action plan included replacing floor mats in the hallway with nonslip coverings, installing a railing to help Ms H get in and out of the shower, a new pair of slippers with a non-slip sole, a new small step ladder with an extended curved hand grip rail, and a plan to ask 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). The occupational therapist provided education to Ms H and her daughter to support Ms H in making the agreed-upon changes.

Ms H had also started a local exercise class that included balance-challenging activities. Two weeks later, the occupational therapist followed up with Ms H, who reported that she was progressing well with the action plan. Ms H now has a greatly reduced risk of falling because she has an improved understanding of her specific risk factors for falling and is actively involved in making changes.

16.3 Special considerations for cognitive impairment

The physical environment assumes greater significance for older people with diminished physical, sensory, or cognitive capacities. The unique characteristics of older people who are cognitively impaired may adversely affect their interaction with the environment.

A home hazard reduction assessment combined with a balance and strength fall prevention exercise program was found to be feasible and acceptable for older people with mild dementia.[467]

In addition to reviewing fall hazard environmental factors and safety monitoring, health professionals should ensure that older people with altered behaviours, such as wandering and agitation, receive an assessment and that behaviour support interventions are implemented to address their needs.[468, 469]

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Additional information

Online Home and Community Safety training module and resources

The following associations and organisations may be helpful:

- Fall Prevention online learning modules offer evidence-based information for healthcare professionals to effectively manage falls, including strategies for home and community safety. The modules have been developed by the Falls Prevention Online Workshop.
- The Home Fast self-assessment tool can be used by older people to identify potential home hazards.
- Active and Healthy provides fall prevention information for patients and carers, including home safety and preventing falls in public places. NSW Clinical Excellence Commission.
- Stepping On: Building Confidence and Reducing Falls is a community-based program for older people. It includes information about home fall safety hazards, safety in public places and community mobility. Sydney University Press.
- The 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 remain at home.

17 Monitoring and observation

17.1 Background and evidence

Approximately half of all falls leading to hospitalisation in Australia occur in and near the home.[470]

Falls by older people living in the community may be associated with delirium, restlessness, agitation, attempts to mobilise to the toilet, stand, turn and transfer, or due to reduced problem-solving abilities in people living with dementia. Older people who live alone and sustain falls are at risk of spending prolonged periods on the floor following a fall.

Providing education to the older person and their carers and family about their risk of falling and actions to reduce this risk could prevent falls and reduce harm from falls.

While remote monitoring and fall detection devices have the potential to prevent this outcome, insufficient research has been conducted in community settings to make robust recommendations. In lieu of this, the good practice points and principles of care in this chapter are informed by preliminary evidence from studies conducted in the community as well as good practice for the hospital setting.

17.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

The ethical, legal and cost considerations of monitoring an older person should be factored into any decisions regarding an older person's care plan.

17.2.1 Education

Older people who are at a high risk of falling should be informed of their risk. It is important to take the time to explain and discuss with the older person what fall risk factors are relevant to them and the appropriate fall prevention interventions.

An information brochure providing advice on how to stay safe at home and prevent falls should be shared with older people and their carers and family (to the extent the older person chooses) to help inform and encourage behaviour change and adherence to fall prevention interventions.[471]

See Chapter 4 for Australian government fall resources for patients and carers.

17.2.2 Sitter programs

Sitter programs are used in some hospitals and residential aged care services.[472-474] These programs use volunteers, family members or paid staff to sit with older people who are at a high risk of falling, to provide company for the older person and to notify appropriate personnel when the older person wishes to undertake an activity with a risk of falling. There is some evidence from the hospital setting that providing sitters reduces inpatient falls in the time that sitters are present in a ward – generally in shifts across business hours on weekdays.[473-475]

Sitter programs require planning, resources, education, investment (particularly for paid individuals) and ongoing coordination.

For older people in the community who are at high risk of falling, the older person's GP or other members of the multidisciplinary team could encourage their carers, family members or friends to spend time sitting with them, particularly during waking hours. A sitter may reduce the older person's risk of falling during the time the sitter is present.

17.2.3 Response systems

Commercially available response systems usually incorporate an alarm that sounds when an older person moves or presses a button. In some systems, an alarm is activated by a pressure sensor when an older person starts to move from a bed or chair. In other systems, an alarm sounds when any part of an older person's body moves within a space monitored by the alarm. Alternatively, a light sensor under the bed can be triggered when the older person steps out of bed during the night, alerting sleeping carers.

Personal emergency alarms

For older people living in the community, personal emergency alarm devices, in the form of a pendant worn around the neck or a bracelet, are advertised as a life-saving emergency communication device in case of an accident, such as a fall.

Personal emergency alarms have a range of responses including:[476]

- calling the emergency services for an ambulance
- alerting the nominated contact
- contact with a person employed by the personal emergency response system, usually a 24-hour call centre.

However, there is little evidence to support the use of personal emergency alarms, as many are found to be unreliable and difficult to use.

Limitations of personal emergency alarms

A primary reason for using a personal alarm system is to minimise the time an older person spends on the floor following a fall. However, there is no evidence to support any difference relative to time spent on the floor or number and length of hospitalisation after an emergency as a result of an older person using a personal alarm system.[477]

Reasons given by older people living alone for not using their personal alarm after a fall include:[478]

- not wearing the device
- wearing the alarm but not wanting to use it (wanting to stay independent, fearful of being taken to hospital)
- difficulty activating the alarm.

If an older person chooses to use a personal emergency alarm, an automatic fall detection device may be preferable, given that the percentage of active alarm users is generally very low (4.5%).[478]

[Point of interest] Influence of a personal alarm on an older person's behaviour

During a 12-month comparison study of community-dwellers who did and did not purchase a personal emergency alarm, the older people who did not have a personal emergency alarm reported restricting their activity to minimise their fall risk in the absence of an emergency alarm.[479] This is noteworthy given the detrimental consequences of activity restriction on physical and cognitive function.

In contrast, those older people with a personal emergency alarm reported feeling safer and more secure and being more active around the home.

17.2.4 Automatic fall detection devices

There has been little real-world testing of wearable and non-wearable fall detection devices to support their use in practice. While most devices claim to measure different aspects of a fall, it is difficult to compare the accuracy between devices due to the lack of standardisation in measuring and reporting falls, as well as a high number of false alarms.[156, 480-482]

Automatic fall detection devices include:

- **Wearable devices, which** include watches, body-worn sensors or smartphones attached to the waist. These generally use accelerometers, tilt sensors, gyroscopes and barometers to detect changes in acceleration, planes of motion or impact to detect falls.
- **Non-wearable systems, which** include cameras, acoustic sensors and pressure sensors placed in an older person's home to detect whether the older person has fallen.

Limitations associated with automatic fall detection devices include:

- the need for older people to remember and choose to wear the device
- dependence on battery power
- dependence on a connection to the internet or mobile phone service to communicate that there has been a fall
- false alarms
- privacy concerns in using the device as personal alarms require the user to provide a lot of personal data
- limitations to a specific location or space
- the expense of purchasing, plus ongoing costs for maintaining a subscription to 24-hour call centre support or an active SIM card (if the device requires one).

Smartphones attached to the waist

Smartphones attached to the waist could be a feasible and attractive option for older people for fall detection. Smartphones generally have higher specificity and sensitivity for fall detection compared to an independent accelerometer. [483]

An external accelerometer attached to the waist and transmitting data to the phone may provide a better alternative, with a less intrusive device that is attached to the user.

Case study

Ms Z is 79 years old and lives alone. Her family worry about the possibility of her falling but also know that it is important to Ms Z that she maintains her independence for as long as possible.

Ms Z has had three falls, all of which were related to meal preparation. An occupational therapist has completed an assessment and discussed 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 calling her daily and bringing her meals five times a week. Ms Z's neighbour visits her twice a week to help her in the kitchen. Ms Z's family has also purchased a pendant alarm for her, which she wears around her neck to activate in the event of a fall and is unable to get up. Ms Z understands how to use the pendant alarm and the importance of wearing it at all times.

17.3 Special considerations for cognitive impairment

An older person with cognitive impairment should not necessarily be subject to intrusive surveillance to prevent falls. [9] Care should be taken that monitoring and observation, including the use of alarms, does not infringe on an older person's autonomy.

17 Monitoring and observation

Additional information

A range of alarm systems and alert devices are available for purchase, including motion sensors, video surveillance systems, and pressure sensors.

In purchasing a personal alarm system:

- The system should be tested for suitability to meet the older person's needs, preferences, and capabilities before purchase.
- The upfront and ongoing costs should be thoroughly researched and clearly explained to the older person before making a purchase.
- Their implementation should be supported by appropriate training of staff and education of the older person.
- Testing of the alarm response mechanism related to the system, including the older person's carers, family, or community care service.

18 Restrictive practices

18.1 Background and evidence

Restrictive practices refer to any practice, intervention, or mechanism that restricts the rights or freedom of an individual and is used to control or modify that individual's behaviour, including reducing a person's risk of falling. Restrictive practices include chemical restraint, environmental restraint, mechanical restraint, physical restraint and seclusion. If used, restraints should be the last option considered.

In Australia, the use of restrictive practices is strictly regulated and monitored to protect the health, rights and dignity of older people receiving aged care services. The Commonwealth aged care legislation contains protections and safeguards that must be met by aged care providers who are registered to provide home and community care before they can use a restrictive practice.

Restrictive practices should not be a substitute for supervision, inadequate staffing or lack of equipment.

18.1.1 Frameworks for the use of restrictive practices in Australia

Primary and community healthcare services

The National Safety and Quality Primary and Community Healthcare Standards (the Standards)[484] aim to protect the public from harm and improve the quality of health care delivered by describing a nationally consistent framework. All primary and community healthcare services in Australia can apply the Standards when delivering care. The Clinical Safety Standard broadly covers restrictive practices, with a focus on comprehensive care.

Residential aged care service providing community care

Where a residential aged care service (RACS) is a provider of home and community care, the provider must adhere to the *Quality of Care Principles 2014* (Part 4A), which details the protections and safeguards that approved providers of RACS must satisfy before using restrictive practices.

The use of restrictive practices is strictly regulated and monitored to protect the health, rights and dignity of older people receiving aged care services.

18.1.2 Types of restrictive practices

The Aged Care Quality and Safety Commission defines five types of restrictive practices:[485]

Chemical restraint

Chemical restraint is a practice or intervention involving medicines for the primary purpose of influencing the behaviour of a person. This does not include the use of medicines prescribed for the treatment of a diagnosed mental disorder, physical illness or condition or end-of-life care.

Medicines, such as sedatives, have sometimes been used as chemical restraints. In most situations, this is regarded as an inappropriate form of restraint. However, when an older person's behaviour is disturbed, and their risk of falling is increased, there may be a case for chemical restraint.

If medicines are being considered as a form of chemical restraint for an older person, legislative requirements must be met. Caution is required to ensure that psychotropic medicines are not prescribed as an alternative method of chemical restraint.

Environmental restraint

Environmental restraint involves a health professional or carer restricting free access to all parts of a person's environment to influence behaviour. This includes items and activities.

Mechanical restraint

Mechanical restraint is when a device is used to prevent, restrict, or subdue movement to influence the behaviour of a person.

Mechanical restraint includes bed rails, lap belts, tabletops, meal trays and backwards-leaning chairs ('palliative care chairs' or 'princess chairs') that are difficult to get out of. Bed alarm devices can also be considered a mechanical restraint.

Covert mechanical restraint practices include tucking bedclothes in too tightly, wedging cupboards against beds, or locking doors.

Physical restraint

Physical restraint is using force to prevent, restrict or subdue movements of a person's body.

Physical restraint is the application by members of the healthcare workforce of hands-on immobilisation or the physical restriction of a person to prevent them from harming themselves or endangering others or to ensure that essential medical treatment can be provided.[486]

Seclusion

Seclusion is using solitary confinement to influence behaviour in a room or physical space. Voluntary exit is prevented, or it is implied that a person cannot leave the room or physical space at any hour of the day or night.

18.1.3 Restrictive practices and fall risk

The current understanding of minimising the use of restrictive practices in older people derives from research conducted in RACS. Caution is recommended when applying knowledge about restrictive practices in RACS to community care, as health professionals often work in the older person's home alone and are unable to supervise them continuously due to the brevity of their visits.[487]

Research involving community nurses, family caregivers and home care providers reported that the family of the older person primarily decided to use restrictive practices to:

- provide relief, particularly when the older person was cognitively impaired
- protect an older person from falling out of a bed or from a chair, and
- avert the older person being transferred to an aged care service.[487, 488]

There is evidence that older people who are restrained are more likely to fall.[489, 490] In some instances, reducing the use of restrictive practices may decrease the risk of falling.[491]

Family caregivers are generally unaware of the harmful effects of restrictive practices or the rules guiding their use.[488] Education on the use of restrictive practices for health professionals, carers and older people and their families (to the extent the older person chooses) is extremely important to minimise further risk of harm.

[Point of interest] Guideline for reducing the use of restrictive practices in the home setting

Researchers from Belgium have developed a validated guideline for reducing the use of restrictive practices in the home setting.[492]

The guideline aims to increase healthcare providers' awareness, knowledge, and competence to adequately address situations or questions related to restraint use. The guideline also includes a flowchart for dealing with complex situations where the use of restraints is requested, already present or considered.

The guideline and flowchart are available in the open-source journal article, Reducing the use of physical restraints in-home care: development and feasibility testing of a multicomponent program to support the implementation of a guideline – PMC.

Information about the project to test the feasibility of a multiple-component program to support the implementation of the guideline for reducing the use of restrictive practices in the home settings is available on the project website LOW-FIXATION CARE – Home.[493]

18 Restrictive practices

18.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

Health service providers should have a policy and procedure in place to eliminate the *inappropriate* use of restrictive practices in line with state or territory legislation and guidelines.

Policies and procedures ensure protections for the physical and mental health of all people receiving community care and should address the use of:

- restrictive practices in limited circumstances where informed consent is provided
- the restrictive practice in line with clinical advice
- restrictive practices that will prevent harm to the person and/or others.

Restrictive practices should not be used as a substitute for supervision, inadequate staffing, or a lack of equipment.

18.2.1 Assessing the need for restrictive practices and considering alternatives

Causes of agitation, wandering or other behaviours should be investigated, and reversible causes of these behaviours, such as delirium, should be treated before the use of restrictive practices is considered.

When not to use restrictive practices

Restrictive practices should not be used at all for older people who:

- can walk safely
- wander, or
- disturb other older people.

Alternatives to the use of restrictive practices

Wandering behaviour in an older person warrants an urgent exploration of alternative management strategies, including behavioural and environmental alternatives to the use of restrictive practices (see Chapter 8: Cognitive Impairment). These alternatives may include:[494]

- using strategies to increase observation or surveillance
- providing companionship
- providing physical and diversionary activity
- meeting the older persons' physical and comfort needs, especially toileting, according to the older person's routine as much as possible
- decreasing environmental noise and activity
- exploring the older person's previous routines, likes and dislikes, and attempting to incorporate these into the care plan.

Multidisciplinary teams should be provided with education about alternatives to restrictive practices. Education can reduce the perceived need to use restrictive practices, as well as minimise the risk of injury when restrictive practices are used.[495-499]

18.2.2 Using restrictive practices in community care

When the older person's multidisciplinary team has considered all alternatives to restrictive practices and agreed that these alternatives are inappropriate or ineffective, restrictive practices could be considered. In such cases, restrictive practices should only be used temporarily to:

- prevent or minimise harm to the older person
- prevent harm to others
- optimise the older person's health status.

Rights and wishes of the older person

The multidisciplinary team must also consider the rights and wishes of the older person, their substitute decision-maker, carers and family (to the extent the older person chooses). Any decision to use restrictive practices should be made by discussing the use of these practices, their benefits and harms, and possible alternatives with the older person and their substitute decision-maker, as well as their carers and family (to the extent the older person chooses).

Implementing restrictive practices

When alternative strategies have not been successful, and the use of restrictive practices is being considered, the type of restrictive practice chosen should always be the least restrictive to achieve the desired outcome. The use of restrictive practices should be documented in full and continually monitored and evaluated.

Documentation to support restrictive practices [499]

The suggested minimum standard of documentation for the use of restrictive practices includes:

- date and time of application
- name of the person ordering the restrictive practice
- type of restrictive practice
- reasons for the restrictive practice
- alternatives considered and trialled
- discussion with the older person, carers or substitute decision makers
- any restrictions on the circumstances in which the restrictive practice may be applied
- intervals at which the older person must be observed
- any special measures necessary to ensure the older persons proper treatment while the restrictive practice is applied
- duration of the restrictive practice.

18.2.3 RACS providers using restrictive practices in community care

Where a RACS is providing home and community care and the older person's multidisciplinary team has considered all alternatives to restrictive practices and agreed that these alternatives are inappropriate or ineffective, restrictive practices could be considered in line with the Quality of Care Principles 2014 (Part 4A).

The *Quality of Care Principles* (Part 4A) include requirements that:

- the restrictive practice is used only as a last resort to prevent harm to the person or others and after consideration of the likely impact on the person
- to the extent possible, best practice alternative strategies have been trialled and documented in the person's behaviour support plan before the restrictive practice is used
- the restrictive practice is only used to the extent necessary and in proportion to the risk of harm to the person or others
- the use of the restrictive practice complies with provisions outlined in the person's behaviour support plan
- the restrictive practice is used with the informed consent of the person, or if they lack the capacity to provide that consent, their restrictive practices substitute the decision maker.

Chemical restraints

Additional obligations for the use of chemical restraints exist under the *Quality of Care Principles*. The RACS community care provider must be satisfied that an approved health practitioner with day-to-day knowledge of the care recipient has:

- assessed the person as posing a risk of harm to themselves or any other person
- assessed that the use of the chemical restraint is necessary
- prescribed medicines for the purpose of using the chemical restraint, and
- obtained informed consent to the prescribing of the medicines for the purpose of using the chemical restraint.

The rights and wishes of the older person must be considered, and all decisions must be documented in line with legislative requirements.

Behaviour support plans

In Australia, RACS providers are required to have a behaviour support plan in place for older people in the RACS who require or may require the use of restrictive practices as part of their care.[138] This includes older people with cognitive impairment.

If relevant, the behaviour support plan will include information on how to best manage fall risk for the older person, taking into account their individual needs and circumstances.

Behaviour support plans are designed to inform the older person's ongoing care needs. Behaviour support plans must be reviewed and updated as behaviour changes are observed or occur and to reflect any new information received about the older person.

18.2.4 Review and monitoring

Aged care providers and health professionals providing home care services should regularly review the restrictive practices policies and procedures.

Health professionals should demonstrate their understanding of this policy, as well as their knowledge and skills in identifying, managing, and escalating changed behaviours and using alternatives to restrictive practices. [18]

Trends in the use of restrictive practices should also be identified, monitored, and documented, including the rationale for using a restrictive practice, the duration of use, and the alternatives that were considered and used.[500]

Case study

Ms S is a 90-year-old woman who lives at home with her family. She has dementia and walks with supervision. Ms S's family requested that the nurse raise the bed rails when she is in bed because they were concerned Ms S would get up without assistance and could fall.

The nurse discussed with Ms S's family the potential for injury if Ms S tried to climb over the raised bed rails. The nurse informed the family of the policy preventing restrictive practices, which specifically targets the reduced use of bed rails or bedside rails.

The nurse reassessed Ms S' fall risk. Ms S was referred to the community physiotherapist, who assessed Ms S and, together with the nurse, they developed a management plan aiming to reduce Ms S's risk of falling.

The management plan identified risk factors for falling, including a medicines review and reduction in a psychotropic medicine, and recommended a supervised balance and strengthening exercise program with the physiotherapist.

Ms S's bed was placed at its lowest height when Ms S was in bed, and the bed was moved against the wall on one side. Everything Ms S needed was placed within her reach.

Despite these efforts, the family remained insistent that the bed rails be raised. The community physiotherapist will continue to work with the family, trialling alternative options, and has requested a case conference with the family and the general practitioner to review the current strategies.

18.3 Special considerations for cognitive impairment

As with all older people, it is a requirement that restrictive practices are used in relation to older people with cognitive impairment only as a last resort after their fall risk has been evaluated and alternate best practice behaviour management strategies have been trialled and documented.

Additional information

- Australian Government. *Aged Care Act 1997: Quality of Care Principles 2014*
- Psychotropic Medicines in Cognitive Disability or Impairment Clinical Care Standard.
- Victoria Health Government Clinical Decision Tool on Physical Restraints.
- Clinical Practice Guidelines for the Management of Delirium in Older People.
- Delirium Clinical Care Standard.
- Reducing physical restraints by older adults in home care: development of an evidence-based guideline.
- National Safety and Quality Primary and Community Healthcare Standards, Australian Commission on Safety and Quality in Health Care

19 Hip protectors

19.1 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.[501] Hip fractures are one of the more severe injuries associated with a fall and usually require surgery and lengthy rehabilitation, with many older people not regaining their previous level of mobility.[424] Pelvic fractures can also occur, although these are less common.

Hip protectors are one approach to reducing the risk of hip fracture. They aim to reduce the risk of hip fracture by absorbing or dispersing forces away from the hip if a fall onto the hip area occurs. Hip protectors consist of undergarments with protective material inserted over the hip region. They are sometimes called 'hip protector pads', 'protector shields' or 'external hip protector pads'. These guidelines refer to them all as hip protectors.

There are three types of hip protectors – soft, hard and adhesive – which are explained in detail below at 19.2.2.

Evidence for the use of hip protectors

There is little evidence that hip protectors reduce the incidence of hip fractures in community-dwelling older people. However, studies have noted that many participants did not wear their protectors all the time, which may have contributed to the poor results.[501] Adherence to the use of hip protectors is crucial to their effectiveness.[502, 503]

In some cases, wearing a hip protector may serve as a visual reminder of the consequences of falling, prompting the older person and their caregivers to modify their behaviour to minimise risk.[501, 504]

[Point of interest] Hip protectors in other care settings

Hip protectors have been shown to be effective as part of multifactorial fall prevention interventions for older people in hospital and residential aged care services. Key factors to the success of hip protectors in preventing harm from falls appear to be the:

- commitment of healthcare workers to supporting and encouraging the use of hip protectors by older people, and
- education of healthcare providers and the older person on how to wear hip protectors and the benefits of using them.[505]

19.1.1 How hip protectors work

Hip protectors work by absorbing or dispersing the energy created by a fall away from the hip joint, allowing the soft tissues and muscles of the surrounding thigh to absorb the energy.[62] Hip protectors must be worn over the greater trochanter of the femur to be effective.[506]

Hip fractures

More than 95% of hip fractures occur from a fall with direct impact on the hip,[507] 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.

The force generated by a fall from a standing height is approximately 6000 newtons and has the potential to break the hip of a person of almost any age. The most effective padding system can reduce this to approximately 2000 newtons in a laboratory test.[508, 509] Most research on hip protectors has evaluated hard hip protectors.

Surgically repaired hips

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.).[510] Equally, it has not been demonstrated to be harmful to do so.

19.1.2 The risk associated with hip protectors

Several risks are associated with the use of hip protectors by older people, with about 5% of wearers experiencing adverse effects.[511]

- Hip protectors can cause bruising if the person falls onto them.
- 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 activities of daily living, especially toileting.[501] For example, older people may become less independent in everyday activities due to the extra time and effort needed to put on and take off the hip protectors. This can also cause incontinence in some people.
- If dexterity is an issue for an older person, wearing hip protectors can increase their risk of falls because they must manage the hip protectors during dressing and undressing.

19.1.3 Adherence to the use of hip protectors

Adherence of both the older person and care staff to hip protector use is an issue in all care settings, with discomfort, impracticality,[501] the extra effort needed to put them on, and urinary incontinence cited as common reasons for low adherence to hip protector use.[512-516]

One study showed that older people wearing hip protectors did not perceive a decrease in their health-related quality of life as a result of wearing the hip protectors, so this is unlikely to be a barrier to use.[517]

Much of the research on hip protectors has been conducted in cooler climates. Using them in warmer and more humid areas of Australia may be problematic due to the increased levels of discomfort associated with wearing the hip protector close to the skin.[256]

Supporting the older person to adhere to the use of hip protectors

Acceptance and adherence by older people in the wearing of hip protectors is most affected by the older person's motivation and understanding of the benefits and risks of wearing hip protectors [12] and by the type of hip protector.[501]

Education and training for the older person and their carers and family (to the extent the older person chooses) may improve acceptance and adherence to the use of hip protectors by addressing any barriers that the older person sees to wearing hip protectors and providing instructions and demonstrations on how to wear them.[518, 519]

Cost of hip protectors

In some situations, cost may be a barrier to using hip protectors.[520] Providing hip protectors at no cost to the older person has been shown to increase initial acceptance and adherence to hip protector use in community-dwelling older people at high risk of hip fracture.[520]

Reimbursement for the cost of hip protectors by private health funds or appliance supply schemes may be an option that could encourage their use.

19.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

To support older people in making an informed decision about wearing hip protectors, involve the older person in discussions about options for hip protectors and offer choices in the types and sizes of hip protectors in line with the older person's needs and preferences.

19 Hip protectors

Soft, energy-absorbing protectors are often reported to be more comfortable to wear in bed. A choice of underwear styles and materials means that problems with hot weather, discomfort, accommodating incontinence aids and appearance can be addressed.

19.2.1 Assessing the need for hip protectors

When assessing an older person's need for hip protectors, health professionals should consider:

- if the older person has a recent history of falls
- the older person's age
- the older person's mobility
- whether the older person has a disability
- whether the older person is unsteady on their feet, and
- whether the older person has osteoporosis or osteomalacia.

Assessing the older person's cognition and independence in daily living skills (e.g., dexterity in dressing) may also help determine whether the older person will be able to use hip protectors independently.

For older people known to have balance difficulties and who wander, hip protectors may need to be used with an additional risk-management strategy.

Fall risk assessment tools

Health professionals can use a fall risk assessment tool (see Chapter 6) and/or fracture risk assessment to determine whether an older person has a high risk of hip fracture and should be considered for the use of hip protectors.

Two web-based fracture risk calculators are:

- Fracture Risk Assessment Tool (FRAX)
- Garvan Institute of Medical Research Fracture risk calculator

19.2.2 Types of hip protectors and how to wear them

There are three types of hip protectors:

Soft hip protectors (type A)

Soft hip protectors 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. They seem to work mainly by absorbing the energy of the fall.

Soft hip protectors must be held in place over the greater trochanter of the femur to be of any benefit.[521] Soft hip protectors can generally be cleaned using domestic washing machines and dryers.

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.[522]

Hard hip protectors (type B)

Hard hip protectors consist of a firmer, curved shell, sewn or slipped into a pocket in a Lycra undergarment, similar to underpants or bike pants. They divert the force of the fall from the bones of the hip to the surrounding muscles of the thigh.

Hard hip protectors are held in place over the hip by Lycra undergarments similar to underpants or bicycle pants. Different sizes (small to extra-large) and designs are available for both men and women. Hard hip protectors can be difficult to launder.

Continence pads can be worn in separate pants, underneath the garments holding the hip protectors.[522]

Adhesive hip protectors (type C)

Adhesive hip protectors are adhesive hip pads that are stuck directly to the wearer's skin.

While self-adhesive hip protectors may be appealing because they can be worn with the older person's own undergarments, there is insufficient evidence to support their safe long-term use.

19 Hip protectors

19.2.3 Using hip protectors at night

An older person's risk of falling and breaking a hip can increase during the evening and night. Therefore, older people who get out of bed to go to the toilet at night may benefit from wearing hip protectors when they go to bed, particularly if they have:

- a high risk of falling
- osteoporosis
- a history of falling at night.

The soft hip protectors (type A) are relatively comfortable when positioned correctly and can be worn more easily in bed because they are less obtrusive than the hard hip protectors (type B).[522]

19.2.4 Training in hip protector use and care

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

Training staff, the older person, and their carers and family (to the extent the older person chooses) in the correct application, including instructions and demonstrations, the reason for use, and the importance of supporting and encouraging the use of hip protectors has been shown to improve adherence to hip protectors.[518, 519] Training the older person may also improve adherence by addressing any perceived barriers to wearing hip protectors.[523]

Before the older person starts wearing hip protectors, the multidisciplinary team and carers should discuss arrangements for cleaning the hip protectors. Washing in domestic washing machines and dryers is feasible, but some hip protectors will not withstand commercial laundering.

19.2.5 Review and monitoring

Currently, the design and production of hip protectors are unregulated, and there are no national or international testing procedures in place for their effectiveness.[501]

A standard definition of adherence to the use of hip protectors should be used when reviewing and monitoring their use.[523] 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 partner 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, so he was at increased risk of further fractures. Physiotherapy and rehabilitation were successful, and he has no physical side effects from his broken hip and is receiving treatment for his osteoporosis. However, Mr T reports a fear of falling again. This means he is reluctant to participate in his normal activities of daily living and has become more dependent on his partner.

The occupational therapist, who makes regular home visits to Mr T, discussed using a hip protector with him to give him more confidence when moving about at home. She showed him how to put the hip protector on correctly and explained that although some studies of older people in residential aged care services have shown a reduction in hip fractures, they have not been shown to be effective in the community setting.

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.

19.3 Special considerations for cognitive impairment

Older people with cognitive impairment have a higher prevalence of falls and fractures[524]. They should be considered for hip protector use only if they are living with a carer or family member. This is because older people with cognitive impairment often require assistance in learning to use and continue using hip protectors.

Additional information

Two web-based fracture risk calculators are:

- Fracture Risk Assessment Tool (FRAX).
- Garvan Institute of Medical Research. Fracture risk calculator.

20 Vitamin D and calcium

Recommendation

Vitamin D supplementation: Support access to recommended doses of daily or weekly vitamin D supplements for older people deficient in vitamin D or with little sunlight exposure (i.e., less than 5-15 min exposure, four to six times per week) unless contraindicated. (Level 1B) Avoid high monthly or yearly mega doses of vitamin D as these can increase the risk of falls. (Level 1A)

20.1 Background and evidence

Low vitamin D levels have been associated with reduced bone mineral density, increased bone turnover, and an increased risk of hip fracture.[525] There is a significant association between vitamin D deficiency and falls for community-dwelling older men.[526]

The potential effects of vitamin D deficiency on muscle cells and fibres are linked to calcium/phosphate handling, muscle fibre differentiation, expression of contractile proteins and mitochondrial fuel metabolism.[527] Vitamin D deficiency has been associated with osteoporosis, urinary incontinence, cognitive decline and macular degeneration.[528]

Vitamin D may prevent falls by improving muscle strength and psychomotor performance, independent of any other role in maintaining bone mineral density.[529-531] However, studies examining the use of vitamin D supplementation for preventing falls in older people have reported conflicting results.[62, 530, 532-534]

Calcium is essential for building and maintaining healthy bones throughout life. Recommended daily intake for calcium with vitamin D supplementation can help decrease fall risk.[535]

[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.[530]

20.1.1 Incidence and risk of vitamin D deficiency

Vitamin D levels are measured by blood 25-hydroxyvitamin D (25-OHD) levels. In Australia, over 30% of adults have a mild, moderate or severe deficiency of vitamin D.[535]

Older people who have a high risk of vitamin D deficiency include those:

- residing in residential aged care
- who are housebound
- admitted to hospital
- with skin conditions that require them to avoid the sun
- with dementia
- from culturally and linguistically diverse groups
- with malabsorption
- with dark skin, as increased skin pigmentation reduces the amount of vitamin D production after sun exposure
- who wear a veil
- who are heavily clothed and/or veiled for religious or cultural reasons.[535, 536]

20.1.2 Intervention approaches for improving vitamin D levels

Intervention approaches for improving vitamin D levels in older people have varying levels of success. These include:

- vitamin D supplementation alone with cholecalciferol or vitamin D3
- vitamin D supplementation together with calcium supplementation, and
- exposure to sunlight.

20 Vitamin D and calcium

Vitamin D supplementation (with or without calcium)

Vitamin D supplementation with or without calcium at the recommended dose can be beneficial in improving an older person's bone mineral density and reducing their risk of falls.[537-539] The benefits of supplementation are more certain in older people who are vitamin D deficient.[539] Bone mineral density increases whether the vitamin D is administered orally or injected.[540]

There is little evidence to demonstrate any effect of vitamin D supplementation on fall-related fractures.

Calcium supplementation

Healthy Bones Australia (formerly Osteoporosis Australia) recommends a daily intake of 1300 mg of calcium for men aged over 70 and women aged over 50 to maintain healthy bone density.[541] Below these ages, the recommendation is 1000 mg per day for both men and women.[541]

The best way to achieve recommended calcium intake is to eat a diet rich in calcium. When consumed, a small amount of calcium is absorbed into the blood and used for the healthy functioning of the heart, muscles, blood and nerves.

Calcium supplementation, when administered with vitamin D (or its analogues), can increase bone density and decrease fall risk.[535, 540] A maximum dose of 500 – 600 mg elemental calcium per day is recommended if dietary calcium intake is insufficient due to concerns about calcium supplementation increasing the risk of cardiovascular events.[542-544]

Vitamin D, sunlight and winter

The body's primary source of vitamin D is exposure to sunlight through the skin. Sourcing vitamin D from dietary intake alone is not sufficient to achieve healthy levels of vitamin D.[535]

Sun exposure may be less effective in older people if their skin does not efficiently convert cholesterol precursors to vitamin D. Frail older people may be at greater risk of vitamin D deficiency because sun exposure recommendations can be difficult for them to meet due to mobility issues.

The Geelong Osteoporosis Study found that, during winter, serum vitamin D levels are reduced, bone resorption is increased, and the proportion of falls resulting in fractures increases.[544, 545] 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 in winter by people who live beyond latitudes of about 35° (i.e., Victoria and Tasmania), especially in older people. An increase in the zenith angle of the sun (the angle between directly overhead and a line through the sun) during winter means more photons are being absorbed by the stratospheric ozone layer and less reaching Earth to allow healthy daylight skin exposure for vitamin D absorption.[545]

Nutrition management

Nutrition management is an important element of good practice and can play an important role, directly and indirectly, in some aspects of fall prevention. For example, good nutrition is required to achieve optimal effects from an exercise program, which can improve balance and mobility, leading to a reduced risk of falling.

Nutrition is not included as a separate core fall prevention activity in the Falls Guidelines, as it is an area with limited research to guide best practice in fall prevention to date.

20 Vitamin D and calcium

20.1.3 Toxicity and dose

Toxicity risk with vitamin D supplementation

Safety considerations in managing vitamin D supplementation for older people at risk of falls include:

- Vitamin D supplementation can cause toxicity.[546] Prolonged sun exposure does not cause toxicity.
- Hypercalcemia may occur if vitamin D is given, particularly in the form of vitamin D analogues.[547]
- There is a small but significant increase in gastrointestinal symptoms and renal disease associated with the use of calcium and vitamin D supplementation.[548] There is no increased risk of death.
- Toxicity from cholecalciferol (vitamin D3) can occur at daily doses of up to 10,000 international units if dietary or oral calcium supplements are high or if granulomatous disorders are present. This is rare.

High doses of vitamin D supplementation can increase the risk of falls. A study of community-dwelling older women found that a single high dose of 500,000 international units of vitamin D administered orally for 3-5 years resulted in a 15% increase in falls and a 26% increase in fractures.[549] The increased risk was pronounced during the 3-month post-dose period when serum 25-OHD levels would have been highest.

Another study found that high monthly doses (60,000 international units per month) of vitamin D supplementation increased falls in community-dwelling older people who had fallen in the previous year.[550]

Dose of vitamin D supplementation

There is no recommended daily intake for vitamin D; however, trials that show a benefit from vitamin D have used a minimum of 800 international units daily.[62] According to Healthy Bones Australia, to prevent vitamin D deficiency in older people who receive less than optimal sun exposure, the recommended vitamin D supplementation is:

- at least 600 international units per day for older people under 70 years of age
- at least 800 international units per day for older people over 70 years of age
- potentially 1000 to 2000 international units per day for sun avoiders or those at high risk of deficiency (housebound or in residential aged care) .[535]

Higher doses are required for older people who are shown to have vitamin D serum levels lower than 50 nmol/L.

20.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

20.2.1 Interventions for preventing falls

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

Assess the adequacy of the older person's vitamin D and calcium levels

Health professionals can assess the adequacy of the older person's vitamin D and calcium levels by using:

- food preference records
- food and fluid intake records
- 25(OH)D blood levels
- a history of the older person's daily routine.

20 Vitamin D and calcium

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.

Ensure the older person receives minimum sun exposure to prevent vitamin D deficiency

Healthy Bones Australia (in association with the Cancer Council Australia) recommends that for most older Australians, vitamin D deficiency can be prevented by exposing the face and upper limbs to sunlight for 5 to 15 minutes, four to six times per week.[541] Note: Exposure to sunlight must be outside, as window glass absorbs nearly all ultraviolet B photons, which are required for vitamin D production.

Deliberate exposure to sunlight between 10 am and 3 pm in the summer months for more than 15 minutes is not advised, nor is overexposure. If this modest sunlight exposure is not possible, then a vitamin D supplement of at least 800 international units per day is recommended.[525]

Consider vitamin D and calcium supplementation

For confirmed cases of vitamin D deficiency, Healthy Bones Australia recommends vitamin D supplementation with 3000–4000 international units per day for 6-12 weeks, followed by a maintenance dose of 1000-2000 international units per day.

Use caution for women older than 70 years

Use caution with calcium supplementation in women older than 70 years of age, as there is a possible association with cardiovascular events.[542, 543] Dietary calcium, as opposed to mineral supplementation, should be encouraged. A maximum supplementation dose of 500 mg/day should be considered if daily dietary intake does not reach 1,000 mg.

Encourage a nutritious diet that allows for calcium intake and absorption

Health professionals can encourage older people to include foods high in calcium in their diets. Increasing calcium and protein intake by consuming dairy foods, such as milk, yogurt and cheese, has been linked to a reduction in the risk of falls and fall-related harm in older people.[551]

Discourage older people from consuming foods that prevent calcium absorption.

Consult with the general practitioner if required

Encourage the older person to consult their general practitioner (GP) if they have trouble consuming adequate calcium, have lactose intolerance, do not typically include calcium as part of their diet (due to cultural reasons) or do not consume dairy products (e.g. follow a vegan diet). The general practitioner may refer the older person to a dietitian if appropriate.

Case study

Ms B presented to her general practitioner (GP) after falling at home recently. She lives alone and rarely goes out. As part of her fall risk assessment, the GP established that Ms B 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 Ms B. They realised that Ms B 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 sources of calcium in her diet.

Ms B and the GP agreed that she needs oral vitamin D supplementation and that her calcium needs will be met by altering her diet.

20.3 Special considerations for cognitive impairment

Cognitive impairment in older people can be associated with nutritional deficiencies, as cognitive impairment may result in reduced oral intake of calcium. Cognitive impairment is also associated with reduced exposure to sunlight, particularly when outdoor mobility is limited.

Medicine 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.

Additional information

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

- Australian Dietary Guidelines, published by the National Health and Medical Research Council (2013).
- Statement on Calcium and Vitamin D for Bone Health in Australian Adult Populations.
- Healthy Bones Australia (Formerly Osteoporosis Australia) provides information and resources to reduce fractures and improve bone health in the community.

21 Osteoporosis

Recommendation

Osteoporosis medicines: Facilitate access to prescribed osteoporosis medicines for older people with diagnosed osteoporosis or a history of minimal trauma fractures, unless contra-indicated. (Level 1A)

21.1 Background and evidence

Osteoporosis is characterised by both low bone mineral density and microarchitectural deterioration of bone tissue, leading to decreased bone strength, increased bone fragility and a consequent increase in fracture risk.[552]

Osteoporosis is a common disease in Australia, with 66% of people aged over 50 years living with osteoporosis or osteopenia (low bone density).[553]

People who are very old or have osteoporosis or osteopenia have an increased fracture risk due to low bone mineral density, as well as an increased fracture risk with each additional fall.[553]

21.1.1 Falls and fractures

Only a small proportion of falls result in fractures, but most fractures occur after falls.[554]

A previous minimal trauma fracture is one of the strongest risk factors for future fractures.[555]

Bone mineral density (BMD), quadriceps strength and postural sway are three key factors that contribute to a person's fracture risk.[556] BMD is an important measure in predicting fractures in both men and women.[556] No therapy is likely to normalise BMD, but small improvements can reduce fracture risk.[557]

Interventions that reduce the risk of falls may prevent fractures, even if bone density is not altered. This is particularly relevant to the very old, who have an increased fracture risk due to low BMD and whose likelihood of a fracture increases with each additional fall.

21.1.2 Diagnosing osteoporosis

The Royal Australian College of General Practitioners (RACGP) guidelines on managing osteoporosis state that a minimal trauma fracture of the hip or spine in a person older than 50 years of age is presumptive of osteoporosis and that treatment may be initiated without confirmation of low BMD.[552]

A 20% or greater loss of anterior or mid vertebral height relative to posterior height is sufficient to diagnose osteoporosis for the purpose of prescribing under the Pharmaceutical Benefits Scheme (PBS).

Fracture risk assessment

A fracture risk assessment can be used to help determine whether an older person is at a high risk of hip fractures and should, therefore, be considered for osteoporosis treatment.

Two web-based fracture risk calculators are:

- Fracture Risk Assessment Tool (FRAX)
- Garvan Institute of Medical Research Fracture risk calculator

Bone mineral density test

Osteoporosis can be diagnosed through a BMD test, which measures the amount of minerals in a specific area of bone, typically at the hip and spine. The most reliable and accurate test of BMD is performed by scanning the skeleton using dual-energy X-ray absorptiometry (DXA), which is widely available in Australia.

The DXA test will give results as a T score and a Z score, detailed in Table 21.1:[553]

21 Osteoporosis

Table 21.1: Dual-energy X-ray absorptiometry (DXA) test results

Score	DXA test detail
T score	Compares bone density with that of an average young adult of the same sex. A T score of −1 or above (>−1) is normal and no treatment is necessary. A T score between −1 and −2.5 indicates lower-than-normal bone density (osteopenia), and the older person has several clinical risk factors for osteoporosis. Treatment should be considered. A T score below –2.5 (<- 2.5) indicates osteoporosis, and treatment is strongly recommended to prevent further bone loss and fractures.
Z score	Compares bone density with the average from the person's age group and sex. A Z-score of 1 or above (>1) indicates that the person's bone density is higher than that of others of the same age and sex. A Z score of zero (0) indicates the bone density is average for their age and sex. A Z score of −1 indicates bone density is below average density. A Z score below –2 (<−2) indicates that bone is being lost more rapidly than matched peers, so treatment needs to be monitored carefully. A Z score below –2 (<-2) may also indicate that an underlying disease is responsible for osteoporosis.

21.1.3 Evidence for pharmacological interventions

Medicines shown to be effective as first-line treatments of osteoporosis include bisphosphonates (risedronate, zoledronic acid and alendronate) and denosumab. These are oral or intravenous anti-resorptive medicines for people who have low bone density, with evidence that they affect a reduction in spine, hip and non-vertebral fractures.[558-560] Table 21.1 provides a full list of osteoporosis medicines available under the PBS.

Selective oestrogen receptor modulators are used for postmenopausal women with osteoporosis and have been shown to increase bone density and reduce the risk of fractures in the spine.[553]

Second-line therapy for osteoporosis management is restricted to people who are deemed to have failed treatment with first-line agents and are deemed at very high fracture risk. A specialist or consultant physician, not a general practitioner, must initiate the prescription of these agents.

Vitamin D and calcium supplementation

As most trials of antiresorptive agents have used concomitant calcium and vitamin D (see Chapter 20), it is appropriate to ensure that vitamin D deficiency is corrected and to add a low-dose calcium supplement to these therapies when dietary calcium intake is suboptimal. Calcium and/or vitamin D alone are not recommended for fracture prevention.[560] Vitamin D should be considered for the prevention of osteomalacia in individuals at risk.[561]

Risks associated with osteoporosis medicines

The responsible prescriber must consider the known risks associated with bisphosphonates, denosumab, and other osteoporosis medicines, as well as the manufacturer's advice, and ensure that these risks are communicated to the older person and their carers and family (to the extent the older person chooses).

Further information on the pharmacologic approaches to the prevention and treatment of osteoporosis in older people is available in the RACGP's Guidelines.

21 Osteoporosis

21.2 Principles of care

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

21.2.1 Assessing bone health

The RACGP guidelines on managing osteoporosis state that an older person who has sustained a minimal trauma fracture of the hip or spine can be presumed to have osteoporosis.[552] It is also likely that any minimal trauma fracture sustained by an older person is an indication of osteoporosis.[562] Therefore, health professionals should consider bone densitometry and specific anti-osteoporosis therapy for these older people.

Older people with a history of minimal trauma fracture should receive a bone health check, as a previous fracture is one of the strongest risk factors for a subsequent fracture.[563]

Older people who sustain a minimal trauma fracture should also be assessed for their risk of falls following the fracture.

Informal screening for signs of osteoporosis using clinical judgement

The multidisciplinary team, including the older person's general practitioner (GP), should be alert for anyone who exhibits signs of osteoporosis, such as thoracic kyphosis, loss of height or a history of minimal trauma fractures.

Health professionals can screen for osteoporosis using indirect indicators or risk factors, such as asking about the older person's lifestyle, including whether they are reluctant to go outside. Understanding how often an older person goes outside is especially important if they live in the southern states of Australia, where there is less exposure to ultraviolet light in winter and a greater risk of vitamin D deficiency (see Chapter 20 on vitamin D supplementation).

21.2.2 Providing interventions

Older people with a history of recurrent falls or those who have sustained a minimal trauma fracture should receive interventions to reduce future fracture risk, particularly when a diagnosis of osteoporosis has been made.[564]

Pharmacological interventions are the primary treatment options for osteoporosis and reducing the risk of fractures.

Table 21.2 provides specific PBS subsidy details for the medicines that are effective in improving bone mineral density in different populations. Note: All agents require authority permission for prescription.

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Table 21.2: Pharmaceutical Benefits Scheme (PBS) details for osteoporosis medicines

Medicine	Subsidised indications
Alendronate	Treatment as the sole PBS-subsidised antiresorptive agent for osteoporosis in a person aged ≥70 years with a bone mineral density T-score of –2.5 or less. Treatment as the sole PBS-subsidised antiresorptive agent for established osteoporosis in people with fractures due to minimal trauma. It is a potent inhibitor of bone resorption. It increases bone density and reduces the frequency of fractures at the hip and spine.[558, 559]
Risedronate	Treatment as the sole PBS-subsidised antiresorptive agent for osteoporosis in a person aged ≥70 years with a bone mineral density T-score of –2.5 or less. Treatment as the sole PBS-subsidised antiresorptive agent for established osteoporosis in people with fractures due to minimal trauma. It is a potent inhibitor of bone resorption. It increases bone density and reduces the frequency of fractures at the hip and spine. [558, 559]
Zoledronic acid	Treatment as the sole PBS-subsidised antiresorptive agent for: (a) established osteoporosis in women with fractures due to minimal trauma, or (b) established osteoporosis in men with hip fractures due to minimal trauma, or (c) for osteoporosis in women aged ≥70 years 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). Used to treat osteoporosis and prevent fractures. It is a potent inhibitor of bone resorption. It works for a long time, so only a single dose is required each year. [558, 559]
Denosumab	Treatment as the sole PBS-subsidised antiresorptive agent for osteoporosis in a person aged ≥70 years with a bone mineral density T-score of –2.5 or less. Treatment as the sole PBS-subsidised antiresorptive agent for established osteoporosis in people with fractures due to minimal trauma. It is a human monoclonal antibody that inhibits the development and activity of osteoclasts, thereby decreasing bone resorption and increasing bone density. It is available as a 6-monthly subcutaneous injection.
Raloxifene	Treatment as the sole PBS-subsidised antiresorptive agent for established postmenopausal osteoporosis in people with fractures due to minimal trauma. It is a selective oestrogen receptor modulator that increases bone density and reduces the risk of fractures in the spine. Evidence also shows that it reduces the incidence of breast cancer.[565]

21 Osteoporosis

Medicine	Subsidised indications
Teriparatide (second-line therapy)	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. It is a parathyroid hormone analogue that stimulates osteoblast activity, thereby promoting bone formation. It is given subcutaneously on a daily basis for up to 18 months. Prescription can only be initiated by a specialist or consultant physician.
Romosozumab (second-line therapy)	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. It is a monoclonal antibody that inhibits the action of sclerostin and is given as a monthly subcutaneous injection for up to 12 months. It has been shown to reduce fracture risk and improve bone mineral density in the spine and hips.[566-570] Prescription can only be initiated by a specialist or consultant physician.

21.2.3 Review and monitoring

A good-practice clinical indicator for identifying older people at risk of osteoporosis is to review their medicines chart for vitamin D supplements, as this can indicate that they have been identified as having reduced bone density.

Case study

Ms E is a 75-year-old lady who fell, fracturing her wrist while walking in her home. Specific questioning revealed that she had 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. She was identified through the hospital fracture liaison service, which systematically identifies everyone coming into the hospital with a minimal trauma fracture, and she was referred to the local osteoporosis clinic for evaluation and treatment of her bone health.

21.3 Special considerations for cognitive impairment

Some older people with cognitive impairment need to be supervised in the correct and safe manner of taking some oral bisphosphonates, as there are restrictions on lying down or eating after taking these medicines. Intravenous medicines might be an appropriate alternative for some older people with cognitive impairment.

Additional information

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

- The Royal Australian College of General Practitioners, *Osteoporosis prevention, diagnosis and management in postmenopausal women and men over 50 years of age*, 2nd edition
- 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.
- Healthy Bones Australia (formerly Osteoporosis Australia) is a national organisation dedicated to reducing fractures and improving bone health in the community.

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22.1 Background

All falls by older people in the community must be taken seriously. This includes falls that result in minor or no injury. Falls may be the first and main indication of another underlying and treatable condition in an older person. Also, older people who fall are more likely to fall again.[554]

Health professionals should be aware of:

- what constitutes a fall
- what to do when an older person falls, or if an older person reports a recent fall
- what follow-up is necessary, including reporting and incident managing processes
- the need to reassess the older person's fall risk following a fall and
- the need to implement actions to address the older person's fall risk factors to reduce the risk of another fall.

Person-centred care involves partnering with the older person to understand their needs, goals and preferences and develop an individualised plan for care that identifies appropriate fall prevention interventions. Involve the older person's carers and family to the extent the older person chooses.

22.1.1 Older people self-reporting a fall

Many older people who fall do not report the fall to their general practitioner (GP), other health professional or sometimes even to their family.[571]

Older people should be encouraged to report all falls, including those that result in minor or no injury, to their general practitioner or another suitably qualified health professional, as a previous fall is a strong risk factor for future falls and harm from falls.[554]

The older person's multidisciplinary team can work together to identify appropriate single, multiple-component, or multifactorial fall prevention actions tailored to the older person living in the community, which can be effective in preventing future falls and harm from falls.

If while providing care to an older person in their home, a community care professional notices signs that indicate a fall may have occurred (for example, the older person has unexplained bruising), the worker should discuss this with the older person and emphasise the importance of being assessed by a suitably qualified health professional to see whether the older person needs treatment.

22.2 Best practice care in responding to falls

The circumstances surrounding a fall are of critical importance. Information regarding a fall can be sourced directly from the older person, as well as from community service providers, carers, and family. This may be particularly important if the older person does not recall the circumstances of the fall.

22.2.1 Policy for preventing and responding to falls

Table 22.1 serves as a guide for what should be included in a service provider's policy and procedures for preventing and responding to falls in the community. The guide is based on good practice from the hospital and residential aged care service settings.

Depending on the background, training and experience of the staff member from a community service, the policy may primarily involve seeking assistance (e.g. an ambulance) or medical review in the first instance.

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Table 22.1: Managing the older person immediately after a fall

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 (e.g. responds to verbal or physical stimulus).
Check the older person's airways, breathing and circulation.
Reassure and comfort the older person.
Check for injuries
Conduct a preliminary assessment, including checking for level of consciousness and vital signs.
Check for signs of injury, including abrasions, contusions, lacerations, fractures, and head injuries.
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.
Safely move the older person
Assess whether it is safe to move the older person from their current position and note any special considerations that may be required during the movement. 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.
Monitor the older person
Ensure that ongoing monitoring of the older person can be provided, as some injuries may not be apparent at the time of the fall.
Carefully 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 provided with relevant details regarding any transfer information if an ambulance has been called.

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Report the fall
Report all falls to the older person's GP, even if injuries are not apparent.
At the earliest opportunity, notify the person nominated to be contacted in case of an emergency.
Note any details of the fall for reference in reporting the fall, including the older person's description, if possible. At a minimum, this should include the location and time of the fall, the older person's activity immediately before they fell, the mechanism of the fall (e.g., slip, trip, overbalance, dizziness), and whether they lost consciousness or experienced a conscious collapse.
Complete an incident-reporting form for all falls, 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.
Discuss the fall and future risk management
Communicate to all relevant staff, family, and carers that the older person has fallen and is at an increased risk of falling again.
Discuss the circumstances of the fall with the older person, its consequences and actions planned to reduce the risk of falling again. Involve the older person's carers and family (to the extent the older person chooses).
Assume that once an older person has fallen, they automatically become at high risk of falling again until they have been assessed.

22.3 Comprehensive assessment after a fall

All older people who fall require a comprehensive assessment in addition to a new fall risk assessment. This is particularly important for older people who fall repeatedly, those who are prone to injurious falls and those who demonstrate abnormalities of gait or balance. [3]

For a more detailed assessment, the older person should be referred to a specialist medical practitioner, such as a geriatrician or to a falls clinic (see 22.4.4 below).

Post-fall assessments are an integral part of successful multifactorial interventions aimed at reducing falls and associated harm. A comprehensive fall assessment involves:[48]

- taking a history of the older person's fall circumstances, medicines, acute or chronic medical problems, and mobility levels
- examining the older person's vision, gait and balance, and lower extremity joint function
- examining the older person's basic neurological function, including mental status, muscle strength, lower extremity peripheral nerves, proprioception, reflexes, and testing cortical, extrapyramidal and cerebellar function
- assessing the older person's 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.

22.4 Post-fall follow-up

After an immediate follow-up on a fall involving an older person, the cause of the fall and any related injuries should be investigated and reported. The fall investigation needs to consider environmental, social and clinical causes, including medicines, which may have contributed to the older person falling so these can be addressed to reduce the risk of another fall.

The following elements comprise best practice post-fall activities. A GP or other suitably qualified health professional can complete these:

- Consider a medicines review with a structured tool to identify medicines that increase fall risk and identify target medicines for deprescribing.
- Investigate the cause of the fall, including assessing the older person for delirium.
- Review the implementation of existing fall prevention strategies, including standard fall prevention strategies for the older person.
- Conduct a fall risk assessment (see Chapter 6), as new fall risk factors may be present in the older person.
- Implement a targeted, individualised plan for daily care for the older person based on the findings of the fall risk assessment tool. Multifactorial interventions should be implemented as necessary to address fall risk factors. This may include, but is not limited to, gait, balance, and exercise programs, footwear reviews, medication reviews, hypotension management, environmental hazard modifications, and cardiovascular disorder treatments. This will often involve referral to other members of the multidisciplinary team, such as a physiotherapist, exercise physiologist, podiatrist and dietitian (see Chapter 5).
- Encourage the older person to resume their normal level of activity. Many older people are apprehensive after a fall, and the fear of falling is a strong predictor of future falls.[572]
- Consider implementing fall injury-prevention interventions. For example, the GP may consider the use of hip protectors and vitamin D and calcium supplementation (see Chapters 19 and 20).
- Consider investigations for osteoporosis in the older person in the presence of minimal trauma fractures (see Chapter 21).
- Ensure the effective communication of assessment and management recommendations to the multidisciplinary team, the older person, and their carers and family (to the extent the older person chooses).

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22.4.1 Analysing the fall

A post-fall analysis is undertaken to inform an evaluation of the older person's daily care plan and the fall prevention interventions. Comorbidities and fall risk factors should be identified and addressed, and the older person's care plan should be updated to reflect the incidence of the fall and the relevant post-fall actions.

Falls resulting in significant harm or death

Fall management policy guides workers on how to respond to and analyse falls.

For falls resulting in significant harm, an in-depth analysis of the fall may be warranted and is sometimes known as a root-cause analysis (RCA).

In a hospital or residential aged care service, where a duty of care exists, an RCA is always required if a fall causes death. Reporting falls is also mandatory in these settings.

If an older person living in the community dies due to a fall, service providers are not necessarily expected to conduct a Root Cause Analysis (RCA). The death certification process, conducted by the attending medical practitioner, will address the necessary reporting requirements, including the report to the coroner.

22.4.2 Assessment and training for rising from the floor after a fall

Assessment of ability to rise from the floor

After an older person experiences a fall, it may be beneficial to assess their ability to rise from the floor. It is important to reduce the risk of a 'long-lie' occurring due to the potential associated poor outcomes.[156] Poor outcomes can include pressure ulcers, dehydration, pneumonia and even death.[156]

Note that it is inappropriate to assess older people who are frail and have multiple comorbidities for their ability to rise from the floor given their already high fall risk.[573]

The Floor Transfer Test is a valid and reliable measure for assessing a person's ability to rise from the floor. [7,8] It involves asking an older person to perform a transfer from standing to a supine position on the floor and then return to a standing position with and without the use of a chair.

Training for rising from the floor

The Backward Chaining Method is a training program that has been shown to improve a person's ability to rise from the floor unassisted.[574, 575] It breaks down the movements of a floor transfer into small individual components and then performs them in the reverse order (standing-to-lying) to reduce the older person experiencing failure in each component.

22.4.3 Loss of confidence after a fall

A common but often overlooked consequence of a fall by an older person is a loss of confidence in walking or fear of falling,[572], which can occur even in the absence of injury. In the period after a fall, the multidisciplinary team (including carers, where appropriate) should observe the older person to note any change in their usual activity that might indicate the presence of, or increase in, fear of falling. Speak to the older person about any concerns they may have about falling.

Common approaches to improving loss of confidence or fear of falling by older people living in the community include participating in a balance and mobility training exercise program, wearing hip protectors or using other fall prevention interventions.[575]

22.4.4 Falls clinics

Falls clinics in Australia can be public or private and are often conducted as part of an outpatient service. The number of fall clinics in Australia is slowly increasing, and a referral from a general practitioner or service provider is usually required.

Falls clinics are staffed by a multidisciplinary team that can provide a falls assessment and advice for the management of fall risk for older people who have fallen.[576] The team usually develops an intervention strategy for the older person, as well as advice, education and training for the older person, their carers and other members of the multidisciplinary team. Falls clinics can also refer the older person to mainstream health services for ongoing management.

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

22.5 Reporting and recording falls

After a fall, it is important that all members of the multidisciplinary team – including the GP, other health professionals, the older person and their carers and family (to the extent the older person chooses) – know about the fall, the factors that might have caused it and what is being done to address the older person's future fall risk.

A community service provider should have systems and processes in place for reporting falls and collecting the relevant information about the fall.

The process should clearly identify the person to whom falls should be first reported; for example, the service coordinator, the older person's GP and the person responsible in case of an emergency.

Table 22.2 provides a comprehensive list of what information can be collected and reported after an older person has fallen. The level of information collected 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.

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

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Table 22.2: Relevant information for recording falls in the community

Information to record about a fall by an older person in the community
Demographic details of the older person (including date of birth)
The older person's current and relevant diagnoses or problems
Date, time and place of the fall
Type of fall (e.g. slip, trip, bumping into or falling on an object)
The older person's activity at the time of the fall (e.g. attempting to stand or walking)
Whether the older person is independent or dependent on carers or aides
Steps taken previously to reduce fall risk and injury risk
Any recent change in the older person's medicines that might be associated with fall risk
Relevant information about clothing, footwear, eyewear and mobility aids used at the time of the fall
Factors contributing to the fall, such as environmental conditions (e.g. floor, lighting, clutter)
The older person's health status after the fall (e.g. baseline observations, injuries)
Interventions to be used after the fall and medical treatment required
The older person's perception of the fall, including a description of any preceding sensations or symptoms and what they think could have prevented the fall
Any witnesses to the fall
Any other comments

22.5.1 Serious Incident Response Scheme

The Aged Care Quality and Safety Commission (the Commission) is the national regulator of Commonwealth-funded aged care services, including home and community care services, and receives reportable incident notifications through the Serious Incident Response Scheme (SIRS).

The SIRS aims to reduce abuse and neglect of older people receiving Commonwealth-funded aged care services. The SIRS establishes responsibilities for all providers, including home and community care providers, to:

- prevent and manage incidents (focusing on the safety and wellbeing of older people)
- use incident data to drive quality improvement, and
- to report serious incidents.

Providers must use the My Aged Care provider portal to notify the Commission if a reportable incident occurs. Reportable incidents under SIRS include:

- unreasonable use of force
- unlawful sexual contact or inappropriate sexual conduct
- neglect
- psychological or emotional abuse
- unexpected death
- stealing or financial coercion by a staff member
- inappropriate use of restrictive practices, and
- unexplained absence from care (missing consumers).

Additional information

- The Royal Australian College of General Practitioners, RACGP Aged Care Clinical Guide (Silver Book). Part A Falls, 5th edition.
- Australian Commission on Safety and Quality in Health Care. Principles for safe and high-quality transitions of care.

Bibliography

1. NSW Clinical Excellence Commission. Fall Prevention in NSW: White Paper 2023 Sydney: NSW CEC; 2023. Available from: https://www.cec.health.nsw.gov.au/keep-patients-safe/older-persons-patient-safety-program/fall-prevention.
2. Montero-Odasso M, van der Velde N, Martin FC, Petrovic M, Tan MP, Ryg J, et al. World guidelines for falls prevention and management for older adults: a global initiative. Age Ageing. 2022;51(9).
3. World Health Organization. Step Safely: Strategies for Preventing and Managing Falls across the Life-Course. Geneva: World Health Organization; 2021.
4. Royal Commission into Aged Care Quality and Safety. Final Report: Care, Dignity and Respect. 2021.
5. Australian Commission on Safety and Quality in Health Care. Preventing Falls and Harm From Falls in Older People — Best Practice Guidelines for Australian Hospitals and Residential Aged Care Facilities. Sydney: ACSQHC; 2005.
6. Australian Commission on Safety and Quality in Health Care. Preventing Falls and Harm from Falls in Older People — Best Practice Guidelines for Residential Aged Care Facilities. Sydney: ACSQHC; 2009.
7. Lord SR, Sherrington C, Naganathan V. Falls in Older People: Risk Factors, Strategies for Prevention and Implications for Practice: Cambridge University Press; 2021.
8. Australian Institute of Health and Welfare AIHW. Older Australians Web Report Canberra: Australian Institute of Health and Welfare; 2024. Available from: https://www.aihw.gov.au/reports/older-people/older-australians/contents/summary.
9. Organization WH. Decade of Healthy Ageing: Baseline Report. Geneva: World Health Organisation; 2021.
10. Organization WH. Falls: World Health Organization 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/falls.
11. Xu D, Kane R, Arling G. Relationship between nursing home quality indicators and potentially preventable hospitalisation. BMJ Quality & Safety. 2019;28(7):524.
12. Cameron ID, Dyer SM, Panagoda CE, Murray GR, Hill KD, Cumming RG, et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews. 2018(9).
13. Sherrington C, Fairhall NJ, Wallbank GK, Tiedemann A, Michaleff ZA, Howard K, et al. Exercise for preventing falls in older people living in the community. Cochrane Database of Systematic Reviews. 2019(1).
14. Hopewell S, Adedire O, Copsey BJ, Boniface GJ, Sherrington C, Clemson L, et al. Multifactorial and multiple component interventions for preventing falls in older people living in the community. Cochrane Database of Systematic Reviews. 2018;7(7):CD012221.
15. Lord SR, Ward JA, Williams P, Anstey KJ. An epidemiological study of falls in older community-dwelling women: The Randwick falls and fractures study. Aust J Public Health. 1993;17(3):240-45.
16. Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. J Gerontol. 1989;44(4):M112-7.
17. Tinetti ME, Speechley M, Ginter SF. Risk Factors for Falls among Elderly Persons Living in the Community. New England Journal of Medicine. 1988;319(26):1701-7.
18. O'Loughlin JL, Robitaille Y, Boivin JF, Suissa S. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. Am J Epidemiol. 1993;137(3):342-54.

Bibliography

19. Luukinen H, Koski K, Laippala P, Kivelä S-L. Predictors for recurrent falls among the home-dwelling elderly. Scandinavian Journal of Primary Health Care. 1995;13(4):294-99.
20. Campbell AJ, Borrie MJ, Spears GF, Jackson SL, Brown JS, Fitzgerald JL. Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study. Age and Ageing. 1990;19(2):136-41.
21. Baker SP, Harvey AH. Fall injuries in the elderly. Clin Geriatr Med. 1985;1(3):501-12.
22. Cripps RA, Carman J. Falls by the elderly in Australia: Trends and data for 1998. Canberra: Australian Institute of Health and Welfare; 2001.
23. New South Wales Health. The epidemiology of falls in older people in NSW. Sydney: NSW Health 1994.
24. Marottoli RA, Berkman LF, Cooney LM, Jr. Decline in physical function following hip fracture. J Am Geriatr Soc. 1992;40(9):861-6.
25. King MB, Tinetti ME. Falls in community-dwelling older persons. J Am Geriatr Soc. 1995;43(10):1146-54.
26. Mallinson WJ, Green MF. Covert muscle injury in aged patients admitted to hospital following falls. Age Ageing. 1985;14(3):174-8.
27. Wild D, Nayak US, Isaacs B. How dangerous are falls in old people at home? Br Med J (Clin Res Ed). 1981;282(6260):266-8.
28. Vellas B, Cayla F, Bocquet H, de Pemille F, Albarede JL. Prospective study of restriction of activity in old people after falls. Age Ageing. 1987;16(3):189-93.
29. Tinetti ME, Liu WL, Claus EB. Predictors and prognosis of inability to get up after falls among elderly persons. Jama. 1993;269(1): 65-70.
30. Hadjistavropoulos T, Delbaere K. The Psychology of Fall Risk: Fear, Anxiety, Depression, and Balance Confidence. In: Lord SR, Sherrington C, Naganathan V, editors. Falls in Older People: Risk Factors, Strategies for Prevention and Implications for Practice. 3 ed. Cambridge: Cambridge University Press; 2021. p. 160-71.
31. Tinetti ME, Mendes de Leon CF, Doucette JT, Baker DI. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. J Gerontol. 1994;49(3):M140-7.
32. Tinetti ME, Williams CS. The effect of falls and fall injuries on functioning in community-dwelling older persons. J Gerontol A Biol Sci Med Sci. 1998;53(2):M112-9.
33. Tinetti ME, Williams CS. Falls, injuries due to falls, and the risk of admission to a nursing home. New England Journal of Medicine. 1997;337(18):1279-84.
34. Lord SR, Sherrington C, Naganathan V. The Relative Importance of Fall Risk Factors: Analysis and Summary. In: Lord SR, Sherrington C, Naganathan V, editors. Falls in Older People: Risk Factors, Strategies for Prevention and Implications for Practice. 3rd ed. Cambridge: Cambridge University Press; 2021. p. 237-48.
35. Sewell A. Step out with confidence. N S W Public Health Bull. 2002;13(1-2):20.
36. Organization. WH. World report on ageing and health. 2015.
37. Delbaere K, Close JC, Brodaty H, Sachdev P, Lord SR. Determinants of disparities between perceived and physiological risk of falling among elderly people: Cohort study. BMJ. 2010;341:c4165.
38. Sturnieks DL, Hicks C, Smith N, Ratanapongleka M, Menant J, Turner J, et al. Exergame and cognitive training for preventing falls in community-dwelling older people: a randomized controlled trial. Nat Med. 2024;30(1):98-105.

Bibliography

39. Schoene D, Valenzuela T, Lord SR, de Bruin ED. The effect of interactive cognitive-motor training in reducing fall risk in older people: a systematic review. BMC geriatr. 2014;14:107.

40. Sturnieks D, Hicks C, Lord S. 139 Preventing falls with motor-cognitive training: a 12-month randomised controlled trial. Injury Prevention. 2022;28(Suppl 2):A21.

41. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020;54(24):1451-62.

42. Close J, Ellis M, Hooper R, Glucksman E, Jackson S, Swift C. Prevention of falls in the elderly trial (PROFET): a randomised controlled trial. The Lancet. 1999;353(9147):93-7.

43. Gates S, Fisher JD, Cooke MW, Carter YH, Lamb SE. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: Systematic review and meta-analysis. BMJ. 2008;336(7636): 130-33.

44. Campbell AJ, Robertson MC. Rethinking individual and community fall prevention strategies: A meta-regression comparing single and multifactorial interventions. Age and Ageing. 2007;36(6):656-62.

45. Hopewell S, Adedire O, Copsey BJ, Boniface GJ, Sherrington C, Clemson L, et al. Multifactorial and multiple component interventions for preventing falls in older people living in the community. Cochrane Database of Systematic Reviews. 2018(7).

46. Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. New England Journal of Medicine. 1994;331(13):821-7.

47. Taylor ME, Wesson J, Sherrington C, Hill KD, Kurrle S, Lord SR, et al. Tailored Exercise and Home Hazard Reduction Program for Fall Prevention in Older People With Cognitive Impairment: The i-FOCIS Randomized Controlled Trial. The Journals of Gerontology: Series A. 2020;76(4):655-65.

48. AGS (American Geriatrics Society). Guideline for the prevention of falls in older persons. Journal of the American Geriatrics Society. 2001;49(5):664-72.

49. Tiedemann A, Shimada H, Sherrington C, Murray S, Lord SR. The comparative ability of eight functional mobility tests for predicting falls in community-dwelling older people. Age and Ageing. 2008;37(4):430-5.

50. Shumway-Cook A, Brauer S, Woollacott M. Predicting the Probability for Falls in Community-Dwelling Older Adults Using the Timed Up & Go Test. Physical Therapy. 2000;80(9):896-903.

51. Gunter KB, White KN, Hayes WC, Snow CM. Functional mobility discriminates nonfallers from one-time and frequent fallers. Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2000;55(11):M672-M6.

52. Rose DJ, Jones CJ, Lucchese N. 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. 2002;10(4):466-75.

53. Schoene D, Wu SMS, Mikolaizak AS, Menant JC, Smith ST, Delbaere K, et al. Discriminative ability and predictive validity of the timed Up and Go test in identifying older people who fall: systematic review and meta-analysis. Journal of the American Geriatrics Society. 2013;61(2):202-8.

54. Russell MA, Hill KD, Day LM, Blackberry I, Gurrin LC, Dharmage SC. Development of the Falls Risk for Older People in the Community (FROP-Com) screening tool. Age and Ageing. 2008;38(1):40-6.

Bibliography

55. Russell M, Hill K, Blackberry I, Gurrin L, Day L, Dharmage S. The reliability, sensitivity and specificity of the falls risk for older people in the community (FROP-Com) assessment tool. Age and Ageing. 2008;37(6):634-9.

56. Tinetti ME, Franklin TW, Mayewski R. Fall risk index for elderly patients based on number of chronic disabilities. The American Journal of Medicine. 1986;80(3):429-34.

57. Shaw FE, Bond J, Richardson DA, Dawson P, Steen IN, McKeith IG, et al. 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. 2003;326(7380):73-.

58. Shaw FE. Prevention of falls in older people with dementia. Journal of Neural Transmission. 2007;114(10):1259-64.

59. Carr JH, Shepherd R. Neurological Rehabilitation: Optimizing Motor Performance. 2 ed. New York: Churchill Livingstone; 2010.

60. Farlie MK, Robins L, Keating JL, Molloy E, Haines TP. Intensity of challenge to the balance system is not reported in the prescription of balance exercises in randomised trials: A systematic review. Journal of Physiotherapy. 2013;59(4):227-35.

61. Lord SR, Ward JA, Williams P, Anstey KJ. Physiological factors associated with falls in older community-dwelling women. Journal of the American Geriatrics Society. 1994;42(10):1110-17.

62. Gillespie LD, Robertson MC, Gillespie WJ, Sherrington C, Gates S, Clemson LM, et al. Interventions for preventing falls in older people living in the community. Cochrane Database of Systematic Reviews. 2012(9):CD007146.

63. American College of Sports Medicine. 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. 1998;31(2):353-54.

64. Howe TE, Rochester L, Neil F, Skelton DA, Ballinger C. Exercise for improving balance in older people. Cochrane Database of Systematic Reviews. 2011(11):Cd004963.

65. Latham NK, Anderson CS, Bennett DA, Stretton C. Progressive resistance strength training for physical disability in older people. Cochrane Database of Systematic Reviews. 2003(2):CD002759.

66. Callisaya ML, Blizzard L, Schmidt MD, Martin KL, McGinley JL, Sanders LM, et al. Gait, gait variability and the risk of multiple incident falls in older people: A population-based study. Age and Ageing. 2011;40(4):481-87.

67. Verghese J, Holtzer R, Lipton RB, Wang C. Quantitative gait markers and incident fall risk in older adults. J Gerontol A Biol Sci Med Sci. 2009;64(8):896-901.

68. Kerrigan DC, Lee LW, Nieto TJ, Markman JD, Collins JJ, Riley PO. Kinetic alterations independent of walking speed in elderly fallers. Archives of Physical Medicine and Rehabilitation. 2000;81(6):730-35.

69. Lord SR, Menz HB, Tiedemann A. A physiological profile approach to falls risk assessment and prevention. Physical Therapy. 2003;83(3):237-52.

70. Lord SR, Delbaere K, Gandevia SC. Use of a physiological profile to document motor impairment in ageing and in clinical groups. Journal of Physiology. 2015;594(16):4513-23.

71. Allali G, Annweiler C, Blumen HM, Callisaya ML, De Cock AM, Kressig RW, et al. Gait phenotype from mild cognitive impairment to moderate dementia: results from the GOOD initiative. European Journal of Neurology. 2016;23(3):527-41.

Bibliography

72. Franchignoni F, Horak F, Godi M, Nardone A, Giordano A. Using psychometric techniques to improve the Balance Evaluation Systems Test: The mini-BESTest. Journal of Rehabilitation Medicine. 2010;42(4):323-31.

73. Martin KL, Blizzard L, Srikanth VK, Wood A, Thomson R, Sanders LM, et al. Cognitive Function Modifies the Effect of Physiological Function on the Risk of Multiple Falls--A Population-Based Study. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2013;68(9):1091-7.

74. Sherrington C, Michaleff ZA, Fairhall N, Paul SS, Tiedemann A, Whitney J, et al. Exercise to prevent falls in older adults: an updated systematic review and meta-analysis. Br J Sports Med. 2017;51(24):1750-8.

75. Veronese N, Bolzetta F, Toffanello ED, Zambon S, De Rui M, Perissinotto E, et al. Association Between Short Physical Performance Battery and Falls in Older People: The Progetto Veneto Anziani Study. Rejuvenation Research. 2014;17(3):276-84.

76. Moe-Nilssen R, Nordin E, Lundin-Olsson L. Criteria for evaluation of measurement properties of clinical balance measures for use in fall prevention studies. Journal of Evaluation in Clinical Practice. 2008;14(2):236-40.

77. Perera S, Mody SH, Woodman RC, Studenski SA. Meaningful change and responsiveness in common physical performance measures in older adults. Journal of the American Geriatrics Society. 2006;54(5):743-9.

78. Duncan PW, Studenski S, Chandler J, Prescott B. Functional reach: Predictive validity in a sample of elderly male veterans. Journal of Gerontology. 1992;47(3):M93-M8.

79. Podsiadlo D, Richardson S. The timed "up & go": a test of basic functional mobility for frail elderly persons. Journal of the American Geriatrics Society. 1991;39(2):142-8.

80. Schoene D, Wu SMS, Mikolaizak AS, Menant JC, Smith ST, Delbaere K, et al. Discriminative ability and predictive validity of the timed Up and Go test in identifying older people who fall: Systematic review and meta□analysis. Journal of the American Geriatrics Society. 2013;61(2):202-8.

81. Csuka M, McCarty DJ. Simple method for measurement of lower extremity muscle strength. American Journal of Medicine. 1985;78(1):77-81.

82. Rikli R, Jones J. Functional fitness normative scores for community-residing older adults, ages 60-94. Journal of Aging and Physical Activity. 1999;7(2):162-81.

83. Berg KO, Wood-Dauphinee SL, Williams JI, Maki B. Measuring balance in the elderly: Validation of an instrument. Canadian Journal of Public Health. 1992;83(Suppl 2):S7-11.

84. Tinetti ME. Performance-oriented assessment of mobility problems in elderly patients. Journal of the American Geriatrics Society. 1986;34(2):119-26.

85. Duncan RP, Leddy AL, Cavanaugh JT, Dibble LE, Ellis TD, Ford MP, et al. Comparative utility of the BESTest, Mini-BESTest, and Brief-BESTest for predicting falls in individuals with Parkinson Disease: A cohort study. Physical Therapy. 2013;93(4):542-50.

86. King L, Horak F. On the Mini-BESTest: Scoring and the reporting of total scores. Physical Therapy. 2013;93(4):571-75.

87. Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C, Todd C. Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age and Ageing. 2005;34(6):614-9.

88. Delbaere K, Close JCT, Mikolaizak AS, Sachdev PS, Brodaty H, Lord SR. The Falls Efficacy Scale International (FES-I). A comprehensive longitudinal validation study. Age and Ageing. 2010;39(2):210-16.

Bibliography

89. Lesinski M, Hortobagyi T, Muehlbauer T, Gollhofer A, Granacher U. Effects of balance training on balance performance in healthy older adults: A systematic review and meta-analysis. Sports medicine (Auckland, NZ). 2015;45(12):1721-38.

90. Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, et al. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. Circulation. 2007;116(9):1094-105.

91. Boyle PA, Buchman AS, Wilson RS, Bienias JL, Bennett DA. Physical activity is associated with incident disability in community-based older persons. Journal of the American Geriatrics Society. 2007;55(2):195-201.

92. McCrum C, Bhatt TS, Gerards MHG, Karamanidis K, Rogers MW, Lord SR, et al. Perturbation-based balance training: Principles, mechanisms and implementation in clinical practice. Front Sports Act Living. 2022;4:1015394.

93. Okubo Y, Schoene D, Lord SR. Step training improves reaction time, gait and balance and reduces falls in older people: a systematic review and meta-analysis. British journal of sports medicine. 2016;0:1-9.

94. Lurie JD, Zagaria AB, Ellis L, Pidgeon D, Gill-Body KM, Burke C, et al. Surface perturbation training to prevent falls in older adults: A highly pragmatic, randomized controlled trial. Phys Ther. 2020;100(7):1153-62.

95. Pai YC, Bhatt T, Yang F, Wang E. Perturbation training can reduce community-dwelling older adults' annual fall risk: a randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2014;69(12):1586-94.

96. Bhatt T, Yang F, Pai YC. Learning to resist gait-slip falls: Long-term retention in community-dwelling older adults. Arch Phys Med Rehabil. 2012;93(4):557-64.

97. Hortobagyi T, Lesinski M, Gabler M, VanSwearingen JM, Malatesta D, Granacher U. Effects of three types of exercise interventions on healthy old adults' gait speed: A systematic review and meta-analysis. Sports medicine (Auckland, NZ). 2015;45(12):1627-43.

98. Visser H. Gait and balance in senile dementia of Alzheimer's Type. Age and Ageing. 1983;12(4):296-301.

99. Taylor ME, Delbaere K, Mikolaizak AS, Lord SR, Close JC. Gait parameter risk factors for falls under simple and dual task conditions in cognitively impaired older people. Gait & posture. 2013;37(1):126-30.

100. Erlenbach E, McAuley E, Gothe NP. The association between light physical activity and cognition among adults: A scoping review. J Gerontol A Biol Sci Med Sci. 2021;76(4):716-24.

101. Gavelin HM, Dong C, Minkov R, Bahar-Fuchs A, Ellis KA, Lautenschlager NT, et al. Combined physical and cognitive training for older adults with and without cognitive impairment: A systematic review and network meta-analysis of randomized controlled trials. Ageing Res Rev. 2021;66:101232.

102. Kelly ME, Loughrey D, Lawlor BA, Robertson IH, Walsh C, Brennan S. The impact of exercise on the cognitive functioning of healthy older adults: A systematic review and meta-analysis. Ageing Res Rev. 2014;16:12-31.

103. Forbes D, Forbes SC, Blake CM, Thiessen EJ, Forbes S. Exercise programs for people with dementia. Cochrane Database of Systematic Reviews. 2015(4):CD006489.

104. Weber JB, Coverdale JH, Kunik ME. Delirium: current trends in prevention and treatment. Internal Medicine Journal. 2004;34(3):115-21.

105. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Arlington, VA: American Psychiatric Association; 2013.

Bibliography

106. Australian Institute of Health and Welfare. Australia's Health 2020: data insights. Canberra: AIHW; 2020.

107. Australian Commission on Safety and Quality in Health Care. Delirium Clinical Care Standard Sydney: ACSQHC; 2021. Available from: https://www.safetyandquality.gov.au/standards/clinical-care-standards/delirium-clinical-care-standard.

108. Wei LA, Fearing MA, Sternberg EJ, Inouye SK. The confusion assessment method: a systematic review of current usage. Journal of the American Geriatrics Society. 2008;56(5):823-30.

109. Inouye SK. Delirium in older persons. New England Journal of Medicine. 2006;354(11):1157-65.

110. Burton JK, Craig LE, Yong SQ, Siddiqi N, Teale EA, Woodhouse R, et al. Non-pharmacological interventions for preventing delirium in hospitalised non-ICU patients. Cochrane Database Syst Rev. 2021;7(7):Cd013307.

111. Hill KD, Vu M, Walsh W. Falls in the acute hospital setting—impact on resource utilisation. Australian Health Review. 2007;31(3):471-77.

112. Buchner DM, Larson EB. Falls and fractures in patients with Alzheimer-type dementia. Journal of the American Medical Association. 1987;257(11):1492-95.

113. Harvey NC, Johansson H, Odén A, Karlsson MK, Rosengren BE, Ljunggren Ö, et al. FRAX predicts incident falls in elderly men: findings from MrOs Sweden. Osteoporosis International. 2016;27(1):267-74.

114. van Dijk PTM, Meulenberg OGRM, van de Sande HJ, Habbema JDF. Falls in Dementia Patients. The Gerontologist. 1993;33(2):200-4.

115. Taylor ME, Delbaere K, Lord SR, Mikolaizak AS, Brodaty H, Close JC. Neuropsychological, physical, and functional mobility measures associated with falls in cognitively impaired older adults. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2014;69(8):987-95.

116. Taylor ME, Delbaere K, Lord SR, Mikolaizak AS, Close JCT. Physical impairments in cognitively impaired older people: implications for risk of falls. International Psychogeriatrics. 2013;25(1):148-56.

117. Allan LM, Ballard CG, Rowan EN, Kenny RA. Incidence and prediction of falls in dementia: a prospective study in older people. PloS One. 2009;4(5):e5521.

118. Morris JC, Rubin EH, Morris EJ, Mandel SA. Senile dementia of the Alzheimer's type: an important risk factor for serious falls. Journal of Gerontology. 1987;42(4):412-7.

119. Chantanachai T, Sturnieks DL, Lord SR, Payne N, Webster L, Taylor ME. Risk factors for falls in older people with cognitive impairment living in the community: Systematic review and meta-analysis. Ageing Research Reviews. 2021;71:101452.

120. Taylor ME, Lord SR, Delbaere K, Kurrle SE, Mikolaizak AS, Close JCT. Reaction time and postural sway modify the effect of executive function on risk of falls in older people with mild to moderate cognitive impairment. The American Journal of Geriatric Psychiatry. 2017;25(4):397-406.

121. Chiaramonte R, Cioni M. Critical spatiotemporal gait parameters for individuals with dementia: A systematic review and meta-analysis. Hong Kong Physiotherapy Journal. 2021;41(1):1-14.

122. Neubauer NA, Azad-Khaneghah P, Miguel-Cruz A, Liu L. What do we know about strategies to manage dementia-related wandering? A scoping review. Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring. 2018;10:615-28.

Bibliography

123. Lai CK, Arthur DG. Wandering behaviour in people with dementia. Journal of Advanced Nursing. 2003;44(2):173-82.

124. Murata S, Takegami M, Ogata S, Ono R, Nakatsuka K, Nakaoku Y, et al. Joint effect of cognitive decline and walking ability on incidence of wandering behavior in older adults with dementia: A cohort study. International Journal of Geriatric Psychiatry. 2022;37(5).

125. Lach HW, Harrison BE, Phongphanngam S. Falls and fall prevention in older adults with early-stage dementia: An integrative review. Research in Gerontological Nursing. 2017;10(3):139-48.

126. Fillit H, Aigbogun MS, Gagnon-Sanschagrin P, Cloutier M, Davidson M, Serra E, et al. Impact of agitation in long-term care residents with dementia in the United States. Int J Geriatr Psychiatry. 2021;36(12):1959-69.

127. Cloak N, Al Khalili Y. Behavioral and Psychological Symptoms in Dementia. Treasure Island, FL: StatPearls Publishing; 2024.

128. Hart LA, Marcum ZA, Gray SL, Walker RL, Crane PK, Larson EB. The association between central nervous system-active medication use and fall-related injury in community-dwelling older adults with dementia. Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy. 2019;39(5):530-43.

129. Taipale H, Hamina A, Karttunen N, Koponen M, Tanskanen A, Tiihonen J, et al. Incident opioid use and risk of hip fracture among persons with Alzheimer disease: a nationwide matched cohort study. Pain. 2019;160(2):417-23.

130. Bengtsson-Lindberg M, Larsson V, Minthon L, Wattmo C, Londos E. Lack of orthostatic symptoms in dementia patients with orthostatic hypotension. Clinical Autonomic Research. 2015;25(2):87-94.

131. Passant U, Warkentin S, Gustafson L. Orthostatic hypotension and low blood pressure in organic dementia: A study of prevalence and related clinical characteristics. International Journal of Geriatric Psychiatry. 1997;12(3):395-403.

132. Sverdrup K, Selbæk G, Bergh S, Strand BH, Thingstad P, Skjellegrind HK, et al. Physical performance across the cognitive spectrum and between dementia subtypes in a population-based sample of older adults: The HUNT study. Archives of Gerontology and Geriatrics. 2021;95:104400.

133. De Cock A-M, Fransen E, Perkisas S, Verhoeven V, Beauchet O, Vandewoude M, et al. Comprehensive quantitative spatiotemporal gait analysis identifies gait characteristics for early dementia subtyping in community dwelling older adults. Frontiers in Neurology. 2019;10:313.

134. Taylor ME, Toots A, Lord SR, Payne N, Close JCT. Cognitive Domain Associations with Balance Performance in Community-Dwelling Older People with Cognitive Impairment. J Alzheimers Dis. 2021;81(2):833-41.

135. Shaw FE. Falls in cognitive impairment and dementia. Clinics in Geriatric Medicine. 2002;18(2):159-73.

136. Muir SW, Gopaul K, Montero Odasso MM. The role of cognitive impairment in fall risk among older adults: A systematic review and meta-analysis. Age and Ageing. 2012;41(3):299-308.

137. Taylor ME, Ketels MM, Delbaere K, Lord SR, Mikolaizak AS, Close JC. Gait impairment and falls in cognitively impaired older adults: an explanatory model of sensorimotor and neuropsychological mediators. Age Ageing. 2012;41(5):665-9.

138. Aged Care Quality and Safety Commission. Behaviour support plan: a fact sheet for residential aged care providers: Aged Care Quality and Safety Commission; 2021. Available from: https://www.agedcarequality.gov.au/sites/default/files/media/fact-sheet-behaviour-support-plans.pdf.

Bibliography

139. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research. 1975;12(3): 189-98.

140. Rowland JT, Basic D, Storey JE, Conforti DA. The Rowland Universal Dementia Assessment Scale (RUDAS) and the Folstein MMSE in a multicultural cohort of elderly persons. International Psychogeriatrics. 2006;18(1): 111-20.

141. Cognitive Decline Partnership Centre Guideline Adaptation Committee. Clinical Practice Guidelines and Principles of Care for People with Dementia Sydney: NHMRC Partnership Centre for Dealing with Cognitive and Related Functional Decline in Older People; 2016. Available from: https://cdpc.sydney.edu.au/wp-content/uploads/2019/06/CDPC-Dementia-Guidelines_WEB.pdf.

142. Patnode CD, Perdue LA, Rossom RC, Rushkin MC, Redmond N, Thomas RG, et al. Screening for cognitive impairment in older adults: Updated evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2020;323(8):764-85.

143. Creavin ST, Wisniewski S, Noel-Storr AH, Trevelyan CM, Hampton T, Rayment D, et al. Mini-Mental State Examination (MMSE) for the detection of dementia in clinically unevaluated people aged 65 and over in community and primary care populations. Cochrane Database Syst Rev. 2016;2016(1):Cd011145.

144. Storey JE, Rowland JTJ, Conforti DA, Dickson HG. The Rowland Universal Dementia Assessment Scale (RUDAS): a multicultural cognitive assessment scale. International Psychogeriatrics. 2004;16(1):13-31.

145. Brodaty H, Pond D, Kemp NM, Luscombe G, Harding L, Berman K, et al. The GPCOG: A new screening test for dementia designed for general practice. Journal of the American Geriatrics Society. 2002;50(3):530-34.

146. Brodaty H, Connors MH, Loy C, Teixeira-Pinto A, Stocks N, Gunn J, et al. Screening for dementia in primary care: A comparison of the GPCOG and the MMSE. Dement Geriatr Cogn Disord. 2016;42(5-6):323-30.

147. Antonelli Incalzi R, Cesari M, Pedone C, Carosella L, Carbonin PU. Construct validity of the abbreviated mental test in older medical inpatients. Dement Geriatr Cogn Disord. 2003;15(4):199-206.

148. Hodkinson HM. Evaluation of a mental test score for the assessment of mental impairment in the elderly. Age and Ageing. 1972;1(4):233-38.

149. Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. Journal of the American Geriatrics Society. 1975;23(10): 433-41.

150. Hooijer C, Dinkgreve M, Jonker C, Lindeboom J, Kay DWK. Short screening tests for dementia in the elderly population. I. A comparison between AMTS, MMSE, MSQ and SPMSQ. International Journal of Geriatric Psychiatry. 1992;7(8):559-71.

151. Nasreddine ZS, Phillips NA, Bedirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. Journal of the American Geriatrics Society. 2005;53(4):695-99.

152. Markwick A, Zamboni G, de Jager CA. Profiles of cognitive subtest impairment in the Montreal Cognitive Assessment (MoCA) in a research cohort with normal Mini-Mental State Examination (MMSE) scores. J Clin Exp Neuropsychol. 2012;34(7):750-7.

153. Hodges JR, Larner AJ. Addenbrooke's cognitive examinations: ACE, ACE-R, ACE-III, ACEapp, and M-ACE. In: Larner AJ, editor. Cognitive Screening Instruments: A Practical Approach. 2nd ed. Cham, Switzerland: Springer; 2017. p. 109-37.

Bibliography

154. Hsieh S, Schubert S, Hoon C, Mioshi E, Hodges JR. Validation of the Addenbrooke's Cognitive Examination III in frontotemporal dementia and Alzheimer's disease. Dement Geriatr Cogn Disord. 2013;36(3-4):242-50.

155. Beishon LC, Batterham AP, Quinn TJ, Nelson CP, Panerai RB, Robinson T, et al. Addenbrooke's Cognitive Examination III (ACE-III) and mini-ACE for the detection of dementia and mild cognitive impairment. Cochrane Database Syst Rev. 2019;12(12):CD013282.

156. Montero-Odasso M, van der Velde N, Martin F, Petrovic M, Tan M, Ryg J, et al. World guidelines for falls prevention and management for older adults: A global initiative. Age and Ageing. 2022;51(9):afac205.

157. Li F, Harmer P, Eckstrom E, Ainsworth BE, Fitzgerald K, Voit J, et al. Efficacy of exercise-based interventions in preventing falls among community-dwelling older persons with cognitive impairment: is there enough evidence? An updated systematic review and meta-analysis. Age and Ageing. 2021;50(5):1557-68.

158. Pitkälä KH, Pöysti MM, Laakkonen M-L, Tilvis RS, Savikko N, Kautiainen H, et al. Effects of the Finnish Alzheimer Disease Exercise Trial (FINALEX). JAMA Internal Medicine. 2013;173(10):894.

159. de Souto Barreto P, Maltais M, Rosendahl E, Vellas B, Bourdel-Marchasson I, Lamb SE, et al. Exercise effects on falls, fractures, hospitalizations, and mortality in older adults with dementia: An individual-level patient data meta-analysis. J Gerontol A Biol Sci Med Sci. 2021;76(9):e203-e12.

160. Song D, Yu DSF, Li PWC, Lei Y. The effectiveness of physical exercise on cognitive and psychological outcomes in individuals with mild cognitive impairment: A systematic review and meta-analysis. International Journal of Nursing Studies. 2018;79:155-64.

161. Groot C, Hooghiemstra AM, Raijmakers PGHM, Van Berckel BNM, Scheltens P, Scherder EJA, et al. The effect of physical activity on cognitive function in patients with dementia: A meta-analysis of randomized control trials. Ageing Research Reviews. 2016;25:13-23.

162. Panza GA, Taylor BA, Macdonald HV, Johnson BT, Zaleski AL, Livingston J, et al. Can Exercise Improve Cognitive Symptoms of Alzheimer's Disease? Journal of the American Geriatrics Society. 2018;66(3):487-95.

163. Du Z, Li Y, Li J, Zhou C, Li F, Yang X. Physical activity can improve cognition in patients with Alzheimer's disease: a systematic review and meta-analysis of randomized controlled trials. Clinical Interventions in Aging. 2018;13:1593-603.

164. Zhao X, Huang X, Cai Y, Cao T, Wan Q. The relative effectiveness of different combination modes for exercise and cognitive training on cognitive function in people with mild cognitive impairment or Alzheimer's disease: a network meta-analysis. Aging Ment Health. 2022;26(12):2328-38.

165. Balbim GM, Falck RS, Barha CK, Starkey SY, Bullock A, Davis JC, et al. Effects of exercise training on the cognitive function of older adults with different types of dementia: a systematic review and meta-analysis. Br J Sports Med. 2022:933-40.

166. Pisani S, Mueller C, Huntley J, Aarsland D, Kempton MJ. A meta-analysis of randomised controlled trials of physical activity in people with Alzheimer's disease and mild cognitive impairment with a comparison to donepezil. Int J Geriatr Psychiatry. 2021;36(10):1471-87.

167. Law CK, Lam FM, Chung RC, Pang MY. Physical exercise attenuates cognitive decline and reduces behavioural problems in people with mild cognitive impairment and dementia: A systematic review. J Physiother. 2020;66(1): 9-18.

Bibliography

168. Zheng G, Xia R, Zhou W, Tao J, Chen L. Aerobic exercise ameliorates cognitive function in older adults with mild cognitive impairment: a systematic review and meta-analysis of randomised controlled trials. Br J Sports Med. 2016;50(23):1443-50.

169. Racey M, Markle-Reid M, Fitzpatrick-Lewis D, Ali MU, Gagne H, Hunter S, et al. Fall prevention in community-dwelling adults with mild to moderate cognitive impairment: a systematic review and meta-analysis. BMC geriatr. 2021;21(1):689.

170. de Almeida SIL, Gomes da Silva M, Marques A. Home-based physical activity programs for people with dementia: Systematic review and meta-analysis. Gerontologist. 2020;60(8):600-8.

171. Lam F, Huang M-Z, Liao L-R, Chung R, Kwok T, Pang M. Physical exercise improves strength, balance, mobility, and endurance in people with cognitive impairment and dementia: A systematic review. Journal of Physiotherapy. 2018;64(1):4-15.

172. Hodgkinson B, Evans D, Wood J. Maintaining oral hydration in older adults: A systematic review. Int J Nurs Pract. 2003;9(3):S19-28.

173. Keller M. Maintaining oral hydration in older adults living in residential aged care facilities. International Journal of Evidence-Based Healthcare. 2006;4(1):68-73.

174. Close J, Ellis M, Hooper R, Glucksman E, Jackson S, Swift C. Prevention of falls in the elderly trial (PROFET): a randomised controlled trial. Lancet. 1999;353(9147):93-7.

175. Van Der Velde N, Stricker BHC, Pols HAP, Van Der Cammen TJM. Risk of falls after withdrawal of fall-risk-increasing drugs: a prospective cohort study. British Journal of Clinical Pharmacology. 2007;63(2):232-7.

176. Davison J, Bond J, Dawson P, Steen IN, Kenny RA. Patients with recurrent falls attending Accident & Emergency benefit from multifactorial intervention—a randomised controlled trial. Age and Ageing. 2005;34(2):162-68.

177. Cumming RG, Miller JP, Kelsey JL, Davis P, Arfken CL, Birge SJ, et al. Medications and Multiple Falls in Elderly People: The St Louis OASIS Study. Age and Ageing. 1991;20(6): 455-61.

178. Ham AC, Swart KM, Enneman AW, van Dijk SC, Oliai Araghi S, van Wijngaarden JP, et al. Medication-related fall incidents in an older, ambulant population: the B-PROOF study. Drugs & Aging. 2014;31(12):917-27.

179. Ma L, Naganathan V. Medications as risk factors for falls. In: Lord S, C. S, Naganathan V, editors. Falls in Older People: Risk Factors, Strategies for Prevention and Implications for Practice. Cambridge: Cambridge University Press; 2021.

180. Seppala LJ, Wermelink AMAT, De Vries M, Ploegmakers KJ, Van De Glind EMM, Daams JG, et al. Fall-Risk-Increasing Drugs: A Systematic Review and Meta-Analysis: II. Psychotropics. Journal of the American Medical Directors Association. 2018;19(4):371.e11-.e17.

181. Seppala LJ, van de Glind EM, Daams JG, Ploegmakers KJ, de Vries M, Wermelink AM, et al. Fall-Risk-Increasing Drugs: A Systematic Review and Meta-Analysis: III. Others. Journal of the American Medical Directors Association. 2018;19(4):372. e1-. e8.

182. De Vries M, Seppala LJ, Daams JG, Van De Glind EMM, Masud T, Van Der Velde N, et al. Fall-risk-increasing drugs: A systematic review and meta-analysis: I. Cardiovascular drugs. Journal of the American Medical Directors Association. 2018;19(4):371.e1-.e9.

183. Fraser LA, Liu K, Naylor KL, Hwang YJ, Dixon SN, Shariff SZ, et al. Falls and fractures with atypical antipsychotic medication use: A population-based cohort study. JAMA Internal Medicine. 2015;175(3):450-52.

Bibliography

184. Hanlon JT, Boudreau RM, Roumani YF, Newman AB, Ruby CM, Wright RM, et al. Number and dosage of central nervous system medications on recurrent falls in community elders: The Health, Aging and Body Composition Study. Journals of Gerontology: Series A. 2009;64A(4):492-98.

185. Lawlor DA, Patel R, Ebrahim S. Association between falls in elderly women and chronic diseases and drug use: cross sectional study. BMJ. 2003;327(7417):712-17.

186. Bakken MS, Engeland A, Engesæter LB, Ranhoff AH, Hunskaar S, Ruths S. Risk of hip fracture among older people using anxiolytic and hypnotic drugs: a nationwide prospective cohort study. European Journal of Clinical Pharmacology. 2014;70(7):873-80.

187. Moura C, Bernatsky S, Abrahamowicz M, Papaioannou A, Bessette L, Adachi J, et al. Antidepressant use and 10-year incident fracture risk: the population-based Canadian Multicentre Osteoporosis Study (CaMoS). Osteoporosis International. 2014;25(5): 1473-81.

188. Tinetti ME, Han L, Lee DSH, McAvay GJ, Peduzzi P, Gross CP, et al. Antihypertensive Medications and Serious Fall Injuries in a Nationally Representative Sample of Older Adults. JAMA Internal Medicine. 2014;174(4):588-95.

189. Butt DA, Mamdani M, Austin PC, Tu K, Gomes T, Glazier RH. The risk of hip fracture after initiating antihypertensive drugs in the elderly. Archives of Internal Medicine. 2012;172(22):1739-44.

190. Berry SD, Zhu Y, Choi H, Kiel DP, Zhang Y. Diuretic initiation and the acute risk of hip fracture. Osteoporosis International. 2013;24(2):689-95.

191. Yoshikawa A, Ramirez G, Smith ML, Foster M, Nabil AK, Jani SN, et al. Opioid Use and the Risk of Falls, Fall Injuries and Fractures among Older Adults: A Systematic Review and Meta-Analysis. The Journals of Gerontology: Series A. 2020;75(10):1989-95.

192. Marcum ZA, Perera S, Thorpe JM, Switzer GE, Gray SL, Castle NG, et al. Anticholinergic use and recurrent falls in community-dwelling older adults: Findings from the health ABC study. Annals of Pharmacotherapy. 2015;49(11):1214-21.

193. Bakken MS, Engeland A, Engesæter LB, Ranhoff AH, Hunskaar S, Ruths S. Increased risk of hip fracture among older people using antidepressant drugs: data from the Norwegian Prescription Database and the Norwegian Hip Fracture Registry. Age and Ageing. 2013;42(4):514-20.

194. Richardson K, Bennett K, Maidment ID, Fox C, Smithard D, Kenny RA. Use of medications with anticholinergic activity and self-reported injurious falls in older community-dwelling adults. Journal of the American Geriatrics Society. 2015;63(8):1561-69.

195. Ruxton K, Woodman RJ, Mangoni AA. Drugs with anticholinergic effects and cognitive impairment, falls and all-cause mortality in older adults: A systematic review and meta-analysis. British Journal of Clinical Pharmacology. 2015;80(2):209-20.

196. Cea-Soriano L, Johansson S, Garcia Rodriguez LA. Risk factors for falls with use of acid-suppressive drugs. Epidemiology. 2013;24(4):600-7.

197. Gnjidic D, Hilmer SN, Blyth FM, Naganathan V, Waite L, Seibel MJ, et al. Polypharmacy cutoff and outcomes: Five or more medicines were used to identify community-dwelling older men at risk of different adverse outcomes. Journal of Clinical Epidemiology. 2012;65(9):989-95.

198. Australian Commission on Safety and Quality in Health Care. Medication without harm. WHO Global Patient Safety Challenge: Australia's Response Sydney: ACSQHC; 2020. Available from: https://www.safetyandquality.gov.au/publications-and-resources/resource-library/medication-without-harm-who-global-patient-safety-challenge-australias-response.

Bibliography

199. Richardson K, Bennett K, Kenny RA. Polypharmacy including falls risk-increasing medications and subsequent falls in community-dwelling middle-aged and older adults. Age and Ageing. 2014;44(1):90-6.

200. van der Velde N, Seppala LJ, Hartikainen S, Kamkar N, Mallet L, Masud T, et al. European position paper on polypharmacy and fall-risk-increasing drugs recommendations in the World Guidelines for Falls Prevention and Management: implications and implementation. European Geriatric medicine. 2023;14(4):649-58.

201. Berry SD, Quach L, Procter-Gray E, Kiel DP, Li W, Samelson EJ, et al. Poor adherence to medications may be associated with falls. The Journals of Gerontology: Series A. 2010;65A(5):553-58.

202. Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Psychotropic medication withdrawal and a home-based exercise program to prevent falls: a randomized controlled trial. Journal of the American Geriatrics Society. 1999;47(7):850-53.

203. Pit SW, Byles JE, Henry DA, Holt L, Hansen V, Bowman DA. A Quality Use of Medicines program for general practitioners and older people: a cluster randomised controlled trial. Medical Journal of Australia. 2007;187(1):23-30.

204. Lee J, Negm A, Wong E, Holbrook A. Does deprescribing fall-associated drugs reduce falls and its complications? A systematic review. Innovation in Aging. 2017;1(Suppl 1):268.

205. Kuhn-Thiel AM, Weiß C, Wehling M. Consensus validation of the FORTA (Fit fOR The Aged) List: A clinical tool for increasing the appropriateness of pharmacotherapy in the elderly. Drugs and Aging. 2014;31(2):131-40.

206. Michalek C, Wehling M, Schlitzer J, Frohnhofen H. Effects of "Fit fOR The Aged" (FORTA) on pharmacotherapy and clinical endpoints—a pilot randomized controlled study. European Journal of Clinical Pharmacology. 2014;70(10):1261-7.

207. Kim DH, Brown RT, Ding EL, Kiel DP, Berry SD. Dementia medications and risk of falls, syncope, and related adverse events: meta-analysis of randomized controlled trials. Journal of the American Geriatrics Society. 2011;59(6):1019-31.

208. Resnick NM. Geriatric incontinence. Urologic Clinics of North America. 1996;23(1):55-74.

209. Gale CR, Cooper C, Aihie Sayer A. Prevalence and risk factors for falls in older men and women: The English Longitudinal Study of Ageing. Age and Ageing. 2016;45(6):789-94.

210. Tannenbaum C, Fritel X, Halme A, van den Heuvel E, Jutai J, Wagg A. Long-term effect of community-based continence promotion on urinary symptoms, falls and healthy active life expectancy among older women: cluster randomised trial. Age Ageing. 2019;48(4): 526-32.

211. Moon S, Chung HS, Kim YJ, Kim SJ, Kwon O, Lee YG, et al. The impact of urinary incontinence on falls: A systematic review and meta-analysis. PLoS One. 2021;16(5):e0251711.

212. Gibson W, Hunter KF, Camicioli R, Booth J, Skelton DA, Dumoulin C, et al. The association between lower urinary tract symptoms and falls: Forming a theoretical model for a research agenda. Neurourol Urodyn. 2018;37(1):501-9.

213. Moon S, Chung HS, Yu JM, Na HR, Kim SJ, Ko KJ, et al. Impact of urinary incontinence on falls in the older population: 2017 national survey of older Koreans. Arch Gerontol Geriatr. 2020;90:104158.

Bibliography

214. Spice CL, Morotti W, George S, Dent TH, Rose J, Harris S, et al. The Winchester falls project: a randomised controlled trial of secondary prevention of falls in older people. Age and Ageing. 2009;38(1):33-40.

215. Delbaere K, Close JC, Menz HB, Cumming RG, Cameron ID, Sambrook PN, et al. Development and validation of fall risk screening tools for use in residential aged care facilities. Med J Aust. 2008;189(4):193-96.

216. Thom DH, Haan MN, Van Den Eeden SK. Medically recognized urinary incontinence and risks of hospitalization, nursing home admission and mortality. Age and Ageing. 1997;26(5):367-74.

217. Pesonen JS, Vernooij RWM, Cartwright R, Aoki Y, Agarwal A, Mangera A, et al. The impact of nocturia on falls and fractures: A systematic review and meta-analysis. J Urol. 2020;203(4):674-83.

218. Paquin MH, Duclos C, Lapierre N, Dubreucq L, Morin M, Meunier J, et al. The effects of a strong desire to void on gait for incontinent and continent older community-dwelling women at risk of falls. Neurourol Urodyn. 2020;39(2):642-49.

219. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardisation of terminology of lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. Neurourology and Urodynamics. 2002;21(2):167-78.

220. Stewart RB, Moore MT, May FE, Marks RG, Hale WE. Nocturia: a risk factor for falls in the elderly. Journal of the American Geriatrics Society. 1992;40(12):1217-20.

221. Chiarelli PE, Mackenzie LA, Osmotherly PG. Urinary incontinence is associated with an increase in falls: A systematic review. Aust J Physiother. 2009;55(2):89-95.

222. Foley AL, Loharuka S, Barrett JA, Mathews R, Williams K, McGrother CW, et al. Association between the geriatric giants of urinary incontinence and falls in older people using data from the Leicestershire MRC Incontinence Study. Age and Ageing. 2012;41(1):35-40.

223. Brown JS, Vittinghoff E, Wyman JF, Stone KL, Nevitt MC, Ensrud KE, et al. Urinary incontinence: does it increase risk for falls and fractures? Journal of the American Geriatrics Society. 2000;48(7):721-25.

224. Fritel X, Lachal L, Cassou B, Fauconnier A, Dargent-Molina P. Mobility impairment is associated with urge but not stress urinary incontinence in community-dwelling older women: Results from the Ossebo study. Bjog. 2013;120(12):1566-72.

225. Booth J, Paul L, Rafferty D, MacInnes C. The relationship between urinary bladder control and gait in women. Neurourology and Urodynamics. 2013;32(1):43-7.

226. Parsons JK, Mougey J, Lambert L, Wilt TJ, Fink HA, Garzotto M, et al. Lower urinary tract symptoms increase the risk of falls in older men. BJU International. 2009;104(1):63-8.

227. Hunter KF, Voaklander D, Hsu ZY, Moore KN. Lower urinary tract symptoms and falls risk among older women receiving home support: A prospective cohort study. BMC geriatr. 2013;13:46.

228. Chiarelli P, Brown W, McElduff P. Constipation in Australian women: Prevalence and associated factors. International Urogynecology Journal and Pelvic Floor Dysfunction. 2000;11(2):71-8.

229. De Lillo AR, Rose S. Functional bowel disorders in the geriatric patient: constipation, fecal impaction, and fecal incontinence. American Journal of Gastroenterology. 2000;95(4):901-5.

Bibliography

230. Charach G, Greenstein A, Rabinovich P, Groskopf I, Weintraub M. Alleviating constipation in the elderly improves lower urinary tract symptoms. Gerontology. 2001;47(2):72-6.

231. Tinetti ME, Inouye SK, Gill TM, Doucette JT. Shared risk factors for falls, incontinence, and functional dependence. Journal of the American Medical Association. 1995;273(17):1348.

232. Lord SR, Sherrington C, Naganathan V, editors. Falls in Older People: Risk factors, strategies for prevention and implications for practice. 3rd ed. Cambridge: Cambridge University Press; 2021.

233. Fonda D, DuBeau C, Harari D, Palmer M, Ouslander J, Roe B. Incontinence in the frail elderly. In: Abrams P, Andersson K, Brubaker L, editors. Incontinence Management. Proceedings of the Third International Consultation on Incontinence, Monte Carlo, 26 - 29 June 2004. 2. Plymouth, UK: Health Publications Ltd; 2005. p. 1163-239.

234. Schnelle JF, Kapur K, Alessi C, Osterweil D, Beck JG, Al-Samarrai NR, et al. Does an exercise and incontinence intervention save healthcare costs in a nursing home population? Journal of the American Geriatrics Society. 2003;51(2):161-68.

235. Mihaľová M, Hagovská M, Oravcová K, Martinásková N, Grus C, Švihra J. Pelvic floor muscle training, the risk of falls and urgency urinary incontinence in older women. Z Gerontol Geriatr. 2022;55(1):51-60.

236. Wenger NS, Roth CP, Hall WJ, Ganz DA, Snow V, Byrkit J, et al. Practice redesign to improve care for falls and urinary incontinence: primary care intervention for older patients. Archives of Internal Medicine. 2010;170(19):1765-72.

237. Wenger NS, Roth CP, Shekelle PG, Young RT, Solomon DH, Kamberg CJ, et al. A practice-based intervention to improve primary care for falls, urinary incontinence, and dementia. Journal of the American Geriatrics Society. 2009;57(3):547-55.

238. LoGiudice DC, Smith K, Atkinson D, Dwyer A, Lautenschlager N, Almeida OA, et al. Preliminary evaluation of the prevalence of falls, pain and urinary incontinence in remote living Indigenous Australians over the age of 45 years. Internal Medicine Journal. 2012;42(6):e102-e7.

239. Gardner J, Fonda D. Urinary incontinence in the elderly. Disability and Rehabilitation. 1994;16(3):140-8.

240. Dmochowski RR, Sanders SW, Appell RA, Nitti VW, Davila GW. Bladder-health diaries: an assessment of 3-day vs 7-day entries. BJU International. 2005;96(7):1049-54.

241. Brown JS, Bradley CS, Subak LL, Richter HE, Kraus SR, Brubaker L, et al. The sensitivity and specificity of a simple test to distinguish between urge and stress urinary incontinence. Annals of Internal Medicine. 2006;144(10):715.

242. Ashley MJ, Gryfe CI, Amies A. A longitudinal study of falls in an elderly population II: Some circumstances of falling. Age and Ageing. 1977;6(4):211-20.

243. Society IC. Incontinence. 6th ed. ed. Bristol UK2017.

244. Lee CY, Chen LK, Lo YK, Liang CK, Chou MY, Lo CC, et al. Urinary incontinence: An under-recognized risk factor for falls among elderly dementia patients. Neurourology and Urodynamics. 2011;30(7):1286-90.

245. Eustice S, Roe B, Paterson J. Prompted voiding for the management of urinary incontinence in adults. Cochrane Database of Systematic Reviews. 2000;2000(2):CD002113.

Bibliography

246. Menz HB, Morris ME, Lord SR. Foot and ankle risk factors for falls in older people: a prospective study. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2006;61(8):866-70.

247. Berg WP, Alessio HM, Mills EM, Tong C. Circumstances and consequences of falls in independent community-dwelling older adults. Age and Ageing. 1997;26(4):261-68.

248. Sherrington C, Menz HB. An evaluation of footwear worn at the time of fall-related hip fracture. Age and Ageing. 2003;32(3):310-4.

249. Dunne RG, Bergman AB, Rogers LW, Inglin B, Rivara FP. Elderly persons' attitudes towards footwear—a factor in preventing falls. Public Health Reports. 1993;108(2):245-48.

250. Robbins S, Waked E, McClaran J. Proprioception and stability: Foot position awareness as a function of age and footwear. Age and Ageing. 1995;24(1):67-72.

251. Menant JC, Steele JR, Menz HB, Munro BJ, Lord SR. Effects of footwear features on balance and stepping in older people. Gerontology. 2008;54(1):18-23.

252. Menant JC, Perry SD, Steele JR, Menz HB, Munro BJ, Lord SR. 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. 2008;89(10): 1970-76.

253. Menant JC, Steele JR, Menz HB, Munro BJ, Lord SR. Effects of walking surfaces and footwear on temporo-spatial gait parameters in young and older people. Gait & posture. 2009;29(3):392-7.

254. Lord SR, Mbbs GMB. Shoe characteristics and balance in older women. Journal of the American Geriatrics Society. 1996;44(4): 429-33.

255. Keegan THM, Kelsey JL, King AC, Quesenberry CP, Sidney S. 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. 2004;159(2):192-203.

256. Kerse N, Butler M, Robinson E, Todd M. Wearing slippers, falls and injury in residential care. Australian and New Zealand Journal of Public Health. 2004;28(2):180-87.

257. Koepsell TD, Wolf ME, Buchner DM, Kukull WA, Lacroix AZ, Tencer AF, et al. Footwear style and risk of falls in older adults. Journal of the American Geriatrics Society. 2004;52(9): 1495-501.

258. Menz HB, Morris ME, Lord SR. Footwear characteristics and risk of indoor and outdoor falls in older people. Gerontology. 2006;52(3):174-80.

259. Menant JC, Steele JR, Menz HB, Munro BJ, Lord SR. Optimising footwear for older people at risk of falls. Journal of Rehabilitation Research and Development. 2008;45(8):1167-81.

260. Menz HB, Auhl M, Munteanu SE. Preliminary evaluation of prototype footwear and insoles to optimise balance and gait in older people. BMC geriatr. 2017;17:212.

261. Menant JC, Steele JR, Menz HB, Munro BJ, Lord SR. Rapid gait termination: Effects of age, walking surfaces and footwear characteristics. Gait & posture. 2009;30(1):65-70.

262. Hatton AL, Sturnieks DL, Lord SR, Lo JC, Menz HB, Menant JC. Effects of nonslip socks on the gait patterns of older people when walking on a slippery surface. Journal of the American Podiatric Medical Association. 2013;103(6): 471-79.

263. Galica AM, Kang HG, Priplata AA, D'Andrea SE, Starobinets OV, Sorond FA, et al. Subsensory vibrations to the feet reduce gait variability in elderly fallers. Gait and Posture. 2009;30(3):383-7.

Bibliography

264. Lipsitz LA, Lough M, Niemi J, Travison T, Howlett H, Manor B. A shoe insole delivering subsensory vibratory noise improves balance and gait in healthy elderly people. Archives of Physical Medicine and Rehabilitation. 2015;96(3):432-39.

265. Thies SB, Price C, Kenney LPJ, Baker R. Effects of shoe sole geometry on toe clearance and walking stability in older adults. Gait & posture. 2015;42(2):105-9.

266. Benvenuti F, Ferrucci L, Guralnik JM, Gangemi S, Baroni A. Foot pain and disability in older persons: an epidemiologic survey. Journal of the American Geriatrics Society. 1995;43(5):479-84.

267. Dunn JE, Link CL, Felson DT, Crincoll MG, Keysor JJ, McKinlay JB. Prevalence of foot and ankle conditions in a multiethnic community sample of older adults. American Journal of Epidemiology. 2004;159(5):491-98.

268. Menz HB, Lord SR. The contribution of foot problems to mobility impairment and falls in community-dwelling older people. Journal of the American Geriatrics Society. 2001;49(12):1651-6.

269. Buldt AK, Menz HB. Incorrectly fitted footwear, foot pain and foot disorders: A systematic search and narrative review of the literature. Journal of Foot and Ankle Research. 2018;11:43.

270. Brodie BS, Rees CL, Robins DJ, Wilson AFJ. Wessex Feet: a regional foot health survey, volume I: the survey. Chiropodist. 1988;43: 152-65.

271. Gorter KJ, Kuyvenhoven MM, de Melker RA. Nontraumatic foot complaints in older people. A population-based survey of risk factors, mobility, and well-being. Journal of the American Podiatric Medical Association. 2000;90(8):397-402.

272. Menz HB, Lord SR. Foot pain impairs balance and functional ability in community-dwelling older people. Journal of the American Podiatric Medical Association. 2001;91(5): 222-9.

273. Menz HB, Morris ME, Lord SR. Foot and ankle characteristics associated with impaired balance and functional ability in older people. Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2005;60(12):1546-52.

274. Mickle KJ, Munro BJ, Lord SR, Menz HB, Steele JR. Gait, balance and plantar pressures in older people with toe deformities. Gait and Posture. 2011;34(3):347-51.

275. Balanowski KR, Flynn LM. Effect of painful keratoses debridement on foot pain, balance and function in older adults. Gait and Posture. 2005;22(4):302-7.

276. Menz HB, Hill KD. Podiatric involvement in multidisciplinary falls-prevention clinics in Australia. Journal of the American Podiatric Medical Association. 2007;97(5):377-84.

277. Munro BJ, Steele JR. Foot-care awareness - a survey of persons aged 65 years and older. Journal of the American Podiatric Medical Association. 1998;88(5):242-48.

278. Lord SR, Lloyd DG, Keung Li S. Sensori-motor function, gait patterns and falls in community-dwelling women. Age and Ageing. 1996;25(4):292-99.

279. Koski K, Luukinen H, Laippala P, Kivelä SL. Risk factors for major injurious falls among the home-dwelling elderly by functional abilities. Gerontology. 1998;44(4):232-38.

280. Wallace C, Reiber GE, Lemaster J, Smith DG, Sullivan K, Hayes S, et al. Incidence of falls, risk factors for falls, and fall-related fractures in individuals with diabetes and a prior foot ulcer. Diabetes Care. 2002;25(11):1983-6.

281. Menz HB, Lord SR, St George R, Fitzpatrick RC. Walking stability and sensorimotor function in older people with diabetic peripheral neuropathy. Archives of Physical Medicine and Rehabilitation. 2004;85(2):245-52.

282. Richardson JK, Ashton-Miller JA, Lee SG, Jacobs K. Moderate peripheral neuropathy impairs weight transfer and unipedal balance in the elderly. Archives of Physical Medicine and Rehabilitation. 1996;77(11):1152-6.

Bibliography

283. Richardson JK, Ashton-Miller JA. Peripheral neuropathy: An often-overlooked cause of falls in the elderly. Postgraduate Medicine. 1996;99(6):161-72.

284. Wechsler S, Wood L. The Effect of Chemotherapy on Balance, Gait, and Falls Among Cancer Survivors: A Scoping Review. Rehabilitation Oncology. 2021;39(1):6-22.

285. Tanay MAL, Armes J, Moss-Morris R, Rafferty AM, Robert G. A systematic review of behavioural and exercise interventions for the prevention and management of chemotherapy-induced peripheral neuropathy symptoms. Journal of Cancer Survivorship. 2021.

286. Spink MJ, Menz HB, Fotoohabadi MR, Wee E, Landorf KB, Hill KD, et al. Effectiveness of a multifaceted podiatry intervention to prevent falls in community dwelling older people with disabling foot pain: randomised controlled trial. British Medical Journal. 2011;342:d3411.

287. Cockayne S, Rodgers S, Green L, Fairhurst C, Adamson J, Scantlebury A, et al. Clinical effectiveness and cost-effectiveness of a multifaceted podiatry intervention for falls prevention in older people: a multicentre cohort randomised controlled trial (the REducing Falls with ORthoses and a Multifaceted podiatry intervention trial). Health Technology Assessment. 2017;21(24): 1-198.

288. Wylie G, Torrens C, Campbell P, Frost H, Gordon AL, Menz HB, et al. Podiatry interventions to prevent falls in older people: a systematic review and meta-analysis. Age and Ageing. 2019;48(3):327-36.

289. Schwenk M, Jordan ED, Honarvararaghi B, Mohler J, Armstrong DG, Najafi B. Effectiveness of foot and ankle exercise programs on reducing the risk of falling in older adults: A systematic review and meta-analysis of randomized controlled trials. Journal of the American Podiatric Medical Association. 2013;103(6):534-47.

290. Hatton AL, Rome K, Dixon J, Martin DJ, McKeon PO. Footwear interventions: a review of their sensorimotor and mechanical effects on balance performance and gait in older adults. Journal of the American Podiatric Medical Association. 2013;103(6):516-33.

291. Park J-H, Jeon H-S, Kim J-H, Yoon H-B, Lim O-B, Jeon M. Immediate effect of insoles on balance in older adults. The Foot. 2021;47:101768.

292. Menz HB, Lord SR. Foot problems, functional impairment, and falls in older people. Journal of the American Podiatric Medical Association. 1999;89(9):458-67.

293. Rosenblatt NJ, Girgis C, Avalos M, Fleischer AE, Crews RT. The role of the podiatrist in assessing and reducing fall risk: An updated review. Clinics in Podiatric Medicine and Surgery. 2020;37(2):327-69.

294. Hatton AL, Rome K. Falls, footwear, and podiatric interventions in older adults. Clinics in Geriatric Medicine. 2019;35(2):161-71.

295. Menz HB, Sherrington C. The Footwear Assessment Form: a reliable clinical tool to assess footwear characteristics of relevance to postural stability in older adults. Clinical Rehabilitation. 2000;14(6):657-64.

296. Menz HB. Foot problems in older people: Assessment and management. London: Churchill Livingstone / Elsevier; 2008.

297. Menz HB. Assessment of the older person. In: Yates B, editor. Merriman's Assessment of the Lower Limb. 3rd ed. London: Churchill Livingston / Elsevier; 2009. p. 443-68.

298. Yang F. Identification of Optimal Foot Tactile Sensation Threshold for Detecting Fall Risk Among Community-Dwelling Older Adults. Physical Therapy. 2021;101(8).

299. Kobayashi R, Hosoda M, Minematsu A, Sasaki H, Maejima H, Tanaka S, et al. Effects of toe grasp training for the aged on spontaneous postural sway. Journal of Physical Therapy Science. 1999;11(1):31-4.

Bibliography

300. Richardson JK, Thies SB, Demott TK, Ashton-Miller JA. Interventions improve gait regularity in patients with peripheral neuropathy while walking on an irregular surface under low light. Journal of the American Geriatrics Society. 2004;52(4):510-5.

301. Spink MJ, Fotoohabadi MR, Wee E, Landorf KB, Hill KD, Lord SR, et al. Predictors of adherence to a multifaceted podiatry intervention for the prevention of falls in older people. BMC geriatr. 2011;11:51.

302. Maki BE, Perry SD, Norrie RG, McIlroy WE. Effect of facilitation of sensation from plantar foot-surface boundaries on postural stabilization in young and older adults. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 1999;54(6):M281-7.

303. Davis A, Murphy A, Haines TP. "Good for older ladies, not me": How elderly women choose their shoes. Journal of the American Podiatric Medical Association. 2013;103(6):465-70.

304. Schwarzkopf R, Perretta DJ, Russell TA, Sheskier SC. Foot and shoe size mismatch in three different New York City populations. J Foot Ankle Surg. 2011;50(4):391-4.

305. Tan MP, Parry SW. Vasovagal Syncope in the Older Patient. Journal of the American College of Cardiology. 2008;51(6):599-606.

306. Jansen S, Kenny RA, De Rooij SE, van der Velde N. Self-reported cardiovascular conditions are associated with falls and syncope in community-dwelling older adults. Age and Ageing. 2015;44(3):525-29.

307. Brignole M, Moya A, de Lange FJ, Deharo JC, Elliott PM, Fanciulli A, et al. 2018 ESC Guidelines for the diagnosis and management of syncope. Eur Heart J. 2018;39(21):1883-948.

308. Shaw BH, Claydon VE. The relationship between orthostatic hypotension and falling in older adults. Clinical Autonomic Research. 2014;24(1):3-13.

309. Hohtari-Kivimäki U, Salminen M, Vahlberg T, Kivelä S-L. Orthostatic hypotension is a risk factor for falls among older adults: 3-Year follow-up. Journal of the American Medical Directors Association. 2021;22(11):2325-30.

310. Hartog LC, Schrijnders D, Landman GWD, Groenier K, Kleefstra N, Bilo HJG, et al. Is orthostatic hypotension related to falling? A meta-analysis of individual patient data of prospective observational studies. Age and Ageing. 2017;46(4):568-75.

311. Shaw BH, Borrel D, Sabbaghan K, Kum C, Yang Y, Robinovitch SN, et al. Relationships between orthostatic hypotension, frailty, falling and mortality in elderly care home residents. BMC geriatr. 2019;19(1):80.

312. Donoghue OA, O'Connell MD, Bourke R, Kenny RA. Is orthostatic hypotension and co-existing supine and seated hypertension associated with future falls in community-dwelling older adults? Results from The Irish Longitudinal Study on Ageing (TILDA). PLoS One. 2021;16(5):e0252212.

313. Doyle K, Lavan A, Kenny R-A, Briggs R. Delayed blood pressure recovery after standing independently predicts fracture in community-dwelling older people. Journal of the American Medical Directors Association. 2021;22(6):1235-41.e1.

314. Chen-Scarabelli C, Scarabelli TM. Neurocardiogenic syncope. BMJ. 2004;329(7461):336-41.

315. Malik V, Gallagher C, Linz D, Elliott AD, Emami M, Kadhim K, et al. Atrial fibrillation is associated with syncope and falls in older adults: a systematic review and meta-analysis. Mayo Clinic Proceedings. 2020;95(4):676-87.

316. Paling D, Vilches-Moraga A, Akram Q, Atkinson O, Staniland J, Paredes-Galán E. Carotid sinus syndrome is common in very elderly patients undergoing tilt table testing and carotid sinus massage because of syncope or unexplained falls. Aging Clinical and Experimental Research. 2011;23(4):304-8.

Bibliography

317. Romero-Ortuno R, Cogan L, Foran T, Kenny RA, Fan CW. Continuous Noninvasive Orthostatic Blood Pressure Measurements and Their Relationship with Orthostatic Intolerance, Falls, and Frailty in Older People. Journal of the American Geriatrics Society. 2011;59(4):655-65.

318. Gupta V, Lipsitz LA. Orthostatic hypotension in the elderly: Diagnosis and treatment. American Journal of Medicine. 2007;120(10):841-47.

319. Maule S, Papotti G, Naso D, Magnino C, Testa E, Veglio F. Orthostatic hypotension: Evaluation and treatment. Cardiovascular & Haematological Disorders-Drug Targets. 2007;7(1):63-70.

320. Freidenberg DL, Shaffer LET, Macalester S, Fannin EA. Orthostatic hypotension in patients with dementia: Clinical features and response to treatment. Cognitive and Behavioral Neurology. 2013;26(3):105-20.

321. Sloane PD, Coeytaux RR, Beck RS, Dallara J. Dizziness: State of the Science. Annals of Internal Medicine. 2001;134(9_Part_2):823.

322. Maarsingh OR, Dros J, Schellevis FG, van Weert HC, Bindels PJ, Horst HE. Dizziness reported by elderly patients in family practice: Prevalence, incidence, and clinical characteristics. BMC Family Practice. 2010;11(2):doi:10.1186/471-2296-11-2.

323. Koo J-W, Chang MY, Woo S-y, Kim S, Cho Y-S. Prevalence of vestibular dysfunction and associated factors in South Korea. BMJ Open. 2015;5(10):e008224.

324. Colledge NR, Barr-Hamilton RM, Lewis SJ, Sellar RJ, Wilson JA. Evaluation of investigations to diagnose the cause of dizziness in elderly people: A community based controlled study. BMJ. 1996;313(7060):788-92.

325. Jayarajan V, Rajenderkumar D. A survey of dizziness management in General Practice. Journal of Laryngology and Otology. 2003;117(8):599-604.

326. Tinetti ME, Williams CS, Gill TM. Dizziness among Older Adults: A Possible Geriatric Syndrome. Annals of Internal Medicine. 2000;132(5):337.

327. Maarsingh OR, Dros J, Schellevis FG, van Weert HC, van der Windt DA, ter Riet G, et al. Causes of persistent dizziness in elderly patients in primary care. Annals of family medicine. 2010;8(3):196-205.

328. Menant JC, Migliaccio AA, Sturnieks DL, Hicks C, Lo J, Ratanapongleka M, et al. Reducing the burden of dizziness in middle-aged and older people: A multifactorial, tailored, single-blind randomized controlled trial. PLOS Medicine. 2018;15(7):e1002620.

329. Hyland S, Hawke LJ, Taylor NF. Benign paroxysmal positional vertigo without dizziness is common in people presenting to falls clinics. Disability and Rehabilitation. 2024;46(25):6108-13.

330. Ekwall A, Lindberg Å, Magnusson M. Dizzy – Why Not Take a Walk? Low level physical activity improves quality of life among elderly with dizziness. Gerontology. 2009;55(6): 652-59.

331. Menant JC, Wong A, Sturnieks DL, Close JCT, Delbaere K, Sachdev PS, et al. Pain and anxiety mediate the relationship between dizziness and falls in older people. Journal of the American Geriatrics Society. 2013;61(3):423-28.

332. Beckman A, Hansson EE. Fractures in people with dizziness: 5-year follow-up. Journal of the American Geriatrics Society. 2011;59(9):1767-69.

333. Baloh RW, Jacobson KM, Socotch TM. The effect of aging on visual-vestibuloocular responses. Experimental Brain Research. 1993;95(3):509-16.

334. Agrawal Y, Carey JP, Della Santina CC, Schubert MC, Minor LB. Disorders of balance and vestibular function in US adults: Data from the National Health and Nutrition Examination Survey, 2001-2004. Archives of Internal Medicine. 2009;169(10):938-44.

Bibliography

335. Kristinsdottir EK, Nordell E, Jarnlo G-B, Tjader A, Thorngren K-G, Magnusson M. Observation of vestibular asymmetry in a majority of patients over 50 years with fall-related wrist fractures. Acta Otolaryngology. 2001;121(4):481-85.

336. Ekvall Hansson E, Magnusson M. Vestibular asymmetry predicts falls among elderly patients with multi- sensory dizziness. BMC geriatr. 2013;13(1):77.

337. Liston MB, Bamiou D-E, Martin F, Hopper A, Koohi N, Luxon L, et al. Peripheral vestibular dysfunction is prevalent in older adults experiencing multiple non-syncopal falls versus age-matched non-fallers: A pilot study. Age and Ageing. 2014;43(1):38-43.

338. Oghalai JS, Manolidis S, Barth JL, Stewart MG, Jenkins HA. Unrecognized benign paroxysmal positional vertigo in elderly patients. Otolaryngology Head and Neck Surgery. 2000;122(5):630-34.

339. Menant JC, St George RJ, Fitzpatrick RC, Lord SR. Perception of the Postural Vertical and Falls in Older People. Gerontology. 2012;58(6):497-503.

340. Waterston J. Neurology. 3: Dizziness. Med J Aust. 2000;172(10):506-11.

341. Kerber KA, Newman-Toker DE. Misdiagnosing dizzy patients: Common pitfalls in clinical practice. Neurol Clin. 2015;33(3):565-75.

342. Halmagyi GM, Curthoys IS. A clinical sign of canal paresis. Archives of Neurology. 1988;45(7):737-39.

343. Schubert MC, Tusa RJ, Grine LE, Herdman SJ. Optimizing the sensitivity of the head thrust test for identifying vestibular hypofunction. Physical Therapy. 2004;84(2):151-58.

344. Maarsingh OR, Dros J, Van Weert HC, Schellevis FG, Bindels PJ, Van Der Horst HE. Development of a diagnostic protocol for dizziness in elderly patients in general practice: A Delphi procedure. BMC Family Practice. 2009;10(1):12.

345. Power L, Murray K, Szmulewicz DJ. Characteristics of assessment and treatment in Benign Paroxysmal Positional Vertigo (BPPV). J Vestib Res. 2020;30(1):55-62.

346. Gordon CR, Levite R, Joffe V, Gadoth N. Is posttraumatic benign paroxysmal positional vertigo different from the idiopathic form? Archives of Neurology. 2004;61(10):1590.

347. Whitney SL. Management of the elderly person with vestibular dysfunction. In: Herdman SJ, editor. Vestibular Rehabilitation. Philadelphia: FA Davis Company; 2000. p. 510-33.

348. Angeli SI, Halwey R, Gomez O. Systematic approach to benign paroxysmal positional vertigo in the elderly. Otolaryngology Head and Neck Surgery. 2003;128:719-25.

349. Fife TD, Tusa RJ, Furman JM, Zee DS, Frohman E, Baloh RW, et al. Assessment: vestibular testing techniques in adults and children: report of the Neurology Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. Neurology. 2000;55(10):1431-41.

350. Dros J, Maarsingh OR, van der Horst HE, Bindels PJ, ter Riet G, van Weert HC. Tests used to evaluate dizziness in primary care. Canadian Medical Association Journal. 2010;182(13):E621-E31.

351. Maarsingh OR, Stam H, van der Horst HE. A different approach of dizziness in older patients: Away from the diagnostic dance between patient and physician. Frontiers in Medicine. 2014;1:50.

352. Dros J, Maarsingh OR, Beem L, van der Horst HE, ter Riet G, Schellevis FG, et al. Functional prognosis of dizziness in older adults in primary care: A prospective cohort study. Journal of the American Geriatrics Society. 2012;60(12):2263-69.

353. Strupp M, Zingler VC, Arbusow V, Niklas D, Maag KP, Dieterich M, et al. Methylprednisolone, valacyclovir, or the combination for vestibular neuritis. New England Journal of Medicine. 2004;351(4): 354-61.

Bibliography

354. Chen J, Liu Z, Xie Y, Jin S. Effects of vestibular rehabilitation training combined with anti-vertigo drugs on vertigo and balance function in patients with vestibular neuronitis: a systematic review and meta-analysis. Frontiers in Neurology. 2023;14:1278307.

355. Lalwani AK, Qian ZJ. The Aging Inner Ear. In: Lalwani AK, editor. Current Diagnosis & Treatment Otolaryngology—Head and Neck Surgery. 4th ed. New York, NY: McGraw-Hill Education; 2020.

356. Pollak L, Kushnir M, Shpirer Y, Zomer Y, Flechter S. Approach to benign paroxysmal positional vertigo in old age. Israeli Medical Association Journal. 2005;7(7):447-50.

357. Laurent G, Vereeck L, Verbecque E, Herssens N, Casters L, Spildooren J. Effect of age on treatment outcomes in benign paroxysmal positional vertigo: A systematic review. J Am Geriatr Soc. 2022;70(1):281-93.

358. Sim E, Tan D, Hill K. Poor Treatment Outcomes Following Repositioning Maneuvers in Younger and Older Adults With Benign Paroxysmal Positional Vertigo: A Systematic Review and Meta-analysis. J Am Med Dir Assoc. 2019;20(2):224.e1-.e23.

359. Brandt T, Daroff RB. Physical therapy for benign paroxysmal positional vertigo. Archives of Otolaryngology. 1980;106(8):484-85.

360. Epley JM. The canalith repositioning procedure for treatment of benign paroxysmal positional vertigo. Otolaryngology Head and Neck Surgery. 1992;107(3):399-404.

361. Woodworth BA, Gillespie MB, Lambert PR. The canalith repositioning procedure for benign positional vertigo: a meta-analysis. Laryngoscope. 2004;114(7):1143-6.

362. Hunt WT, Zimmermann EF, Hilton MP. Modifications of the Epley (canalith repositioning) manoeuvre for posterior canal benign paroxysmal positional vertigo (BPPV). Cochrane Database of Systematic Reviews. 2012;2012(4):CD008675.

363. Correia F, Castelhano L, Cavilhas P, Escada P. Lateral semicircular canal-BPPV: Prospective randomized study on the efficacy of four repositioning maneuvers. Acta Otorrinolaringológica Española. 2022;73(1): 27-34.

364. Jeong SH, Kim JS, Kim HJ, Choi JY, Koo JW, Choi KD, et al. Prevention of benign paroxysmal positional vertigo with vitamin D supplementation: A randomized trial. Neurology. 2020;95(9):e1117-e25.

365. Whitney SL, Rossi MM. Efficacy of vestibular rehabilitation. Otolaryngologic Clinics of North America. 2000;33(3):659-72.

366. Cohen H. Vestibular rehabilitation reduces functional disability. Otolaryngology Head and Neck Surgery. 1992;107(5):638-43.

367. Swan L. Facilitating psychological intervention for a patient with unilateral vestibular hypofunction. Journal of Neurologic Physical Therapy. 2003;27(2):54-60.

368. McDonnell MN, Hillier SL. Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. Cochrane Database of Systematic Reviews. 2015;2015(1):CD005397.

369. Regauer V, Seckler E, Müller M, Bauer P. Physical therapy interventions for older people with vertigo, dizziness and balance disorders addressing mobility and participation: A systematic review. BMC geriatr. 2020;20(1):494.

370. Bamiou DE, Davies RA, McKee M, Luxon LM. Symptoms, disability and handicap in unilateral peripheral vestibular disorders: Effects of early presentation and initiation of balance exercises. Scandinavian Audiology. 2000;29(4):238-44.

371. Whitney SL, Wrisley DM, Marchetti GF, Furman JM. The effect of age on vestibular rehabilitation outcomes. Laryngoscope. 2002;112(10):1785-90.

Bibliography

372. Ekvall Hansson E, Dahlberg LE, Magnusson M. Vestibular rehabilitation affects vestibular asymmetry among patients with fall-related wrist fractures - A randomized controlled trial. Gerontology. 2015;61(4):310-18.

373. Macias JD, Massingale S, Gerkin RD. Efficacy of vestibular rehabilitation therapy in reducing falls. Otolaryngology Head and Neck Surgery. 2005;133(3):323-25.

374. Hall CD, Schubert MC, Herdman SJ. Prediction of fall risk reduction as measured by dynamic gait index in individuals with unilateral vestibular hypofunction. Otology and Neurotology. 2004;25(5):746-51.

375. Hansson EE, Månsson N-O, Ringsberg KA, Håkansson A. Falls among dizzy patients in primary healthcare: An intervention study with control group. International Journal of Rehabilitation Research. 2008;31(1):51-7.

376. Nakamagoe K, Fujimiya S, Koganezawa T, Kadono K, Shimizu K, Fujizuka N, et al. Vestibular Function Impairment in Alzheimer's Disease. Journal of Alzheimer's Disease. 2015;47:185-96.

377. Reed-Jones RJ, Solis GR, Lawson KA, Loya AM, Cude-Islas D, Berger CS. Vision and falls: A multidisciplinary review of the contributions of visual impairment to falls among older adults. Maturitas. 2013;75(1):22-8.

378. Wang JJ, Foran S, Mitchell P. Age-specific prevalence and causes of bilateral and unilateral visual impairment in older Australians: the Blue Mountains Eye Study. Clinical and Experimental Ophthalmology. 2000;28(4):268-73.

379. Dhital A, Pey T, Stanford MR. Visual loss and falls: a review. Eye. 2010;24(9):1437-46.

380. Pineles SL, Repka MX, Yu F, Lum F, Coleman AL. Risk of musculoskeletal injuries, fractures, and falls in Medicare beneficiaries with disorders of binocular vision. JAMA Ophthalmology. 2015;133(1):60-5.

381. Yip JLY, Khawaja AP, Broadway D, Luben R, Hayat S, Dalzell N, et al. Visual acuity, self-reported vision and falls in the EPIC-Norfolk Eye study. British Journal of Ophthalmology. 2014;98(3):377-82.

382. Hong T, Mitchell P, Burlutsky G, Samarawickrama C, Wang JJ. Visual impairment and the incidence of falls and fractures among older people: Longitudinal findings from the Blue Mountains Eye Study. Investigative Ophthalmology and Visual Science. 2014;55(11):7589-93.

383. Attebo K, Mitchell P, Smith W. Visual acuity and the causes of visual loss in Australia. Ophthalmology. 1996;103(3):357-64.

384. Jack CIA, Smith T, Neoh C, Lye M, McGalliard JN. 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. 1995;41(5):280-85.

385. Klein R, Klein BEK, Lee KE. Changes in visual acuity in a population: The Beaver Dam Eye Study. Ophthalmology. 1996;103(8):1169-78.

386. Liou H-L, McCarty CA, Jin CL, Taylor HR. Prevalence and predictors of undercorrected refractive errors in the Victorian population. American Journal of Ophthalmology. 1999;127(5):590-96.

387. Tielsch JM, Sommer A, Witt K, Katz J, Royall RM. Blindness and Visual Impairment in an American Urban Population. Archives of Ophthalmology. 1990;108(2):286-90.

388. Choy NL, Brauer S, Nitz J. Changes in postural stability in women aged 20 to 80 years. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2003;58(6):M525-M30.

389. Klein BEK, Klein R, Lee KE, Cruickshanks KJ. 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. 1998;105(1):160-64.

Bibliography

390. Dargent-Molina P, Favier F, Grandjean H, Baudoin C, Schott A, Hausherr E, et al. Fall-related factors and risk of hip fracture: the EPIDOS prospective study. Lancet. 1996;348(9021):145-49.

391. Lord SR, Dayhew J. Visual risk factors for falls in older people. Journal of the American Geriatrics Society. 2001;49(5):508-15.

392. De Boer MR, Pluijm SM, Lips P, Moll AC, Völker-Dieben HJ, Deeg DJ, et al. Different aspects of visual impairment as risk factors for falls and fractures in older men and women. Journal of Bone and Mineral Research. 2004;19(9):1539-47.

393. Lord SR, Dayhew J, Howland A. Multifocal glasses impair edge-contrast sensitivity and depth perception and increase the risk of falls in older people. Journal of the American Geriatrics Society. 2002;50(11):1760-66.

394. Nevitt MC, Cummings SR, Kidd S, Black D. Risk factors for recurrent nonsyncopal falls: A prospective study. JAMA. 1989;261(18):2663.

395. Coleman AL, Cummings SR, Yu F, Kodjebacheva G, Ensrud KE, Gutierrez P, et al. Binocular visual-field loss increases the risk of future falls in older white women. Journal of the American Geriatrics Society. 2007;55(3):357-64.

396. Freeman EE, Muñoz B, Rubin G, West SK. Visual field loss increases the risk of falls in older adults: The Salisbury Eye Evaluation. Investigative Ophthalmology & Visual Science. 2007;48(10):4445-50.

397. Klein BEK, Moss SE, Klein R, Lee KE, Cruickshanks KJ. Associations of visual function with physical outcomes and limitations 5 years later in an older population: The Beaver Dam eye study. Ophthalmology. 2003;110(4):644-50.

398. Ramrattan RS, Wolfs RCW, Panda-Jonas S, Jonas JB, Bakker D, Pols HA, et al. Prevalence and causes of visual field loss in the elderly and associations with impairment in daily functioning: the Rotterdam Study. Archives of Ophthalmology. 2001;119(12):1788-94.

399. Chew FLM, Yong C-K, Ayu SM, Tajunisah I. The association between various visual function tests and low fragility hip fractures among the elderly: a Malaysian experience. Age and Ageing. 2010;39(2):239-45.

400. Ehrlich JR, Hassan SE, Stagg BC. Prevalence of falls and fall-related outcomes in older adults with self-reported vision impairment. Journal of the American Geriatrics Society. 2019;67(2):239-45.

401. Lee S-P, Hsu Y-W, Andrew L, Davis T, Johnson C. Fear of falling avoidance behavior affects the inter-relationship between vision impairment and diminished mobility in community-dwelling older adults. Physiotherapy Theory and Practice. 2020;38(5):686-94.

402. Johnson L, Buckley JG, Scally AJ, Elliott DB. Multifocal spectacles increase variability in toe clearance and risk of tripping in the elderly. Investigative Ophthalmology and Visual Science. 2007;48(4):1466.

403. Schwartz S, Segal O, Barkana Y, Schwesig R, Avni I, Morad Y. The effect of cataract surgery on postural control. Investigative Ophthalmology and Visual Science. 2005;46(3):920-24.

404. Ivers RQ, Cumming RG, Mitchell P, Simpson JM, Peduto AJ. Visual risk factors for hip fracture in older people. J Am Geriatr Soc. 2003;51(3):356-63.

405. Palagyi A, McCluskey P, White A, Rogers K, Meuleners L, Ng JQ, et al. While We Waited: Incidence and Predictors of Falls in Older Adults With Cataract. Investigative Opthalmology & Visual Science. 2016;57(14):6003.

Bibliography

406. Keay L, Palagyi A. Preventing falls in older people with cataract - it is not just about surgery. Ophthalmic and Physiological Optics. 2018;38(2):117-18.

407. Palagyi A, Ng JQ, Rogers K, Meuleners L, McCluskey P, White A, et al. Fear of falling and physical function in older adults with cataract: Exploring the role of vision as a moderator. Geriatrics and Gerontology International. 2017;17(10):1551-58.

408. Black AA, Wood JM, Lovie-Kitchin JE, Newman BM. Visual impairment and postural sway among older adults with glaucoma. Optometry and Vision Science. 2008;85(6):489-97.

409. Dolinis J, Harrison JE, Andrews GR. Factors associated with falling in older Adelaide residents. Australian and New Zealand Journal of Public Health. 1997;21(5):462-68.

410. Mihailovic A, Swenor BK, Friedman DS, West SK, Gitlin LN, Ramulu PY. Gait implications of visual field damage from glaucoma. Translational Vision Science and Technology. 2017;6(3):23.

411. Black AA, Wood JM, Lovie-Kitchin JE. Inferior field loss increases rate of falls in older adults with glaucoma. Optometry and Vision Science. 2011;88(11):1275-82.

412. Wood JM, Lacherez PF, Black AA, Cole MH, Boon MY, Kerr GK. Postural stability and gait among older adults with age-related maculopathy. Ophthalmology and Visual Science. 2009;50(1):482.

413. Szabo SM, Janssen PA, Khan K, Lord SR, Potter MJ. Neovascular AMD: an overlooked risk factor for injurious falls. Osteoporosis International. 2010;21(5):855-62.

414. Wood JM, Lacherez P, Black AA, Cole MH, Boon MY, Kerr GK. Risk of Falls, Injurious Falls, and Other Injuries Resulting from Visual Impairment among Older Adults with Age-Related Macular Degeneration. Investigative Ophthalmology & Visual Science. 2011;52(8):5088-92.

415. Day L, Fildes B, Gordon I, Fitzharris M, Flamer H, Lord SR. Randomised factorial trial of falls prevention among older people living in their own homes. BMJ. 2002;325(7356):128.

416. Pelli DG, Robson JG, Wilkins AJ. The design of a new letter chart for measuring contrast sensitivity. Clinical Vision Science. 1988;2(3):187-99.

417. Anderson AJ, Shuey NH, Wall M. Rapid confrontation screening for peripheral visual field defects and extinction. Clinical and Experimental Optometry. 2009;92(1):45-8.

418. Tseng VL, Yu F, Lum F, Coleman AL. Risk of fractures following cataract surgery in Medicare beneficiaries. Jama. 2012;308(5): 493-501.

419. Foss AJE, Harwood RH, Osborn F, Gregson RM, Zaman A, Masud T. Falls and health status in elderly women following second eye cataract surgery: A randomised controlled trial. Age and Ageing. 2006;35(1):66-71.

420. Harwood RH, Foss AJE, Osborn F, Gregson RM, Zaman A, Masud T. Falls and health status in elderly women following first eye cataract surgery: A randomised controlled trial. British Journal of Ophthalmology. 2005;89(1):53-9.

421. Healey F, Monro A, Cockram A, Adams V, Heseltine D. Using targeted risk factor reduction to prevent falls in older in-patients: a randomised controlled trial. Age and Ageing. 2004;33(4):390-95.

422. Cumming RG, Ivers R, Clemson L, Cullen J, Hayes MF, Tanzer M, et al. Improving vision to prevent falls in frail older people: a randomized trial. Journal of the American Geriatrics Society. 2007;55(2):175-81.

423. Haran MJ, Cameron ID, Ivers RQ, Simpson JM, Lee BB, Tanzer M, et al. Effect on falls of providing single lens distance vision glasses to multifocal glasses wearers: VISIBLE randomised controlled trial. BMJ. 2010;340:c2265.

Bibliography

424. Campbell AJ, Robertson MC, Grow SJL, Kerse NM, Sanderson GF, Jacobs RJ, et al. Randomised controlled trial of prevention of falls in people aged ≥75 with severe visual impairment: the VIP trial. BMJ. 2005;331(7520):817.

425. La Grow SJ, Robertson MC, Campbell AJ, Clarke GA, Kerse NM. Reducing hazard related falls in people 75 years and older with significant visual impairment: How did a successful program work? Injury Prevention. 2006;12(5):296-301.

426. Cumming RG, Thomas M, Szonyi G, Salkeld G, O'Neill E, Westbury C, et al. 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. 1999;47(12):1397-402.

427. Dillon L, Duffy P, Tiedemann A, Keay L. Acceptability of fall prevention strategies for older people with vision impairment. International Journal of Orientation and Mobility. 2018;9(1):1-9.

428. Adams N, Skelton DA, Howel D, Bailey C, Lampitt R, Fouweather T, et al. Feasibility of trial procedures for a randomised controlled trial of a community based group exercise intervention for falls prevention for visually impaired older people: the VIOLET study. BMC geriatr. 2018;18(1):307.

429. Johnson L, Elliott DB, Buckley JG. Effects of gaze strategy on standing postural stability in older multifocal wearers. Clinical and Experimental Optometry. 2009;92(1):19-26.

430. Menant JC, St. George RJ, Sandery B, Fitzpatrick RC, Lord SR. Older people contact more obstacles when wearing multifocal glasses and performing a secondary visual task. Journal of the American Geriatrics Society. 2009;57(10):1833-38.

431. Lin FR, Niparko JK, Ferrucci L. Hearing loss prevalence in the United States. Archives of Internal Medicine. 2011;171(20):1851-53.

432. Lin FR, Thorpe R, Gordon-Salant S, Ferrucci L. Hearing loss prevalence and risk factors among older adults in the United States. Journals of Gerontology: Series A. 2011;66A(5):582-90.

433. Kiely KM, Mitchell P, Gopinath B, Luszcz MA, Jagger C, Anstey KJ. Estimating the years lived with and without age-related sensory impairment. Journals of Gerontology: Series A. 2016;71(5):637-42.

434. Chia E-M, Wang JJ, Rochtchina E, Cumming RR, Newall P, Mitchell P. Hearing impairment and health-related quality of life: the Blue Mountains Hearing Study. Ear and Hearing. 2007;28(2):187-95.

435. Viljanen A, Kaprio J, Pyykkö I, Sorri M, Pajala S, Kauppinen M, et al. Hearing as a Predictor of Falls and Postural Balance in Older Female Twins. The Journals of Gerontology: Series A. 2009;64A(2):312-7.

436. Dalton DS, Cruickshanks KJ, Klein BEK, Klein R, Wiley TL, Nondahl DM. The impact of hearing loss on quality of life in older adults. Gerontologist. 2003;43(5):661-68.

437. Fenwick EK, Gupta P, Chan AWD, Man REK, Aravindhan A, Ng JH, et al. The impact of hearing impairment on health indicators in a multiethnic population of older adults in Singapore. Innovation in Aging. 2023;7(8):igad101.

438. Kiely KM, Anstey KJ, Luszcz MA. Dual sensory loss and depressive symptoms: The importance of hearing, daily functioning, and activity engagement. Frontiers in Human Neuroscience. 2013;7:837.

439. Lin FR, Ferrucci L. Hearing loss and falls among older adults in the United States. Archives of Internal Medicine. 2012;172(4):369-71.

Bibliography

440. Skalska A, Wizner B Fau - Piotrowicz K, Piotrowicz K Fau - Klich-Rączka A, Klich-Rączka A Fau - Klimek E, Klimek E Fau - Mossakowska M, Mossakowska M Fau - Rowiński R, et al. The prevalence of falls and their relation to visual and hearing impairments among a nation-wide cohort of older Poles. (1873-6815 (Electronic)).

441. Kamil RJ, Betz J, Powers BB, Pratt S, Kritchevsky S, Ayonayon HN, et al. Association of Hearing Impairment With Incident Frailty and Falls in Older Adults. Journal of Aging and Health. 2015;28(4):644-60.

442. Hill A-M, Hoffmann T, Haines TP. Circumstances of falls and falls-related injuries in a cohort of older patients following hospital discharge. Clinical Interventions in Aging. 2013;8:765-74.

443. Leclerc BS, Begin C, Cadieux E, Goulet L, Allaire JF, Meloche J, et al. Relationship between home hazards and falling among community-dwelling seniors using home-care services. Rev Epidemiol Sante Publique. 2010;58(1):3-11.

444. Studenski S, Duncan PW, Chandler J, Samsa G, Prescott B, Hogue C, et al. Predicting Falls: The Role of Mobility and Nonphysical Factors. Journal of the American Geriatrics Society. 1994;42(3):297-302.

445. Pighills A, Drummond A, Crossland S, Torgerson DJ. What type of environmental assessment and modification prevents falls in community dwelling older people? BMJ. 2019;364:l880.

446. Iwarsson S, Horstmann V, Carlsson G, Oswald F, Wahl H-W. Person—environment fit predicts falls in older adults better than the consideration of environmental hazards only. Clinical Rehabilitation. 2009;23(6):558-67.

447. Bleijlevens M, Diederiks J, Hendriks M, Van Haastregt J, Crebolder H, Van Eijk J. Relationship between location and activity in injurious falls: An exploratory study. BMC geriatr. 2010;10(1):40.

448. National Ageing Research Institute. An Analysis of Research on Preventing Falls and Falls Injury in Older People: Community, Residential Care and Hospital Settings (2004 update) Canberra: Australian Government Department of Health and Ageing; 2004.

449. Clemson L, Mackenzie L, Ballinger C, Close JCT, Cumming RG. Environmental interventions to prevent falls in community-dwelling older people: A meta-analysis of randomized trials. Journal of Aging and Health. 2008;20(8): 954-71.

450. Pighills AC, Torgerson DJ, Sheldon TA, Drummond AE, Bland JM. Environmental Assessment and Modification to Prevent Falls in Older People. Journal of the American Geriatrics Society. 2011;59(1):26-33.

451. Nikolaus T, Bach M. 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. 2003;51(3):300-5.

452. Logan PA, Coupland CAC, Gladman JRF, Sahota O, Stoner-Hobbs V, Robertson K, et al. Community falls prevention for people who call an emergency ambulance after a fall: Randomised controlled trial. BMJ. 2010;340:c2102.

453. Keall MD, Pierse N, Howden-Chapman P, Cunningham C, Cunningham M, Guria J, et al. Home modifications to reduce injuries from falls in the Home Injury Prevention Intervention (HIPI) study: A cluster-randomised controlled trial. Lancet. 2015;385(9964):231-38.

454. Peterson EW, Clemson L. Understanding the role of occupational therapy in fall prevention for community dwelling older adults. OT Practice. 2008;13(3):CE1-8.

Bibliography

455. Keglovits M, Clemson L, Hu YL, Nguyen A, Neff AJ, Mandelbaum C, et al. A scoping review of fall hazards in the homes of older adults and development of a framework for assessment and intervention. Australian Occupational Therapy Journal. 2020;67(5):470-78.

456. Mahoney J, Sager M, Dunham NC, Johnson J. Risk of falls after hospital discharge. Journal of the American Geriatrics Society. 1994;42(3):269-74.

457. Cumming RG, Thomas M, Szonyi G, Frampton G, Salkeld G, Clemson L. Adherence to occupational therapist recommendations for home modifications for falls prevention. American Journal of Occupational Therapy. 2001;55(6):641-48.

458. Oliver D, Daly F, Martin F, C., McMurdo MET. Risk factors and risk assessment tools for falls in hospital in-patients: A systematic review. Age and Ageing. 2004;33(2):122-30.

459. Daniel H, Oesch P, Stuck AE, Born S, Bachmann S, Schoenenberger AW. Evaluation of a novel photography-based home assessment protocol for identification of environmental risk factors for falls in elderly persons. Swiss Medical Weekly. 2013;143:w13884.

460. Clemson L, Bundy AC, Cumming RG, Kay L, Luckett T. Validating the Falls Behavioural (FaB) scale for older people: a Rasch analysis. Disability and Rehabilitation. 2008;30(7): 498-506.

461. Clemson L, Fitzgerald MH, Heard R. Content validity of an assessment tool to identify home fall hazards: The Westmead Home Safety Assessment. British Journal of Occupational Therapy. 1999;62(4):171-79.

462. Mackenzie L, Byles J, D'Este C. Longitudinal study of the Home Falls and Accidents Screening Tool in identifying older people at increased risk of falls. Australasian Journal on Ageing. 2009;28(2):64-9.

463. Horowitz BP, Nochajski SM, Schweitzer JA. Occupational therapy community practice and home assessments: Use of the Home Safety Self-Assessment Tool (HSSAT) to support aging in place. Occupational Therapy In Health Care. 2013;27(3):216-27.

464. Tomita MR, Saharan S, Rajendran S, Nochajski SM, Schweitzer JA. Psychometrics of the Home Safety Self-Assessment Tool (HSSAT) to Prevent Falls in Community-Dwelling Older Adults. American Journal of Occupational Therapy. 2014;68(6):711.

465. Swenor BK, Yonge AV, Goldhammer V, Miller R, Gitlin LN, Ramulu P. Evaluation of the Home Environment Assessment for the Visually Impaired (HEAVI): an instrument designed to quantify fall-related hazards in the visually impaired. BMC geriatr. 2016;16(1).

466. Gitlin LN, Schinfeld S, Winter L, Corcoran M, Boyce AA, Hauck W. Evaluating home environments of persons with dementia: Interrater reliability and validity of the Home Environmental Assessment Protocol (HEAP). Disability and Rehabilitation. 2002;24(1-3):59-71.

467. Wesson J, Clemson L, Brodaty H, Lord S, Taylor M, Gitlin L, et al. A feasibility study and pilot randomised trial of a tailored prevention program to reduce falls in older people with mild dementia. BMC geriatr. 2013;13:89.

468. Bennett S, Laver K, Voigt-Radloff S, Letts L, Clemson L, Graff M, et al. Occupational therapy for people with dementia and their family carers provided at home: A systematic review and meta-analysis. BMJ Open. 2019;9(11):e026308.

469. Gitlin L, Piersol CV. A Caregiver's Guide to Dementia: Using Activities and Other Strategies to Prevent, Rduce and Manage Behavioural Symptoms. Philadelphia, PA: Camino Books; 2014.

Bibliography

470. Australian Institute of Health and Welfare. Falls in older Australians 2019–20: Hospitalisations and deaths among people aged 65 and over Canberra: AIHW; 2022. Available from: https://www.aihw.gov.au/reports/injury/falls-in-older-australians-2019-20-hospitalisation/contents/about.

471. Haines TP, Bennell KL, Osborne RH, Hill KD. Effectiveness of targeted falls prevention programme in subacute hospital setting: randomised controlled trial. BMJ. 2004;328(7441):676.

472. Boswell DJ, Ramsey J, Smith MA, Wagers B. 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 Healthcare. 2001;10(1):10-6.

473. Donoghue J, Graham J, Mitten-Lewis S, Murphy M, Gibbs J. A volunteer companion-observer intervention reduces falls on an acute aged care ward. International Journal of Health Care Quality Assurance. 2005;18(1):24-31.

474. Giles LC, Bolch D, Rouvray R, McErlean B, Whitehead CH, Phillips PA, et al. Can volunteer companions prevent falls among inpatients? A feasibility study using a pre-post comparative design. BMC geriatr. 2006;6(1):11.

475. Greeley AM, Tanner EP, Mak S, Begashaw MM, Miake-Lye IM, Shekelle PG. Sitters as a patient safety strategy to reduce hospital falls: A systematic review. Ann Intern Med. 2020;172(5):317-24.

476. Andrew NE, Wang Y, Teo K, Callisaya ML, Moran C, Snowdon DA, et al. Exploring patterns of personal alarm system use and impacts on outcomes. Australasian Journal on Ageing. 2021;40(3):252-60.

477. De San Miguel K, Lewin G, Burton EL, Howat P, Boldy D, Toye C. Personal emergency alarms: Do health outcomes differ for purchasers and nonpurchasers? Home Health Care Serv Q. 2017;36(3-4):164-77.

478. Fleming J, Brayne C. Inability to get up after falling, subsequent time on floor, and summoning help: prospective cohort study in people over 90. BMJ. 2008;337:a2227.

479. Bloch F, Lundy JE, Rigaud AS. Profile differences of purchasers, non-purchasers, and users and non-users of Personal Emergency Response Systems: Results of a prospective cohort study. Disabil Health J. 2017;10(4):607-10.

480. Chaudhuri S, Thompson H, Demiris G. Fall detection devices and their use with older adults: a systematic review. J Geriatr Phys Ther. 2014;37(4):178-96.

481. Schwickert L, Becker C, Lindemann U, Marechal C, Bourke A, Chiari L, et al. Fall detection with body-worn sensors : a systematic review. Zeitschrift für Gerontologie und Geriatrie. 2013;46(8):706-19.

482. Bagala F, Becker C, Cappello A, Chiari L, Aminian K, Hausdorff JM, et al. Evaluation of accelerometer-based fall detection algorithms on real-world falls. PLoS One. 2012;7(5):e37062.

483. Lee RYW, Carlisle AJ. Detection of falls using accelerometers and mobile phone technology. Age and Ageing. 2011;40(6):690-96.

484. Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service Standards Sydney: ACSQHC; 2021. 2nd [Available from: https://www.safetyandquality.gov.au/sites/default/files/2021-05/national_safety_and_quality_health_service_nsqhs_standards_second_edition_-_updated_may_2021.pdf.

485. Aged Care Quality and Safety Commission. Minimising restrictive practices: Aged Care Quality and Safety Commission; n.d. Available from: https://www.agedcarequality.gov.au/older-australians/safety-care/minimising-restrictive-practices.

Bibliography

486. Australian Institute of Health and Welfare. Mental Health Services in Australia: Key Concepts 2012. Available from: https://www.aihw.gov.au/mental-health/overview/mental-health-services.

487. Scheepmans K, Dierckx de Casterlé B, Paquay L, Van Gansbeke H, Boonen S, Milisen K. Restraint use in home care: a qualitative study from a nursing perspective. BMC geriatr. 2014;14(1):17.

488. Kurata S, Ojima T. Knowledge, perceptions, and experiences of family caregivers and home care providers of physical restraint use with home-dwelling elders: a cross-sectional study in Japan. BMC geriatr. 2014;14(1):39.

489. Hamers JPH, Gulpers MJM, Strik W. Use of physical restraints with cognitively impaired nursing home residents. Journal of Advanced Nursing. 2004;45(3):246-51.

490. Sze TW, Leng CY, Lin SKS. The effectiveness of physical restraints in reducing falls among adults in acute care hospitals and nursing homes: a systematic review. JBI Evidence Synthesis. 2012;10(5):307-51.

491. Shojania KG, Duncan BW, McDonald KM, Wachter RM, Markowitz AJ. Making health care safer: a critical analysis of patient safety practices. Evid Rep Technol Assess (Summ). 2001(43):i-x, 1-668.

492. Scheepmans K, Dierckx de Casterlé B, Paquay L, Van Gansbeke H, Milisen K. Reducing physical restraints by older adults in home care: development of an evidence-based guideline. BMC geriatr. 2020;20(1):169.

493. Vandervelde S, Scheepmans K, Milisen K, van Achterberg T, Vlaeyen E, Flamaing J, et al. Reducing the use of physical restraints in home care: development and feasibility testing of a multicomponent program to support the implementation of a guideline. BMC geriatr. 2021;21(1):77.

494. Enns E, Rhemtulla R, Ewa V, Fruetel K, Holroyd-Leduc JM. A controlled quality improvement trial to reduce the use of physical restraints in older hospitalized adults. Journal of the American Geriatrics Society. 2014;62(3):541-45.

495. Pellfolk TJ-E, Gustafson Y, Bucht G, Karlsson S. Effects of a restraint minimization program on staff knowledge, attitudes, and practice: A cluster randomized trial. Journal of the American Geriatrics Society. 2010;58(1):62-9.

496. Köpke S, Mühlhauser I, Gerlach A, Haut A, Haastert B, Möhler R, et al. Effect of a guideline-based multicomponent intervention on use of physical restraints in nursing homes: A randomized controlled trial. JAMA. 2012;307(20):2177-84.

497. Koczy P, Becker C, Rapp K, Klie T, Beische D, Büchele G, et al. Effectiveness of a multifactorial intervention to reduce physical restraints in nursing home residents. Journal of the American Geriatrics Society. 2011;59(2):333-39.

498. Gulpers MJM, Bleijlevens MHC, Ambergen T, Capezuti E, van Rossum E, Hamers JPH. Belt restraint reduction in nursing homes: effects of a multicomponent intervention program. Journal of the American Geriatrics Society. 2011;59(11):2029-36.

499. Park M, Tang JH-C, Adams S, Titler MG. Changing the practice of physical restraint use in acute care. Journal of Gerontological Nursing. 2007;33(2):9-16.

500. Evans D, Wood J, Lambert L. Patient injury and physical restraint devices: A systematic review. Journal of Advanced Nursing. 2003;41(3):274-82.

501. Santesso N, Carrasco-Labra A, Brignardello-Petersen R. Hip protectors for preventing hip fractures in older people. Cochrane Database of Systematic Reviews. 2014;2014(3):CD001255.

Bibliography

502. Campbell AJ. Purity, pragmatism and hip protector pads. Age and Ageing. 2001;30(6):431-32.

503. Lauritzen JB, Petersen MM, Lund B. Effect of external hip protectors on hip fractures. Lancet. 1993;341(8836):11-3.

504. Lachman ME, Howland J, Tennstedt S, Jette A, Assmann S, Peterson EW. 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. 1998;53(1):P43-P50.

505. Lockwood K, Cameron ID, Gladman J, Kurrle SE, Lanzarone S. Hip protectors: An implementation trial in two geriatric rehabilitation wards. Australasian Journal on Ageing. 2003;22(1):38-40.

506. Greenspan SL, Myers ER, Kiel DP, Parker RA, Hayes WC, Resnick NM. Fall direction, bone mineral density, and function: Risk factors for hip fracture in frail nursing home elderly. American Journal of Medicine. 1998;104(6):539-45.

507. Norton R, Campbell AJ, Lee-Joe T, Robinson E, Butler M. Circumstances of falls resulting in hip fractures among older people. Journal of the American Geriatrics Society. 1997;45(9):1108-12.

508. Kannus P, Parkkari J, Poutala J. Comparison of force attenuation properties of four different hip protectors under simulated falling conditions in the elderly: An in vitro biomechanical study. Bone. 1999;25(2):229-35.

509. Robinovitch SN, Hayes WC, McMahon TA. Energy-shunting hip padding system attenuates femoral impact fin a simulated fall. Journal of Biomechanical Engineering. 1995;117(4):409.

510. Cameron ID, Kurrle SE, Quine S, Lockwood K, Cumming RG. Hip protectors: promising but no panacea. Australasian Journal on Ageing. 2002;21(1):4-8.

511. Cameron ID, Cumming RG, Kurrle SE, Lockwood SQ, Lockwood K, Salkeld G, et al. A randomised trial of hip protector use by frail older women living in their own homes. Injury Prevention. 2003;9(2):138-41.

512. Cameron I, Quine S. Likely non-compliance with external hip protectors: findings from focus groups. Archives of Gerontology and Geriatrics. 1994;19(3):273-81.

513. Cryer C, Knox A, Martin D, Barlow J. Hip protector compliance among older people living in residential care homes. Injury Prevention. 2002;8(3):202-6.

514. Parkkari J, Heikkilä J, Kannus P. Acceptability and compliance with wearing energy-shunting hip protectors: A 6-month prospective follow-up in a Finnish nursing home. Age and Ageing. 1998;27(2):225-29.

515. Villar MTA, Hill P, Inskip H, Thompson P, Cooper C. Will elderly rest home residents wear hip protectors? Age and Ageing. 1998;27(2):195-8.

516. Blalock SJ, Demby KB, McCulloch KL, Stevens JA. Factors influencing hip protector use among community-dwelling older adults. Injury Prevention. 2010;16(4):235-39.

517. Schaafsma FG, Kurrle SE, Quine S, Lockwood K, Cameron ID. Wearing hip protectors does not reduce health-related quality of life in older people. Age and Ageing. 2012;41(1):121-5.

518. Meyer G, Warnke A, Bender R, Mühlhauser I. Effect on hip fractures of increased use of hip protectors in nursing homes: Cluster randomised controlled trial. BMJ. 2003;326(7380):76.

519. Van Schoor NM, Devill WL, Bouter LM, Lips P. Acceptance and compliance with external hip protectors: a systematic review of the literature. Osteoporosis International. 2002;13(12):917-24.

Bibliography

520. Cameron ID, Kurrle S, Quine S, Sambrook P, March L, Chan D, et al. Increasing adherence with the use of hip protectors for older people living in the community. Osteoporosis International. 2011;22(2):617-26.

521. Jensen J, Lundin-Olsson L, Nyberg L, Gustafson Y. Fall and injury prevention in older people living in residential care facilities: A cluster randomized trial. Annals of Internal Medicine. 2002;136(10):733-41.

522. Queensland Health. Best Practice Guidelines for Public Hospitals and State Government Residential Aged Care Facilities Incorporating a Community Integration Supplement. Brisbane: Queensland Health; 2003.

523. Kurrle SE, Cameron ID, Quine S, Cumming RG. Adherence with hip protectors: A proposal for standardised definitions. Osteoporosis International. 2004;15(1):1-4.

524. Horikawa E, Matsui T, Arai H, Seki T, Iwasaki K, Sasaki H. Risk of falls in Alzheimer's disease: A prospective study. Internal Medicine. 2005;44(7):717-21.

525. Nowson CA, McGrath JJ, Ebeling PR, Haikerwal A, Daly RM, Sanders KM, et al. Vitamin D and health in adults in Australia and New Zealand: A position statement. Medical Journal of Australia. 2012;196(11):686-87.

526. Menant JC, Close JC, Delbaere K, Sturnieks DL, Trollor J, Sachdev PS, et al. Relationships between serum vitamin D levels, neuromuscular and neuropsychological function and falls in older men and women. Osteoporosis International. 2012;23(3):981-9.

527. Girgis CM, Clifton-Bligh RJ, Turner N, Lau SL, Gunton JE. Effects of vitamin D in skeletal muscle: Falls, strength, athletic performance and insulin sensitivity. Clinical Endocrinology. 2014;80(2):169-81.

528. Binkley N. Does low vitamin D status contribute to "age-related" morbidity? Journal of Bone and Mineral Research. 2007;22(S2):V55-V8.

529. Cangussu LM, Nahas-Neto J, Orsatti CL, Bueloni-Dias FN, Nahas EAP. Effect of vitamin D supplementation alone on muscle function in postmenopausal women: a randomized, double-blind, placebo-controlled clinical trial. Osteoporosis International. 2015;26(10): 2413-21.

530. Bischoff-Ferrari HA, Dawson-Hughes B, Willett WC, Staehelin HB, Bazemore MG, Zee RY, et al. Effect of vitamin D on falls: a meta-analysis. Journal of the American Medical Association. 2004;291(16):1999-2006.

531. Boland R. Role of vitamin D in skeletal muscle function. Endocrine Reviews. 1986;7(4):434-48.

532. Bolland MJ, Grey A, Gamble GD, Reid IR. Vitamin D supplementation and falls: A trial sequential meta-analysis. Lancet Diabetes and Endocrinology. 2014;2(7):573-80.

533. Zheng YT, Cui QQ, Hong YM, Yao WG. A meta-analysis of high dose, intermittent vitamin D supplementation among older adults. PLoS One. 2015;10(1):e0115850.

534. Latham NK, Anderson CS, Reid IR. Effects of Vitamin D supplementation on strength, physical performance, and falls in older persons: A systematic review. Journal of the American Geriatrics Society. 2003;51(9):1219-26.

535. Nowson CA, Diamond TH, Pasco JA, Mason RS, Sambrook PN, Eisman JA. Vitamin D in Australia: Issues and recommendations. Australian Family Physician. 2004;33(3):133-8.

536. Healthy Bones Australia. Vitamin D and Bone Health Fact Sheet: Healthy Bones Australia; 2020. Available from: https://healthybonesaustralia.org.au/wp-content/uploads/2022/10/hba-fact-sheet-vitamin-d.pdf.

537. Zeimer H, Hunter P, Agius S. Association between vitamin D deficiency and dementia, residential care and non english speaking background. Australian Society for Geriatric Medicine Conference; Cairns, Queensland2010.

Bibliography

538. Octary T, Gautama MSN, Duong H. Effectiveness of Vitamin D Supplements in Reducing the Risk of Falls among Older Adults: A Meta-Analysis of Randomized Controlled Trials. Ann Geriatr Med Res. 2023;27(3): 192-203.

539. Ling Y, Xu F, Xia X, Dai D, Xiong A, Sun R, et al. Vitamin D supplementation reduces the risk of fall in the vitamin D deficient elderly: An updated meta-analysis. Clinical Nutrition. 2021;40(11):5531-37.

540. Kong SH, Jang HN, Kim JH, Kim SW, Shin CS. Effect of vitamin D supplementation on risk of fractures and falls according to dosage and interval: A meta-analysis. Endocrinol Metab (Seoul). 2022;37(2):344-58.

541. Healthy Bones Australia. Osteoporosis Risk Factors: Healthy Bones Australia; n.d. Available from: https://healthybonesaustralia.org.au/your-bone-health/risk-factors/.

542. Dukas L, Bischoff HA, Lindpaintner LS, Schacht E, Birkner-Binder D, Damm TN, et al. 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. 2004;52(2):230-36.

543. Bolland MJ, Barber PA, Doughty RN, Mason B, Horne A, Ames R, et al. Vascular events in healthy older women receiving calcium supplementation: Randomised controlled trial. BMJ. 2008;336(7638):262-66.

544. Reid I, Bolland M. Calcium supplementation and vascular disease. Climacteric. 2008;11(4):280-86.

545. Pasco JA, Henry MJ, Kotowicz MA, Sanders KM, Seeman E, Pasco JR, et al. Seasonal periodicity of serum Vitamin D and parathyroid hormone, bone resorption, and fractures: The Geelong Osteoporosis Study. Jounral of Bone and Mineral Research. 2004;19(5):752-58.

546. Holick MF. Vitamin D: A millenium perspective. Journal of Cellular Biochemistry. 2003;88(2):296-307.

547. National Health and Medical Research Council, Australian Government Department of Health and Ageing, New Zealand Ministry of Health. Nutrient reference values for Australia and New Zealand including recommended dietary intakes (Version 1.2, updated 2017). Canberra: NHMRC; 2006.

548. Gillespie WJ, Avenall A, Henry D, O'Connell D, Robertson J. Vitamin D and vitamin D analogues for preventing fractures associated with involutional and post menopausal osteoporosis. Cochrane Database of Systematic Reviews. 2005(1):CD000227.

549. Avenell A, Mak CSJ, O'Connell D. Vitamin D and vitamin D analogues for preventing fractures in post-menopausal women and older men. Cochrane Database of Systematic Reviews. 2015;2014(4):CD000227.

550. Sanders KM, Stuart AL, Williamson EJ, Simpson JA, Kotowicz MA, Young D, et al. Annual High-Dose Oral Vitamin D and Falls and Fractures in Older Women. JAMA. 2010;303(18):1815.

551. Healthy Bones Australia. Vitamin D & Bone Health - Vitamin D Deficiency. Available from: https://healthybonesaustralia.org.au/your-bone-health/vitamin-d-bone-health/.

552. Royal Australian College of General Practitioners, Osteoporosis Australia. Osteoporosis prevention, diagnosis and management in postmenopausal women and men over 50 years of age East Melbourne, Vic: RACGP; 2017. 2nd:[Available from: https://healthybonesaustralia.org.au/wp-content/uploads/2022/12/oa-racgp-osteoporosis-clinical-guidelines-2nd-ed.pdf.

553. Healthy Bones Australia. Osteoporosis and You - Diagnosis: Healthy Bones Australia; n.d. Available from: https://healthybonesaustralia.org.au/osteoporosis-you/diagnosis/.

Bibliography

554. Nevitt MC, Cummings SR, Hudes ES. Risk factors for injurious falls: A prospective study. Journal of Gerontology. 1991;46(5):M164-M70.

555. Klotzbuecher CM, Ross PD, Landsman PB, Abbott TA, Berger M. 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. 2010;15(4):721-39.

556. Nguyen T, Sambrook PN, Kelly P, Jones G, Lord SR, Freund J, et al. Prediction of osteoporotic fractures by postural instability and bone density. BMJ. 1993;307(6912):1111-15.

557. Ensrud KE, Black DM, Palermo L, Bauer DC, Barrett-Connor E, Quandt SA, et al. Treatment with alendronate prevents fractures in women at highest risk. Archives of Internal Medicine. 1997;157(22):2617-24.

558. Wells GA, Cranney A, Peterson J, Boucher M, Shea B, Welch V, et al. Risedronate for the primary and secondary prevention of osteoporotic fractures in postmenopausal women. Cochrane Database of Systematic Reviews. 2008(1).

559. Cranney A, Guyatt G, Griffith L, Wells G, Tugwell P, Rosen C. Meta-analyses of therapies for postmenopausal osteoporosis. IX: Summary of meta-analyses of therapies for postmenopausal osteoporosis. Endocr Rev. 2002;23(4):570-78.

560. Ebeling P, Seeman E, Center J, Chen W, Chiang C, Diamond T, et al. Position Statement on the Management of Osteoporosis: Healthy Bones Australia; 2022. Available from: https://healthybonesaustralia.org.au/wp-content/uploads/2023/01/position-statement-on-osteoporosis-dec-2022.pdf.

561. Bolland MJ, Grey A, Reid IR. Should we prescribe calcium or vitamin D supplements to treat or prevent osteoporosis? Climacteric. 2015;18(S2):22-31.

562. Ashe M, Khan K, Guy P, Kruse K, Hughes K, O'Brien P, et al. Wristwatch—distal radial fracture as a marker for osteoporosis investigation. Journal of Hand Therapy. 2004;17(3):324-28.

563. Brown JP, Josse RG. 2002 clinical practice guidelines for the diagnosis and management of osteoporosis in Canada. CMAJ. 2002;167(10 Suppl):S1-34.

564. Naik-Panvelkar P, Norman S, Elgebaly Z, Elliott J, Pollack A, Thistlethwaite J, et al. Osteoporosis management in Australian general practice: An analysis of current osteoporosis treatment patterns and gaps in practice. BMC Family Practice. 2020;21(1):32.

565. Stevenson M, Lloyd Jones M, De Nigris E, Brewer N, Davis S, Oakley J. A systematic review and economic evaluation of alendronate, etidronate, risedronate, raloxifene and teriparatide for the prevention and treatment of postmenopausal osteoporosis. Health Technology Assessment. 2005;9(22):1-160.

566. McClung MR, Grauer A, Boonen S, Bolognese MA, Brown JP, Diez-Perez A, et al. Romosozumab in postmenopausal women with low bone mineral density. New England Journal of Medicine. 2014;370(5):412-20.

567. Langdahl BL, Libanati C, Crittenden DB, Bolognese MA, Brown JP, Daizadeh NS, et al. Romosozumab (sclerostin monoclonal antibody) versus teriparatide in postmenopausal women with osteoporosis transitioning from oral bisphosphonate therapy: A randomised, open-label, phase 3 trial. Lancet. 2017;390(10102):1585-94.

568. Cosman F, Crittenden DB, Adachi JD, Binkley N, Czerwinski E, Ferrari S, et al. Romosozumab treatment in postmenopausal women with osteoporosis. New England Journal of Medicine. 2016;375(16):1532-43.

Bibliography

569. Saag KG, Petersen J, Brandi ML, Karaplis AC, Lorentzon M, Thomas T, et al. Romosozumab or alendronate for fracture prevention in women with osteoporosis. New England Journal of Medicine. 2017;377(15):1417-27.

570. Lewiecki EM, Blicharski T, Goemaere S, Lippuner K, Meisner PD, Miller PD, et al. A phase III randomized placebo-controlled trial to evaluate efficacy and safety of romosozumab in men with osteoporosis. J Clin Endocrinol Metab. 2018;103(9):3183-93.

571. Mackintosh SF, Hill K, Dodd KJ, Goldie P, Culham E. Falls and injury prevention should be part of every stroke rehabilitation plan. Clinical Rehabilitation. 2005;19(4):441-51.

572. Scheffer AC, Schuurmans MJ, Van Dijk N, Van Der Hooft T, De Rooij SE. Fear of falling: Measurement strategy, prevalence, risk factors and consequences among older persons. Age and Ageing. 2008;37(1):19-24.

573. Burton E, Farrier K, Lewin G, Petrich M, Boyle E, Hill KD. Are interventions effective in improving the ability of older adults to rise from the floor independently? A mixed method systematic review. Disability and Rehabilitation. 2020;42(6):743-53.

574. Reece AC, Simpson JM. Preparing older people to cope after a fall. Physiotherapy. 1996;82(4):227-35.

575. Leonhardt R, Becker C, Groß M, Mikolaizak AS. Impact of the backward chaining method on physical and psychological outcome measures in older adults at risk of falling: A systematic review. Aging Clinical and Experimental Research. 2020;32(6):985-97.

576. Zijlstra GAR, Van Haastregt JCM, Van Rossum E, Van Eijk JTM, Yardley L, Kempen GIJM. Interventions to reduce fear of falling in community-living older people: a systematic review. Journal of the American Geriatrics Society. 2007;55(4):603-15.

Appendix

Appendix 1: Acknowledgements

The Australian Commission on Safety and Quality in Health Care acknowledges the diligent work of the authors, reviewers and contributors listed below in researching and updating the Falls Guidelines.

The Commission thanks its Aged Care Advisory Group, the Australian Government Department of Health and Aged Care, the Aged Care Quality and Safety Commission and key stakeholders who provided advice and support for this work.

The significant contribution of the 2009 Falls Guidelines Review Expert Advisory Group in the development of the original Falls Guidelines published in 2009, as listed in Appendix 2, is also acknowledged.

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Appendix 2: Contributors to the 2009 guidelines

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Appendix

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Appendix 3: Methodology, systematic review and meta-analysis

Guideline methodology

Detailed information on the methodology used to develop *Preventing Falls and Harm from Falls in Older People: Best Practice Guidelines for Community Care in Australia* is provided below, including a discussion on the analysis of evidence in identifying current best practice in preventing falls and harm from falls in older people in the community.

The information is presented in line with the chapters of the Falls Guidelines.

Background

During 2021 and 2022, the Australian Commission on Safety and Quality in Health Care (the Commission) engaged Neuroscience Research Australia (NeuRA) to undertake a systematic review and meta-analysis of international evidence from intervention trials in home and community care settings with falls and/or falls injuries outcomes to inform these Guidelines, as an update of the 2009 Falls Guidelines. Evidence was drawn from relevant Cochrane Collaboration reviews, [1-4] literature searches and the 2022 World Falls Guidelines. [5]

Definition of evidence

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. [6] This approach also involves avoiding interventions that are shown to be less effective or even harmful.

Expert Advisory Group

To guide and provide advice to the project, an expert panel comprising members of the Australian and New Zealand Falls Prevention Society was established in 2022. This included specialists in the areas of fall prevention research, measurement and monitoring, and quality improvement, as well as health professionals from fields including geriatric medicine, allied health and nursing. When necessary, the expert panel accessed resources outside its membership.

Risk factors and 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. The information retrieved in this way was checked and supplemented by information from the extensive personal research databases of the clinical experts.

Evidence-based recommendations

The recommendations in these updated Falls Guidelines build on the recommendations included in the 2009 Falls Guidelines and are informed by the World Falls Guidelines. [5] For the 2024 edition, the recommendations were developed by the authors based on updated evidence reviews with two rounds of input from the broader group of expert clinicians and researchers as outlined above.

Each recommendation is provided with a level of evidence from the modified GRADE system, with '1' indicating a strong recommendation, '2' indicating a conditional recommendation, and 'A-C' indicating high, intermediate and low-quality evidence, respectively.

Where there was insufficient evidence from good quality studies with falls outcomes to justify a recommendation, good practice points were developed for care initiatives and fall prevention interventions that the expert advisory group/ authors considered likely to be beneficial.

Appendix

Good practice points

Good practice points were developed by the expert advisory group and authors based on current practice and a review of the literature discussed in the text of each section.

The good practice points in these updated Guidelines build on the 2009 Falls Guidelines and are informed by the World Falls Guidelines. [3] The good practice points were developed by the expert advisory group and authors based on multidisciplinary expert opinion and relevant literature. In areas where no studies with falls as an outcome are available, good practice points have been developed to enhance understanding of and/or evaluate the management of risk factors for falls in older people. Additional good practice points have also been included based on feedback from consultation.

Consultation

For this 2024 edition, the consultation process undertaken by the authors involved seeking feedback from leading clinicians and researchers in falls and fractures through the Australian and New Zealand Fall Prevention Society and the National Health and Medical Research Council (NHMRC)-funded Centre of Research Excellence in the Prevention of Falls Injuries.

Consultations run by the Commission, the Australian and New Zealand Fall Prevention Society and the NHMRC Centre of Research Excellence in the Prevention of Falls injuries received feedback from multidisciplinary researchers, clinicians, professional organisations and consumers.

Feedback was provided by the Commission's Aged Care Advisory Group, the Australian Government Department of Health and Aged Care, the Aged Care Quality and Safety Commission, and key stakeholders (see Appendix 1).

Systematic review and meta-analysis

Chapter 3. Falls, falls injuries and risk factors

The definitive prospective studies documenting the incidence of falls in older people were primarily conducted in the 1980s and 1990s. These studies found fall rates in older people who live in the community to be approximately 30 to 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. [7]

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%. [8]

A study from the United States found a 32% incidence rate (of one or more falls) in 336 people aged 75 years and older. [9]

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%),[10] and in Finland in 833 people (70 years and older), living in the community in five rural districts (30%).[11]

Cost of falls

In 2018, an estimated $4.3 billion was spent on treating injuries due to falls across all age groups in Australia. [12]

Among those people aged 65 and over, costs are estimated to be $2.3 billion each year or $595 per capita. This figure includes the combined cost of hospital, primary health care (including general practitioners, allied health and pharmaceuticals) and referred medical services (such as medical imaging and pathology) where data are available. This does not include costs beyond the health system, such as income losses by family who take on carer roles, modifications to living situations, including admission to residential aged care services, or the emotional costs to the injured person and their family.

Appendix

Rates of hospitalisation and death related to falls

Older people aged 65 years and over are about 8 times more likely to be hospitalised and 68 times more likely to die from a fall than those aged 15-64 years. [12]

Falls are the leading cause of injury-related deaths across all age groups in Australia, with a rate of 15.4/100,000 (age-standardised death rate), ahead of suicide (12.5/100,000) and transport (5/100,000). [12]

Older people make up 94% of all fall-related deaths in Australia. Among older people, there were 5,034 fall-related deaths in 2020, and a projected 6,594 in 2030 and 7,802 in 2040 if current rates remain unchanged. [12]

Chapter 5. Fall interventions

Single fall prevention interventions

Exercise is the most studied single fall prevention intervention.

The 2019 Cochrane review of exercise for fall prevention confirmed that exercise can prevent falls in the community in terms of the rate of falls (number of falls experienced per person) and the number of people experiencing one or more falls per year (proportion of people who fell in each group).[2] Exercise programs were categorised according to criteria established by the European-funded ProFaNE.[13] As not all exercise modalities were equally effective in preventing falls, the impact of different types of exercise was explored independently.

There was no evidence that strength training alone, walking alone, or dancing prevents falls. These findings remain unchanged in the update of this review.

Training in voluntary stepping to avoid a fall shows promise as a fall prevention strategy, as do exergames, cognitive-motor interventions and behavioural approaches to address the fear of falling.

Exergames are interactive video games where the person is required to produce physical body movements to complete set tasks or actions, usually in response to visual cues. These approaches can also be incorporated into multi-component exercise interventions recommended for all older people by World Health Organization Physical Activity Guidelines. [14]

Multifactorial fall prevention interventions

It is difficult to draw conclusions about the optimal approach from meta-analyses of multi-factorial interventions as the many trials in this area have included a range of approaches, and some studies have methodological issues. Two examples of particularly successful multifactorial interventions are from earlier trials:

- Tinetti et al. [15] found that targeting fall risk factors in a systematic way with medicines adjustment, behavioural instructions, and/or exercise led to a 30% lower fall rate in the intervention compared to the control group.
- Close et al. [16] tested a detailed medical and occupational therapy assessment for community dwellers who presented to an accident and emergency department with a fall and found marked reductions in the risk of falling and recurrent falls, as well as significantly lower risks of hospitalisation and functional decline.

Other multi-factorial interventions have been less successful.

Elley et al. [17] found that a general-practice-based program that involved a home-based fall-risk assessment by a nurse and referral to community services and exercise where indicated did not prevent falls (IRR: 0.96, 95% CI: 0.70, 1.34).

There is some evidence that interventions provided as part of studies have greater impacts than referral-based programs, [18] presumably due to better adherence to interventions. It may be that intervention effects have become diluted over time as fall prevention interventions are more commonly applied to control groups.

Appendix

Chapter 6. Risk assessment

Balance and mobility performance

Even though the Timed Up and Go test has been widely used as a simple screening test, [19-21] a meta-analysis of 53 retrospective and prospective falls studies (n=12832) showed that the Timed-Up and Go Test in healthy, high-functioning older people is not useful for discriminating fallers from non-fallers. [22] The test is of more use in less-healthy, lower-functioning older people, and a cut point of >15 s has been recommended as being at an increased risk of falls. [5]

Chapter 7. Balance and Mobility

Mini Balance Evaluation Systems Test

Even though many studies report scoring out of 32, with a 4-level ordinal scale (e.g., 29), the original developers of the Mini BESTest recommend using the 3-level scale, with 28 as the maximum score. [23]

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: [24]

- exercise in a standing position
- minimal upper limb support – minimise the use of rails or chairs for support while exercising. However, it may be useful for older people to exercise near supportive objects so they can steady themselves when necessary
- a minimal base of support – 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, exercises need to be:

- carefully prescribed
- set up safely, such as 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

Exercise programs prevent more falls if they include three or more hours of exercise each week. [24] An effective balance training protocol for healthy older people could look like:

- a training period of 11 to 12 weeks, with a frequency of 3 sessions per week
- a single training session duration of 31 to 45 minutes with a total duration of 91 to 120 minutes of balance training per week. [25]

Ongoing exercise is required to help address fall rates, given that the effects of exercise are lost once exercise stops. [26] Research into other benefits of exercise has found that there is a dose-response relationship where greater effects are seen with more exercise. [26,27] This may also be the case for fall prevention.

Walking programs and fall prevention

Walking is a popular form of exercise and can provide many health benefits associated with increased physical activity levels. [26] Walking training may be included in a falls prevention program in addition to balance training.

People at high risk of falls should not be prescribed brisk walking programs. [24]

Reactive balance training

Reactive balance training or perturbation-based balance training is a task-specific approach that uses repeated, externally applied mechanical perturbations to trigger rapid reactions to regain postural stability in a safe and controlled environment. [28,29] Reactive balance training aims to specifically target and improve the reactive balance and stepping required in daily-life situations that can lead to falls (e.g., tripping over an object).

Appendix

To meet the task-specific requirement of reactive balance training should use external perturbations that induce a sudden motor response. Perturbations should be of sufficient magnitude to induce a loss of stability that would lead to a fall without a sufficient motor response, such as reactive stepping. [28]

Perturbation methods used in reactive balance training trials include:

- treadmills that induce belt accelerations, decelerations, [30] lateral shifts, [31] sudden start with a foam block, [32] cable pulls at the waist [33] or ankles [34]
- walkways with tripping and/or slipping devices, [35,36] and
- manual methods, including push, pull, lean-and-release, [37] tether-release, and waist-pulls. [38]

Where possible, reactive balance training programs should incorporate:

- pre-perturbation activities, such as walking and standing
- perturbations, such as trips, slips and a push, and
- target reaction, including reactive stepping, feet-in-place balance and grasping as relevant for the older person.

It is strongly recommended to use a full-body safety harness (anchored on a ceiling or portable structure) to ensure the older person's safety during reactive balance training with sufficient perturbation intensity.

The fall prevention effects of reactive balance training can last from 3 months [30] to up to 12 months [36], and booster sessions are likely required for long-term benefit. [39] Further research is needed to provide clear recommendations on optimal perturbation methods, training dose and booster frequency.

Chapter 9. Medicines

Polypharmacy

In one study, the relative risk of falling for older people using only one medicine (compared with older people not taking any medicines) was 1.4, increasing to 2.2 for older people using two medicines and 2.4 for older people using three or more medicines. [40] Another study of community-dwelling men aged 70 years and over found that the use of five or more medicines was significantly associated with adverse effects on frailty, disability, mortality and falls. [41]

Polypharmacy is associated with increased fall risk in community-dwelling adults aged 50 years and over, [42] and an increased risk of fall-related fractures in people aged 65 years and over. [43] However, for each medicine, the potential fall risk reduction should be balanced against the benefit of the medicine. Poor medicines adherence has been associated with a 50% increased rate of falls in older people, and strategies to improve medicines adherence may be beneficial. [44]

Deprescribing medicines

Early trials showed that medicines review intervention and deprescribing medicines that increase fall risk, including cardiovascular and psychotropic medicines, were effective interventions for preventing falls, [45-47]

However, a recent systematic review found fall risk-increasing medicines deprescribing strategies (mostly targeting psychotropic medicines) did not significantly reduce fall rates (RaR: 0.98, 95% CI: 0.63,1.51) in older people over a 6-to-12-month follow-up period. [48] This suggests that strategies to prevent the initial uptake of psychoactive medicines are warranted.

Appendix

Chapter 10. Continence

A Cochrane systematic review [49] showed pelvic floor muscle training is used in the treatment of women with mixed incontinence and less commonly for urge incontinence. However, study limitations make it difficult to judge whether pelvic floor muscle training is better or worse than other treatments for managing overactive bladder symptoms. [50] There is evidence from another systematic review to support conservative management of faecal incontinence. [51]

Cochrane systematic reviews of these interventions found limited evidence for their effectiveness, and further investigation is needed. [52-54]

Chapter 11. Feet and footwear

The level of evidence for 'safe' and 'unsafe' shoes is based on cohort studies, as no fall prevention randomised controlled trials of footwear interventions alone have been conducted to date.

One small trial investigated the effect of a balance-enhancing insole – a footwear insole with a raised ridge around the perimeter designed to facilitate sensation in the foot soles – on lateral gait stability and its effectiveness in daily life. The authors concluded that this relatively simple change in insole design can help to counter the effects of age-related (non-neuropathic) decline in foot-sole sensitivity and is a viable intervention to improve balance control. [55]

Another small trial compared balance and gait parameters in 30 older women while they wore flexible footwear, their own footwear and prototype footwear designed to improve dynamic balance. [56] The prototype footwear (the safe shoe in Figure 10.1) had a firm rubber sole of 25mm thickness under the heel and 18mm under the forefoot, laces plus Velcro® fastening, a high collar to support the ankle and a firm heel counter. The outer sole had a 10-degree heel bevel and grooves perpendicular across the sole and heel surface. The textured insole featured dome-shaped projections across the forefoot and along the lateral border extending to the heel. [55]

Tandem walking was enhanced in the prototype footwear, suggesting it may be beneficial to lateral stability in older women. However, standing balance, leaning balance and gait parameters were not improved by the prototype shoes.

Podiatry interventions to improve function and reduce falls

A multifaceted podiatry intervention, including foot orthoses, advice and provision of footwear, home-based foot and ankle exercises and fall prevention education, was effective in reducing falls in community-dwelling older people with disabling foot pain. [57] In addition, fewer participants had a fracture resulting from a fall. Contributing factors likely included improvements in foot and ankle strength, range of motion, balance and functional ability.

The REFORM multifaceted podiatry intervention trial [58] delivered a modified version of the above RCT comprising foot and ankle strengthening exercises, foot orthoses, provision of new footwear if required and a fall prevention leaflet. This trial involving 1010 community-dwelling older people at risk of falling found a small, non-statistically significant reduction in the incidence rate of falls in the intervention group compared to usual care.

The evidence from multifaceted podiatry interventions and multifactorial interventions involving referral to podiatry as a fall prevention strategy has now been synthesised into a systematic review, [59] with the primary conclusion being that these interventions significantly reduce fall rates in community-living older people. There is also modest evidence from a systematic review (n=8 articles) that foot and ankle exercise programs reduce the risk of falling in older people. [60]

Two systematic reviews have also synthesised findings in relation to footwear interventions and balance. One review (n=14 articles) found that footwear interventions, including shoe insoles and foot orthoses, can significantly facilitate balance and gait in adults 60 years and older through a combination of mechanical and sensorimotor mechanisms, which may translate to the prevention of falls. [61]

Appendix

The second review and meta-analysis, including data from seven studies, recently demonstrated that insoles improve standing balance and gait performance in older people, with vibration and textured insoles having the greatest effects.[62]

Chapter 12. Syncope

Orthostatic hypotension and fall risk

Orthostatic hypotension is associated with an increased risk of falls; however, there are inconsistencies in results from studies evaluating the link.[63-67] Several large prospective studies of older people have reported significant associations between orthostatic hypotension and increased risk of falls[64,67] and fractures.[68]

Evidence from a cohort study of prospective falls in 722 community-dwelling older adults found the risk of falls was 2.5 times higher for those with orthostatic hypotension after 1 minute of standing and uncontrolled hypotension compared to those with uncontrolled hypotension and no orthostatic hypotension.[69] However, in this cohort, orthostatic hypotension by itself was not associated with falls.[69] Similarly, a case-control study of older community-dwelling older adults found that orthostatic hypotension was not associated with the risk of recurrent or injurious falls.[70] Rather, lower standing systolic blood pressure soon after rising from a supine position or after 2-3 minutes after standing was associated with recurrent and injurious falls.[69,70]

Treating syncope

A randomised controlled trial found a reduction of falls by 70% in people with accurately diagnosed carotid sinus hypersensitivity receiving cardiac pacing.[71] However, a follow-up randomised, double-blind, crossover, placebo-controlled trial found no effect on fall rates in older patients with carotid sinus hypersensitivity receiving cardiac pacing.[72]

There is limited evidence for currently used therapies to manage orthostatic hypotension due to the lack of good quality, randomised, placebo-controlled trials.[73]

Chapter 13. Dizziness and vertigo

Vestibular dysfunction was found to be more prevalent in fallers versus non-fallers in a case-controlled study of 56 community-dwelling older people in the UK.[74] An epidemiological study found that participants with vestibular dysfunction who were clinically symptomatic had 12-fold increased odds of falling.[75]

A study of 66 adults found that older people who live in the community and who had sustained a wrist fracture as a result of a fall were more likely to have vestibular asymmetry than an age-matched group of non-fallers.[76] A prospective study of 55 older people with multisensory dizziness (dizziness attributed to age and deterioration of the sensory receptor system) found that those with signs of vestibular asymmetry (as measured with the headshake test) were at an increased risk of falls.[77] Multivariate analyses of 21,782 adults in the US National Health Interview Survey found those with bilateral vestibular hypofunction had a 31-fold increase in their odds of falling compared with all respondents, with 25% reporting a recent fall-related injury.[78]

Assessing dizziness

A systematic review of diagnostic tests used to evaluate dizziness in primary care found that validation of commonly used diagnostic tests is poor and practice guidelines are based on opinion rather than evidence.[79] The review also found a lack of studies including older people, despite the prevalence of dizziness increasing with age.

Of the studies examined for assessing dizziness for the update of the Falls Guidelines, only four tests had been evaluated in more than one study: the Dix-Hallpike manoeuvre, head-shaking nystagmus test, head impulse test and vibration-induced nystagmus. The head impulse test was the only test with evidence to support the diagnostic process in primary care, with a positive result diagnosing peripheral vestibular dysfunction and a negative result diagnosing central peripheral dysfunction.

Appendix

Chapter 14. Vision

Diabetic retinopathy

Diabetic retinopathy can reduce visual field size and may increase the risk of falls; [80] however, results of independent studies investigating this are mixed. A systematic review included two studies that found no association between diabetic retinopathy and the risk of falling. [81] Another study found that individuals with mild or moderate diabetic retinopathy had significantly elevated odds of falling in comparison to older people with diabetes without diabetic retinopathy. [82]

Cataract surgery

Cataract surgery has been shown to be effective in reducing falls in older people in RCTs [83,84] and prospective observational studies. [85-888] The first RCT, involving 306 women aged 70 years and over, examined cataract surgery for one eye and found the fall rate in the operated group over one year was reduced by 34% compared with the controls (IRR:0.66, 95% CI:0.45,0.96). The second follow-on RCT evaluated whether surgery on the second eye led to further reductions in falls, with the rationale that improving vision in both eyes would lead to better depth perception and, subsequently, fewer falls. Over the one-year trial period, the fall rate in the intervention group was reduced, although not significantly, by 32% (IRR:0.68, 95% CI:0.39,1.19).

The prospective cohort studies, whilst uncontrolled, add strong supporting evidence that cataract surgery can reduce fall rates. [85-88] These studies have found that cataract surgery on the first eye significantly reduces falls and that the second eye surgery provides additional benefits for fall prevention. For example, in a cohort of 407 older people, the incidence of falls among older people referred for cataract surgery was 31% lower after the first eye surgery and a further 50% lower after the second eye surgery. [88] These findings indicate that timely cataract surgery for both eyes not only optimises vision in older people with cataracts but also provides greater protection against falls. [88]

Further indirect evidence for cataract surgery for preventing falls comes from a cohort study of over 1 million US Medicare beneficiaries aged 65 years and older with a diagnosis of cataract. This study found that patients who had cataract surgery had significantly lower odds of hip fracture within one year after surgery compared with patients who had not undergone cataract surgery. [89]

Optimal prescription

The findings of one large RCT, however, imply that care is required when prescribing anyone glasses. [90] In this trial involving 616 older people, those assigned to the intervention group received vision-related treatments, which were most often a new pair of glasses. During the follow-up period, these participants reported significantly more falls than those in the control group (RR: 1.57, 95% CI: 1.20,2.95). The authors suggested that this unexpected finding may have been due to the participants in the intervention group often receiving large changes to prescriptions, which they might have needed considerable time to adapt to while being at greater risk of falling during this period.

One RCT has evaluated the effect of providing regular multifocal users at increased risk of falls with a second pair of tinted single-lens glasses for use while moving around. The intervention was effective in preventing falls in the sub-group of older people who more regularly undertook outside activities. In this group, there were significant reductions in all falls (IRR: 0.60, 95% CI: 0.4,0.85), falls outside the home (IRR: 0.61, 95% CI: 0.42,0.87) and injurious falls (IRR: 0.62, 95% CI: 0.42,0.92). [91] However, there was a significant increase in outside falls in older people who undertook little outside activity in the intervention group (IRR: 1.56, 95% CI: 1.11,2.19).

Appendix

Home safety assessment and modification

Only one adequately powered RCT has evaluated whether a home safety program can prevent falls in visually impaired older people. This trial involving 392 older people with severe visual impairment living in the community found falls were reduced significantly by 41% in those receiving the home safety program compared with those who were not. [92]

Exercise-based fall prevention programs

A systematic review and meta-analysis (n=7) found that exercise-based fall prevention programs can improve physical function but found no evidence that such programs can reduce falls in adults aged 50 years and older with vision impairment. [93]

Chapter 15. Hearing

Several studies have examined hearing impairment in relation to fall risk. [94,96-100] Most of the studies included large samples from longitudinal studies. Some studies measured hearing impairments using audiometric measurements [94,97,100,101], whereas others based their hearing impairment measure on self-report. [96,98,99,102] As self-reporting underestimates hearing loss, the studies that measured hearing loss using audiometry are, therefore, likely to yield more valid results. [95] Some studies have used retrospective designs, basing their analyses on a single question about past falls (usually in the past year). Others have collected prospective falls following the hearing assessment, a preferred outcome measure in fall prevention trials due to its greater precision and reduced reliance on good memory. [103,104]

Four retrospective studies [99-102] and the prospective Finnish Twin study [94] found hearing impairment increased fall risk, whereas one retrospective study [96] and two large studies using prospective fall data did not find this to be the case. [97,98] Most studies performed analyses to adjust for a range of confounders (such as age, gender, cardiovascular risk factors, and diabetes) to determine whether there was an independent effect of hearing impairment and falls. However, many studies have been conducted in selected populations which may not have been representative of the community population as a whole. Although no meta-analysis has been undertaken, findings of studies to date indicate that hearing impairment contributes to falls in older people.

Interventions to improve physical function in people with hearing impairment

Interventions to address the detrimental psychosocial and physical effects of hearing impairment in older age are lacking. A pilot study conducted in Canada demonstrated that a ten-week holistic program involving a combination of exercise, walking and cognitive-behavioural therapy sessions was effective in improving loneliness and key measures of physical function, including lower limb strength, gait speed and upper body flexibility among 71 older people with self-reported hearing impairment. [105] In this study, participants were randomly allocated to a control group prescribed group audiological rehabilitation (n=31) or an intervention group (n=35) who received an exercise and socialisation/health education program in addition to the group audiological rehabilitation.

Appendix

Chapter 16. Environment

A meta-analysis of environmental interventions pooled results from six trials and found a 21% reduction in fall risk when compared with usual care.[106] A sub-analysis of four datasets showed that home safety interventions that were comprehensive and focused and that targeted older people at high risk had the greatest effect. These targeted interventions reduced falls by 39%, with a number needed to treat four people (for every four people who received the intervention, one benefited most from this intervention). These results indicate that home hazard modification is a clinically viable and cost-effective intervention when offered to at-risk older people.

Assessing the older person in their environment

The Falls-HIT German trial[107] involved 361 people with mobility limitations who had recently been discharged from a geriatric hospital. The intervention consisted of in-hospital and post-discharge home visits to assess the home, recommendations and training in the use of mobility aids, with an occupational therapist and, if indicated, a physiotherapist. At one year, the intervention group had 31% fewer falls than the control group, with subgroup analysis demonstrating it was particularly effective in those with a history of multiple falls.

A UK study of older people living in the community aged 70 and over showed that older people had a lower mean physical function than the general population (MOS-12 item Physical Component subscale) and demonstrated some dependence on assisted daily living (Barthel Index).[108] The intervention was delivered by an occupational therapist using the Westmead content-validated assessment tool to identify hazards. The study proved that a formally trained assessor could deliver the intervention rather than an occupational therapist.

The NZ VIP RCT[92] found that a home safety intervention in older people 75 years and over with visual impairment (acuity ≤ 6/24) reduced fall risk by 41%. The intervention consisted of an occupational therapy assessment of environmental and behavioural risks with joint agreement on recommendations, a follow-up letter outlining these, along with facilitation of equipment purchase and installation, and if appropriate, a referral to low vision support services.

Chapter 17. Monitoring and observation

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.[109]

Response systems

In a retrospective cohort study of over 42,000 older people who were provided with a personal emergency response system in Victoria, 38% activated the alarm over a 12-month period,[110] and of these alarm activations, 43% were for falls. The responses comprised attendance by an ambulance (44%), alerting the nominated contact (43%) or reassurance provided by the personal emergency response system person (13%). One prospective cohort study has also investigated the use of alarms by people older than 90 years of age who lived alone.[111] Seventy per cent owned a call alarm (57 out of 81 participants), and 78% (28 out of 36 participants) used the alarm after a fall. 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 activating it.

A primary reason for using alarm systems is to minimise the time an older person who has fallen spends time on the floor. However, a 12-month longitudinal comparison of community-dwellers who did and did not purchase a personal emergency alarm reported no significant differences relative to time spent on the floor or the number and length of hospitalisation after an emergency, the majority of which were due to falls.[112] However, non-purchasers reported restricting their activity during the follow-up duration.

Appendix

This is noteworthy given the detrimental consequences of activity restriction on physical and cognitive function. In contrast, purchasers reported feeling more safe and secure and being more active around the home. Similarly, a study of 433 older people reported no significant differences between purchasers (n=118) and non-purchasers of personal emergency alarms in terms of time spent on the ground subsequent to a fall resulting in an emergency department presentation. [113] Interestingly, only 16% of purchasers used their alarm to seek help, and these participants did not have shorter periods lying on the floor than those who did not use their alarm. Overall, the percentage of alarm users was very low (4.5%), leading the authors to suggest automatic detection is warranted, given that not pressing the alarm button was the main reason for purchasers not using their devices.

Automatic fall detection devices

A systematic review of body-worn sensors for fall detection also found it difficult to compare studies with standardisation of measuring and reporting falls needed, and there was a lack of real-world trials. [114] There is little evidence-based support for commercially available fall detection devices. [5]

One study has performed a systematic comparison of thirteen published fall detection algorithms tested on a database of 29 real-world falls and found that algorithms that were successful at detecting simulated falls but did not perform well with detecting real-world falls with a high number of false alarms. [115]

Chapter 19. Hip protectors

The 2014 Cochrane Collaboration review [116] contains tables that summarise the randomised trials of hip protectors. See http://www.thecochranelibrary.org and search for 'hip protectors'.

Chapter 20. Vitamin D and calcium

Vitamin D supplementation (with or without calcium)

A recent systematic review conducted a meta-analysis of 21 RCTs (51,984 participants) of vitamin D supplementation alone (daily or intermittent doses of 400-60,000 IU) and found no benefit with respect to reduced risk of falls (RR= 1.00, 95% C= 0.95 to 1.05) compared to placebo or no treatment. However, a sub-group analysis showed that vitamin D supplementation reduced falls by 23% (RR 0.77, 95% CI 0.61 to 0.98) in participants with serum 25(OH)D concentration levels less than 50 nmol/L. [117]

Importantly, two randomised controlled trials have reported that very high doses of vitamin D supplementation can increase the risk of falls. A double-blind, placebo-controlled trial of 2256 community-dwelling women aged 70 years or older found that a single high dose of 500,000 IU vitamin D administered orally for 3-5 years resulted in a 15% increase in falls and a 26% increase in fractures. [118] The second trial included 200 older community-dwelling people with a history of falls and found that 66% of those randomised to a high monthly dose of vitamin D supplementation (60,000 IU per month) fell during the 12-month study period, which was significantly higher compared to the comparison lower dose (24,000 IU per month) group - 48% ($p<0.05$). [119]

Of note, 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. [120]

Appendix

Chapter 22. Post-fall management

Training for rising from the floor

A meta-analysis of interventions for improving the ability to rise from the floor showed no improvement in time to rise from the floor; however, a sub-group analysis on resistance training interventions showed a trend towards significance. [121] They noted limitations due to small sample sizes and limiting populations to healthy community-dwelling older people, where those at most risk of being unable to rise from the floor are frail, have increased fall risk and multiple comorbidities.

Appendix 3 references

1. Cameron ID, Dyer SM, Panagoda CE, Murray GR, Hill KD, Cumming RG, Kerse N: Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews 2018, 9(9):Cd005465.
2. Sherrington C, Fairhall NJ, Wallbank GK, et al. Exercise for preventing falls in older people living in the community. Cochrane Database. 2019.
3. Hopewell S, Adedire O, Copsey B, et al. Multifactorial and multiple component interventions for preventing falls in older people living in the community. Cochrane Database. 2018.
4. Clemson L, Stark S, Pighills A, Lamb S, et al. Environmental interventions for preventing falls in older people living in the community. Cochrane Database, 2023.
5. Montero-Odasso M, van der Velde N, Martin FC, et al. World guidelines for falls prevention and management for older adults: a global initiative. Age Ageing. 2022;51(9).
6. Health Evidence. Helping public health use best evidence in practice since 2005. [Available from: https://www.healthevidence.org/]
7. Lord SR, Ward JA, Williams P, et al. An epidemiological study of falls in older community-dwelling women: the Randwick falls and fractures study. Aust J Public Health. 1993;17:240-5.
8. Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. Journal of Gerontology. 1989;44:M112-7.
9. Tinetti ME, Speechley M, Ginter SF. Risk Factors for Falls among Elderly Persons Living in the Community. N Engl J Med. 1988;319:1701-7.
10. O'Loughlin JL, Robitaille Y, Boivin JF, et al. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. American Journal of Epidemiology. 1993;137:342-54.
11. Luukinen H, Koski K, Laippala P, et al. Predictors for recurrent falls among the home-dwelling elderly. Scandinavian Journal of Primary Health Care Supplement. 1995;13
12. Australian Institute of Health and Welfare. Falls in older Australians 2019–20: hospitalisations and deaths among people aged 65 and over. 2022.
13. Lamb SE, Jørstad-Stein EC, Hauer K, et al. Development of a common outcome data set for fall injury prevention trials: the Prevention of Falls Network Europe consensus. Journal of the American Geriatric Society. 2005;53:1618-22.
14. Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. British Journal of Sports Medicine. 2020;54:1451-62.
15. Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med. 1994;331:821-7.
16. Close J, Ellis M, Hooper R, et al. Prevention of falls in the elderly trial (PROFET): a randomised controlled trial. Lancet. 1999;353:93-7.
17. Elley CR, Robertson MC, Garrett S, et al. Effectiveness of a Falls-and-Fracture Nurse Coordinator to Reduce Falls: A Randomized, Controlled Trial of At-Risk Older Adults. J Am Geriatr Soc. 2008;56:1383-9.
18. Gates S, Fisher JD, Cooke MW, et al. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. BMJ. 2008;336:130-3.

Appendix

19. Shumway-Cook A, Brauer S, Woollacott M. Predicting the Probability for Falls in Community-Dwelling Older Adults Using the Timed Up & Go Test. Physical Therapy Rehabilitation. 2000;80:896-903.

20. Gunter KB, White KN, Hayes WC, et al. Functional mobility discriminates nonfallers from one-time and frequent fallers. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2000;55:M672-M6.

21. Rose DJ, Jones CJ, Lucchese N. 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. 2002;10:466-75.

22. Schoene D, Wu SM, Mikolaizak AS, et al. Discriminative ability and predictive validity of the timed up and go test in identifying older people who fall: systematic review and meta-analysis. Journal of American Geriatric Society. 2013;61:202-8.

23. King L, Horak F. On the Mini-BESTest: Scoring and the Reporting of Total Scores. Physical Therapy Rehabilitation Science. 2013;93:571-5.

24. Sherrington C, Michaleff ZA, Fairhall N, et al. Exercise to prevent falls in older adults: an updated systematic review and meta-analysis. British Journal of Sports Medicine. 2017;51:1750-8.

25. Lesinski M, Hortobagyi T, Muehlbauer T, et al. Effects of balance training on balance performance in healthy older adults: a systematic review and meta-analysis. Sports Medicine. 2015;45:1721-38.

26. Nelson ME, Rejeski WJ, Blair SN, et al. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. Circulation. 2007;116:1094-105.

27. Boyle PA, Buchman AS, Wilson RS, et al. Physical activity is associated with incident disability in community-based older persons. Journal of the American Geriatric Society. 2007;55:195-201.

28. McCrum C, Bhatt TS, Gerards MHG, et al. Perturbation-based balance training: Principles, mechanisms and implementation in clinical practice. Front Sports Act Living. 2022;4:1015394.

29. Okubo Y, Schoene D, Lord SR. Step training improves reaction time, gait and balance and reduces falls in older people: a systematic review and meta-analysis. British Journal of Sports Medicine. 2017;51:586-93.

30. Lurie JD, Zagaria AB, Ellis L, et al. Surface Perturbation Training to Prevent Falls in Older Adults: A Highly Pragmatic, Randomized Controlled Trial. Phys Ther. 2020;100:1153-62.

31. Kurz I, Gimmon Y, Shapiro A, et al. Unexpected perturbations training improves balance control and voluntary stepping times in older adults – a double blind randomized control trial. BMC Geriatr. 2016;16:58.

32. Aviles J, Allin LJ, Alexander NB, et al. Comparison of Treadmill Trip-Like Training Versus Tai Chi to Improve Reactive Balance Among Independent Older Adult Residents of Senior Housing: A Pilot Controlled Trial. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2019;74:1497-503.

33. Martelli D, Kang J, Aprigliano F, et al. Acute Effects of a Perturbation-Based Balance Training on Cognitive Performance in Healthy Older Adults: A Pilot Study. Front Sports Act Living. 2021;3:688519.

34. Konig M, Epro G, Seeley J, et al. Retention of improvement in gait stability over 14 weeks due to trip-perturbation training is dependent on perturbation dose. Journal of Biomechanics. 2019;84:243-6.

35. Okubo Y, Sturnieks DL, Brodie MA, et al. Effect of reactive balance training involving repeated slips and trips on balance recovery among older adults: a blinded randomized controlled trial. The Journals of Gerontology: Series A. 2019;74:1489-96.

Appendix

36. Pai YC, Bhatt T, Yang F, et al. Perturbation training can reduce community-dwelling older adults' annual fall risk: a randomized controlled trial. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2014;69:1586-94.

37. Mansfield A, Aqui A, Danells CJ, et al. Does perturbation-based balance training prevent falls among individuals with chronic stroke? A randomised controlled trial. BMJ Open. 2018;8:e021510.

38. Rogers MW, Creath RA, Gray V, et al. Comparison of Lateral Perturbation-Induced Step Training and Hip Muscle Strengthening Exercise on Balance and Falls in Community-Dwelling Older Adults: A Blinded Randomized Controlled Trial. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2021;76:e194-e202.

39. Bhatt T, Yang F, Pai YC. Learning to resist gait-slip falls: long-term retention in community-dwelling older adults. Archives of Physical Medicine and Rehabilitation. 2012;93:557-6

40. Cumming RG, Miller JP, Kelsey JL, et al. Medications and Multiple Falls in Elderly People: The St Louis OASIS Study. Age Ageing. 1991;20:455-61.

41. Gnjidic D, Hilmer SN, Blyth FM, et al. Polypharmacy cutoff and outcomes: five or more medicines were used to identify community-dwelling older men at risk of different adverse outcomes. Journal of Clinical Epidemiology. 2012;65:989-95.

42. Richardson K, Bennett K, Kenny RA. Polypharmacy including falls risk-increasing medications and subsequent falls in community-dwelling middle-aged and older adults. Age Ageing. 2015;44:90-6.

43. Pan HH, Li CY, Chen TJ, et al. Association of polypharmacy with fall-related fractures in older Taiwanese people: age- and gender-specific analyses. BMJ Open. 2014;4.

44. Berry SD, Quach L, Procter-Gray E, et al. Poor Adherence to Medications May Be Associated with Falls. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2010;65A:553-8.

45. Campbell AJ, Robertson MC, Gardner MM, et al. Ps Van Der Velde N, Stricker BHC, Pols HAP, et al. Risk of falls after withdrawal of fall-risk-increasing drugs: a prospective cohort study. British Journal of Clinical Pharmacology. 2007;63:232-7.

46. Campbell AJ, Robertson MC, Gardner MM, et al. Psychotropic medication withdrawal and a home-based exercise program to prevent falls: a randomized controlled trial. Journal of the American Geriatric Society. 1999;47:850-3.

47. Pit SW, Byles JE, Henry DA, et al. A Quality Use of Medicines program for general practitioners and older people: a cluster randomised controlled trial. The Medical Journal of Australia. 2007;187:23-30.

48. Lee J, Negm A, Wong E, et al. Does deprescribing fall-associated drugs reduce falls and its complications?: A systematic review. Innovation in Aging. 2017;1:268.

49. Todhunter-Brown A, Hazelton C, Campbell P, et al. Conservative interventions for treating urinary incontinence in women: an Overview of Cochrane systematic reviews. Cochrane Database of Systematic Reviews. 2022;9(9):Cd012337.

50. Dumoulin C, Cacciari LP, Hay-Smith EJC. Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. Cochrane Database of Systematic Reviews. 2018.

51. Sahlin Y, Berner E. Evidence-based physical therapy for the pelvic floor. In: Bø K, Berghmans B, Mørkved S, et al., editors. Evidence-Based Physical Therapy for the Pelvic Floor: Churchill Livingstone Elsevier; 2007. p. 304-8.

Appendix

52. Eustice S, Roe B, Paterson J. Prompted voiding for the management of urinary incontinence in adults. Cochrane Database of Systematic Reviews. 2000.

53. Ostaszkiewicz J, Johnston L, Roe B. Timed voiding for the management of urinary incontinence in adults. Cochrane Database of Systematic Reviews. 2004.

54. Ostaszkiewicz J, Chestney T, Roe B. Habit retraining for the management of urinary incontinence in adults. Cochrane Database of Systematic Reviews. 2004.

55. Perry SD, Radtke A, McIlroy WE, et al. Efficacy and effectiveness of a balance-enhancing insole. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2008;63:595-602.

56. Menz HB, Auhl M, Munteanu SE. Preliminary evaluation of prototype footwear and insoles to optimise balance and gait in older people. BMC Geriatrics. 2017;17.

57. Spink MJ, Menz HB, Fotoohabadi MR, et al. Effectiveness of a multifaceted podiatry intervention to prevent falls in community dwelling older people with disabling foot pain: randomised controlled trial. BMJ. 2011;342:d3411.

58. Cockayne S, Rodgers S, Green L, et al. Clinical effectiveness and cost-effectiveness of a multifaceted podiatry intervention for falls prevention in older people: a multicentre cohort randomised controlled trial (the REducing Falls with ORthoses and a Multifaceted podiatry intervention trial). Health Technology Assessment (Rockv). 2017;21:1-198.

59. Wylie G, Torrens C, Campbell P, et al. Podiatry interventions to prevent falls in older people: a systematic review and meta-analysis. Age Ageing. 2019;48:327-36.

60. Schwenk M, Jordan ED, Honarvararaghi B, et al. Effectiveness of foot and ankle exercise programs on reducing the risk of falling in older adults: a systematic review and meta-analysis of randomized controlled trials. Journal of the American Podiatric Medical Association. 2013;103:534-47.

61. Hatton AL, Rome K, Dixon J, et al. Footwear interventions: a review of their sensorimotor and mechanical effects on balance performance and gait in older adults. Journal of the American Podiatric Medical Association. 2013;103:516-33.

62. Park J-H, Jeon H-S, Kim J-H, et al. Immediate effect of insoles on balance in older adults. Foot (Edinb). 2021;47:101768.

63. Shaw BH, Claydon VE. The relationship between orthostatic hypotension and falling in older adults. Clinical Autonomic Research. 2014;24:3-13.

64. Hohtari-Kivimäki U, Salminen M, Vahlberg T, et al. Orthostatic Hypotension is a Risk Factor for Falls Among Older Adults: 3-Year Follow-Up. Journal of the American Medical Directors Association. 2021;22:2325-30.

65. Hartog LC, Schrijnders D, Landman GWD, et al. Is orthostatic hypotension related to falling? A meta-analysis of individual patient data of prospective observational studies. Age Ageing. 2017;46:568-75.

66. Shaw BH, Borrel D, Sabbaghan K, et al. Relationships between orthostatic hypotension, frailty, falling and mortality in elderly care home residents. BMC Geriatrics. 2019;19:80.

67. Donoghue OA, O'Connell MD, Bourke R, et al. Is orthostatic hypotension and co-existing supine and seated hypertension associated with future falls in community-dwelling older adults? Results from The Irish Longitudinal Study on Ageing (TILDA). PLoS ONE. 2021;16:e0252212.

68. Doyle K, Lavan A, Kenny R-A, et al. Delayed blood pressure recovery after standing independently predicts fracture in community-dwelling older people. Journal of the American Medical Directors Association. 2021;22:1235-41. e1.

Appendix

69. Gangavati A, Hajjar I, Quach L, et al. Hypertension, orthostatic hypotension, and the risk of falls in a community-dwelling elderly population: the maintenance of balance, independent living, intellect, and zest in the elderly of Boston study. [Erratum appears in J Am Geriatr Soc. 2011 May;59(5):960]. Journal of the American Geriatric Society. 2011;59:383-9.

70. Zia A, Kamaruzzaman SB, Myint PK, et al. The association of antihypertensives with postural blood pressure and falls among seniors residing in the community: A case-control study. European Journal of Clinical Investigation. 2015;45:1069-76.

71. Kenny RAM, Richardson DA, Steen N, et al. Carotid sinus syndrome: a modifiable risk factor for nonaccidental falls in older adults. The Journal of the American College of Cardiology. 2001;38:1491-6.

72. Parry SW, Steen N, Bexton RS, et al. Pacing in elderly recurrent fallers with carotid sinus hypersensitivity: a randomised, double-blind, placebo controlled crossover trial. Heart. 2009;95:405-9.

73. Logan IC, Witham MD. Efficacy of treatments for orthostatic hypotension: a systematic review. Age Ageing. 2012;41:587-94.

74. Liston MB, Bamiou DE, Martin F, et al. Peripheral vestibular dysfunction is prevalent in older adults experiencing multiple non-syncopal falls versus age-matched non-fallers: a pilot study. Age Ageing. 2014;43:38-43

75. Agrawal Y, Carey JP, Della Santina CC, et al. Disorders of balance and vestibular function in US adults: data from the National Health and Nutrition Examination Survey, 2001-2004. [Erratum appears in Arch Intern Med. 2009 Aug 10;169(15):1419]. Archives of Internal Medicine. 2009;169:938-44.

76. Kristinsdottir EK, Nordell E, Jarnlo G-B, et al. Observation of vestibular asymmetry in a majority of patients over 50 years with fall-related wrist fractures. Acta Oto-Laryngologica. 2001;121:481-5.

77. Ekvall Hansson E, Magnusson M. Vestibular asymmetry predicts falls among elderly patients with multi-sensory dizziness. BMC Geriatrics. 2013;13:77.

78. Ward BK, Agrawal Y, Hoffman HJ, et al. Prevalence and impact of bilateral vestibular hypofunction: results from the 2008 US National Health Interview Survey. JAMA Otolaryngology – Head & Neck Surgery. 2013;139:803-10.

79. Dros J, Maarsingh OR, van der Horst HE, et al. Tests used to evaluate dizziness in primary care. Canadian Medical Association Journal. 2010;182:E621-E31.

80. Dhital A, Pey T, Stanford MR. Visual loss and falls: a review. Eye (Lond). 2010;24:1437-46.

81. Cooper OAE, Taylor DJ, Crabb DP, et al. Psychological, social and everyday visual impact of diabetic macular oedema and diabetic retinopathy: a systematic review. Diabetic Medicine. 2020;37:924-33.

82. Gupta P, Aravindhan A, Gan ATL, et al. Association Between the Severity of Diabetic Retinopathy and Falls in an Asian Population With Diabetes. JAMA Ophthalmology. 2017;135:1410.

83. Foss AJE, Harwood RH, Osborn F, et al. Falls and health status in elderly women following second eye cataract surgery: a randomised controlled trial. Age Ageing. 2006;35:66-71.

84. Harwood RH, Foss AJE, Osborn F, et al. Falls and health status in elderly women following first eye cataract surgery: a randomised controlled trial. British Journal of Ophthalmology. 2005;89:53-9.

85. To KG, Meuleners L, Bulsara M, et al. A longitudinal cohort study of the impact of first- and both-eye cataract surgery on falls and other injuries in Vietnam. Clinical Interventions in Aging. 2014;9:743-51.

86. Feng YR, Meuleners LB, Fraser ML, et al. The impact of first and second eye cataract surgeries on falls: a prospective cohort study. Clinical Interventions in Aging. 2018;13:1457-64.

Appendix

87. Palagyi A, Morlet N, McCluskey P, et al. Visual and refractive associations with falls after first-eye cataract surgery. *Journal of Cataract & Refractive Surgery*. 2017;43:1313-21.

88. Keay L, Ho KC, Rogers K, et al. The incidence of falls after first and second eye cataract surgery: a longitudinal cohort study. The Medical Journal of Australia. 2022;217:94-9.

89. Tseng VL, Yu F, Lum F, et al. Risk of fractures following cataract surgery in medicare beneficiaries. JAMA. 2012;308:493-501.

90. Cumming RG, Ivers R, Clemson L, et al. Improving vision to prevent falls in frail older people: a randomized trial. Journal of the American Geriatric Society. 2007;55:175-81.

91. Haran MJ, Cameron ID, Ivers RQ, et al. Effect on falls of providing single lens distance vision glasses to multifocal glasses wearers: VISIBLE randomised controlled trial. BMJ. 2010;340:c2265.

92. Campbell AJ, Robertson MC, Grow SJL, et al. Randomised controlled trial of prevention of falls in people aged ≥75 with severe visual impairment: the VIP trial. BMJ. 2005;331:817.

93. Dillon L, Clemson L, Ramulu P, et al. A systematic review and meta-analysis of exercise-based falls prevention strategies in adults aged 50+ years with visual impairment. *Ophthalmic* and *Physiological* Optics. 2018;38:456-67.

94. Viljanen A, Kaprio J, Pyykko I, Sorri M, Pajala S, Kauppinen M, et al. Hearing as a Predictor of Falls and Postural Balance in Older Female Twins. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2009: gln015.

95. Dalton DS, Cruickshanks KJ, Klein BEK, Klein R, Wiley TL, Nondahl DM. The Impact of Hearing Loss on Quality of Life in Older Adults. The Gerontologist. 2003;43(5):661-8.

96. Tromp AM, Pluijm SMF, Smit JH, Deeg DJH, Bouter LM, Lips P. Fall-risk screening test: A prospective study on predictors for falls in community-dwelling elderly. Journal of Clinical Epidemiology. 2001;54(8):837-44.

97. Purchase-Helzner EL, Cauley JA, Faulkner KA, Pratt S, Zmuda JM, Talbott EO, et al. Hearing sensitivity and the risk of incident falls and fracture in older women: the study of osteoporotic fractures. Annals of Epidemiology. 2004;14(5):311-8.

98. Sihvonen S, Era P, Helenius M. Postural balance and health-related factors in middle-aged and older women with injurious falls and non-fallers. Aging Clinical and Experimental Research. 2004;16(2):139-46.

99. Lopez D, McCaul KA, Hankey GJ, Norman PE, Almeida OP, Dobson AJ, et al. Falls, injuries from falls, health related quality of life and mortality in older adults with vision and hearing impairment—Is there a gender difference? Maturitas. 2011;69(4):359-64.

100. Lin FR, Ferrucci L. Hearing loss and falls among older adults in the United States. Archives of Internal Medicine. 2012;172(4):369-71.

101. Kamil RJ, Betz J, Powers BB, Pratt S, Kritchevsky S, Ayonayon HN, et al. Association of hearing impairment with incident frailty and falls in older adults. Journal of Aging and Health. 2015;ePub(ePub):ePub-ePub.

102. Skalska A, Wizner B, Piotrowicz K, Klich-Rączka A, Klimek E, Mossakowska M, et al. The prevalence of falls and their relation to visual and hearing impairments among a nation-wide cohort of older Poles. Experimental Gerontology. 2013;48(2):140-6.

103. Hauer K, Lamb SE, Jorstad EC, Todd C, Becker C. Systematic review of definitions and methods of measuring falls in randomised controlled fall prevention trials. Age and Ageing. 2006;35(1):5-10.

Appendix

104. Rapp K, Freiberger E, Todd C, Klenk J, Becker C, Denkinger M, et al. Fall incidence in Germany: results of two population-based studies, and comparison of retrospective and prospective falls data collection methods. BMC Geriatrics. 2014;14:105.

105. Jones CA, Siever J, Knuff K, Van Bergen C, Mick P, Little J, Jones G, Murphy MA, Kurtz D, Miller H. Walk, Talk and Listen: a pilot randomised controlled trial targeting functional fitness and loneliness in older adults with hearing loss. BMJ Open. 2019;9(4):e026169.

106. Clemson L, Mackenzie L, Ballinger C, et al. Environmental interventions to prevent falls in community-dwelling older people: a meta-analysis of randomized trials. Journal of Aging and Health. 2008;20:954-71.

107. Nikolaus T, Bach M. 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 Geriatric Society. 2003;51:300-5.

108. Pighills AC, Torgerson DJ, Sheldon TA, et al. Environmental assessment and modification to prevent falls in older people. Journal of the American Geriatric Society. 2011;59:26-33.

109. Haines TP, Bennell KL, Osborne RH, et al. Effectiveness of targeted falls prevention programme in subacute hospital setting: randomised controlled trial. BMJ. 2004;328:676.

110. Andrew NE, Wang Y, Teo K, et al. Exploring patterns of personal alarm system use and impacts on outcomes. Australasian Journal on Ageing. 2021;40:252-60.

111. Fleming J, Brayne C. Inability to get up after falling, subsequent time on floor, and summoning help: prospective cohort study in people over 90. BMJ. 2008;337:a2227.

112. De San Miguel K, Lewin G, Burton EL, et al. Personal emergency alarms: do health outcomes differ for purchasers and nonpurchasers? Home Health Care Services Quarterly. 2017;36:164-77.

113. Bloch F, Lundy JE, Rigaud AS. Profile differences of purchasers, non-purchasers, and users and non-users of Personal Emergency Response Systems: Results of a prospective cohort study. Disability Health Journal. 2017;10:607-10.

114. Schwickert L, Becker C, Lindemann U, et al. Fall detection with body-worn sensors : a systematic review. Zeitschrift für Gerontologie und Geriatrie. 2013;46:706-19.

115. Bagala F, Becker C, Cappello A, et al. Evaluation of accelerometer-based fall detection algorithms on real-world falls. PLoS ONE. 2012;7:e37062.

116. Santesso N, CarrascoLabra A, BrignardelloPetersen R. Hip protectors for preventing hip fractures in older people. Cochrane Database of Systematic Reviews. 2014.

117. Ling Y, Xu F, Xia X, Dai D, Xiong A, Sun R, Qiu L, Xie Z. Vitamin D supplementation reduces the risk of fall in the vitamin D deficient elderly: An updated meta-analysis. Clinical Nutrition. 2021 Nov;40(11):5531-5537.

118. Sanders KM, Stuart AL, Williamson EJ, et al. Annual High-Dose Oral Vitamin D and Falls and Fractures in Older Women. JAMA. 2010;303:1815.

119. Bischoff-Ferrari HA, Dawson-Hughes B, Orav EJ, et al. Monthly High-Dose Vitamin D Treatment for the Prevention of Functional Decline. JAMA Internal Medicine. 2016;176:175.

120. Dukas L, Bischoff HA, Lindpaintner LS, et al. 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 Geriatric Society. 2004;52:230-6.

121. Burton E, Farrier K, Lewin G, et al. Are interventions effective in improving the ability of older adults to rise from the floor independently? A mixed method systematic review. Disability Rehabilitation. 2020;42: 743-53.

Glossary

Cognitive impairment: Impairment in one or more domains of normal brain function (e.g. memory, perception, calculation).

Cognitively Intact: Suffering no form of cognitive impairment.

Comorbidity: Two or more health conditions or disorders occurring at the same time.

Delirium: An acute change in cognitive function characterised by fluctuating confusion, impaired concentration and attention.

Dementia: Impairment in more than one cognitive domain that affects a person's ability to function and that progresses over time.

Exergames: Interactive video games that can improve a person's physical and cognitive factors by requiring participants to produce physical body movements to complete set tasks or actions, usually in response to visual cues. Exergames also involve interactive cognitive-motor training because participants are required to interact with a computer interface via gross motor movements.

Extrinsic factors: Factors that relate to a person's environment or their interaction with the environment.

Fall: A standard definition of a fall should be used in Australia so that a nationally consistent approach to fall 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

Falls Guidelines: Used in place of the full title of these guidelines, Preventing Falls and Harm from Falls in Older People: Best Practice Guidelines for Australian Residential Aged Care Facilities 2009.

Fall risk assessment: A more detailed and systematic process than a fall risk screen and is used to identify a person's risk factors for falling.

Fall 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 fall 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.

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 as a falls-related injury, particularly as falls are the leading cause of traumatic brain injuries 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.

Multifactorial interventions: Where people receive multiple interventions, but the combination of these interventions is tailored to the individual, based on an individual assessment.

Glossary

Multiple component interventions: Are a number of interventions known to complement each other in addressing risk factors for falls and harm from falls, such as tailored ongoing exercise, education and medication review.

Multiple interventions: Where everyone receives the same, fixed combination of interventions.

Older person or older people: These guidelines define older people as 65 years of age and over. When considering Aboriginal and Torres Strait Islander peoples, the term 'older people' refers to people 50 years of age and over.

Pharmacodynamics: The study of the biochemical and physiological effects that medicines have on the body.

Pharmacokinetics: The study of the way in which the body handles medicines, including the processes of absorption, distribution, excretion and localisation in tissues and chemical breakdown.

Psychoactive medicine: A medicine that affects the mental state. Psychoactive medicines include antidepressants, anticonvulsants, antipsychotics, mood stabilisers, anxiolytics, hypnotics, antiparkinsonian medicines, psychostimulants and dementia medicines.

Reasonable adjustments: A reasonable adjustment is a change to an existing approach or process that is essential to ensure a person's access to a service. Making reasonable adjustment for a person's disability creates an inclusive environment and facilitates meeting the National Safety and Quality Health Service Standards.

Residential aged care services (RACS): Refers to both high-care and low-care settings.

Restraint: A form of restrictive practice.

Restrictive practice: Any practice or intervention that has the effect of restricting the rights or freedom of movement of individuals.

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.

Serious Incident Response Scheme (SIRS): SIRS is a national scheme that helps prevent and reduce the risk of incidents of abuse and neglect in aged care services that the Australian Government subsidises. The Aged Care Quality and Safety Commission administers the scheme.

Single interventions: Interventions targeted at single risk factors.

Strengthened Aged Care Quality Standards: The strengthened Aged Care Quality Standards set out requirements for government-funded aged care providers to ensure they deliver quality care that is safe and meets the needs and preferences of older people. These will be implemented under the New Aged Care Act.

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 glasses 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 (e.g. 6/5, 6/3); however, 6/6 has been established as the standard for good vision.

Z-drugs: A class of non-benzodiazepine hypnotics used for insomnia; for example, zolpidem and zopiclone.

Acronyms and abbreviations

Acronym	Meaning
25(O)HD	25-hydroxyvitamin D
ACE-III	Addenbrooke's Cognitive Examination-III
AMTS	Abbreviated Mental Test Score
AST	Alternate Step Test
BMD	Bone mineral density
BPPV	benign paroxysmal positional vertigo
CI	Confidence Interval
DXA	Fracture Risk Assessment Tool
FRAX	Fracture Risk Assessment Tool
FROP-Com	Falls risk for older people in the community
GPCOG	General Practitioner assessment of Cognition
HOME FAST	Home Falls and Accidents Screening Tool
IRR	Internal rate of return
IU	International unit
Mini BESTest	Mini Balance Evaluation Systems Test
MMSE	Mini Mental State Examination
MoCA	Montreal Cognitive Assessment
(OH)D	Hydroxyvitamin D
PBS	Pharmaceutical Benefits Scheme
POMA	Tinetti Performance-Oriented Mobility Assessment Tool
PPA	Physiological Profile Assessment
ProFaNE	Prevention of Falls Network Europe
PROFET	Prevention of Falls in the Elderly Trial
RACS	Residential aged care service
RCT	Randomised controlled trials
RUDAS	Rowland Universal Dementia Scale
SMW	Six Metre Walk Test
SPMSQ	The Short Portable Mental Status Questionnaire

Glossary

Acronym	Meaning
SPPB	Short Physical Performance Battery
STS	Sit to Stand Test
TUG	Timed Up and Go Test
VR	Vestibular rehabilitation

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