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Invited Topical Review

Physiotherapy in the prevention of falls in older people

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Introduction

Falls in older people are a common and important problem that can have devastating consequences for individuals and their support networks. Falls are also important for health systems due to the burden they place on health services. Physiotherapists can play a crucial role in the prevention of falls in older people.[1] There is high-level evidence that appropriately prescribed interventions can prevent falls.[2] This review overviews: the impact of falls; the physiological basis of falls; evidence for the prevention of falls, with a focus on exercise-based interventions; implications for practice; and future directions for research.

The increasing problem of falls

At least one-third of people aged 65 years and over fall once or more annually. Thus, 1 million older Australians currently fall each year. Falls can result in injuries, loss of confidence, and a subsequent reduction in activity levels and community participation. Unless fall rates can be reduced at a population level, the impact of falls will grow substantially in the near future due to the increased proportion of older people in the global population. The proportion of Australians aged over 65 years is predicted to increase from 13% (3 million people) in 2010 to around 24% (9 million people) by 2050.[3] By 2050, around 2.7 million older Australians will fall each year and national annual health costs from fall-related injury are predicted to increase almost threefold, to AUD1.4 billion, if current fall rates cannot be reduced.[4] Therefore, health agencies internationally are increasingly investing in fall prevention initiatives.

Understanding falls

Daily life requires humans to undertake tasks in a range of environmental settings. Falls occur due to a mismatch between an individual's physiological function, environmental requirements and the individual's behaviour. Each of these components will be considered in turn.

Physiological function

A range of body structures and functions are involved in maintaining the body in an upright position. The appropriate co-ordination of these structures and functions is also crucial. To avoid falling, a sighted ambulant person needs adequate: vision to observe environmental challenges (eg, uneven or slippery surfaces); proprioception (awareness of where body parts are in space); reaction time to respond to unexpected perturbations; and muscle strength to extend the legs against gravity, with spare capacity to enable a stronger activation to regain an upright position in case of a trip. Adequate co-ordination of these functions enables the correct muscles to be activated at the correct times, with the correct amount of force to successfully undertake tasks such as walking and stair climbing. Postural control (balance) reflects the successful co-ordination of these functions. Adequate cardiovascular and respiratory function also ensures oxygen transport to the muscles and the brain to enable these functions to occur.

Function of the various components of successful postural control can be adversely affected by physiological ageing and low levels of appropriate physical activity (disuse). Diseases and medications may also have this impact. Postural control can also 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 medications on successful postural control is also likely to vary according to dose, interactions and metabolism but psychoactive medications have been particularly associated with falls.

Fortunately, many of these functions can be improved by physiotherapy intervention, particularly with the implementation of structured exercise interventions. Or course, people with impairments in one or more of these systems can also learn to compensate for these with other strategies such as the use of a cane, for those with visual impairments, or walking aids, for those with insufficient leg muscle strength. Physiotherapists can also have an important role in the provision of compensatory strategies and the decision about when to attempt rehabilitation rather than compensation.

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Environmental context

It is important to consider the interaction between the environment in which an individual is undertaking tasks and his or her physiological functioning. An individual with a high level of functioning in the physiological systems that are crucial to falls avoidance is still likely to fall in very challenging environments. For example, sportspeople often fall during competitions and young fit people may fall while hiking or walking on icy surfaces. The key distinction is that an older person with impaired physiology may fall in an unchallenging environment such as walking across a room. Physiotherapists should seek to understand the context of falls reported by their clients rather than assuming that all older people have fallen in an unchallenging environment.

Behavioural context

A person's behaviour is also crucial in the consideration of risk of falling. People can choose which tasks they undertake and how they undertake them. Behaviour is likely to be influenced by cognitive impairment, insight and level of support available. Some individuals with a high physiological risk of falling may be able to avoid falling by increased awareness and use of assistance when required. Individual variations in attitudes and behaviour probably explain the differences between measured fall risk and actual falls experienced.[5]

Fall prediction tools

Although individual falls are complex and multifaceted, a number of tools have been developed that can quantify a person's risk of falling with reasonable accuracy. The choice of tool will depend on the purpose of the tool and the setting in which it is to be used.

The strongest single predictor of future falls is a history of previous falls.[6] This is probably because an individual's reason for falling the first time is likely to recur. Assessment of physical functioning is the next strongest predictor and so its inclusion is likely to increase a tool's predictive ability. In general, fall prediction tools have greater predictive power if they include more components, but this needs to be traded off against the utility of performing a longer assessment. The QuickScreen[7] fall risk assessment tool has been developed and validated for use among community-dwelling older people. This tool involves assessments of balance, peripheral sensation and vision, and questions about past falls and medication use. The risk of falling increases dramatically for people with multiple risk factors on the tool. People with zero or one risk factor had a 7% chance of experiencing multiple falls in the year of follow-up, yet those with six or more risk factors had a 49% chance of multiple falls.

Fall prediction tools also need to be setting specific, because if most individuals in a particular setting have a particular risk factor (eg, muscle weakness in stroke survivors), a tool that measures this risk factor won't discriminate fallers from non-fallers. Yet, if the purpose of using the tool is to raise awareness of risk, then a tool that classifies everyone in a particular population as being at risk may still be useful.

It is important to understand the difference between a prediction tool that simply aims to predict the probability of falling and an assessment tool that can be used to guide prescription of interventions. It is not necessarily the case that addressing all risk factors identified on a prediction tool will prevent falls. Evidence that these risk factors are amenable to change with particular interventions is required.

Prevention of falls

A summary of fall prevention interventions supported by evidence from randomised, controlled trials, along with the strength of this evidence, is provided in Table 1. This summary is based on the most recent update of the Cochrane Review on falls prevention in community-dwelling older people.[2]

Randomised, controlled trials with falls as an outcome typically compare the number of falls experienced by people randomised to the intervention group with the number of falls experienced by people randomised to the control group using a rate ratio. If there were the same number of falls in both groups, the rate ratio would be 1. A rate ratio of 0.7 means there were 30% fewer falls in the intervention group compared to the control group. Rate ratios are reported with 95% confidence intervals reflecting the certainty of the effect estimate, with a smaller confidence interval indicating more certainty. Trials also often compare the proportion of people experiencing one or more falls in each group (ie, 'fallers') using a risk ratio. Similarly, if there were the same proportion of fallers in both groups, the risk ratio would be 1. A risk ratio of 0.7 means there were 30% fewer fallers in the intervention group compared to the control group. The Cochrane review[2] thus reports pooled data for both the rate of falls and risk of falling. The present review will focus on rate of falling because this is likely to be more sensitive to intervention impacts, especially in higher risk populations.

Exercise interventions

There is now strong evidence for the effectiveness of exercise in the prevention of falls in community-dwelling older people.[2,8] Exercise is an obvious choice as a fall prevention intervention because impaired muscle strength and poor postural control are known to increase the risk of falling and are amendable to change with exercise.[9,10] Exercise is the most highly-researched fall prevention intervention; the 2012 Cochrane review identified 59 randomised, controlled trials of exercise as a fall prevention intervention.[2]

Researchers have sought to establish optimal approaches to exercise by exploring effects from different types of exercise. The Cochrane review[2] concluded that 'multiple-component' exercise programs prevent falls when delivered in a group (rate ratio 0.71, 95% CI 0.63 to 0.82; 16 trials; 3622 participants) or home-based format (rate ratio 0.68, 95% CI 0.58 to 0.80; seven trials; 951 participants). The multiple-component programs involved exercise targeting several of the following categories: gait, balance, functional tasks, strength, flexibility and endurance. The Cochrane review[2] concluded that for Tai Chi, the reduction in rate of falls bordered on statistical significance (rate ratio 0.72, 95% CI 0.52 to 1.00; five trials, 1563 participants) but Tai Chi did significantly reduce risk of falling (risk ratio 0.71, 95% CI 0.57 to 0.87; six trials, 1625 participants). Classes that included just gait, balance or functional training led to a reduction in the rate of falls (rate ratio 0.72, 95% CI 0.55 to 0.94; four trials, 519 participants). Conversely, no significant reduction in falls was seen as a result of strengthening exercise alone or walking groups, but fewer trials have investigated these interventions.

An earlier meta-analysis with meta-regression by the present authors identified a focus on postural control as a crucial component of exercise to prevent falls.[8] We classified the interventions as including a high challenge to balance if the exercise was undertaken while standing and aimed to: narrow the base of support (by standing with the feet closer together or on one foot); include exercise done without the use of the arms to support the body; and involve controlled movement of the body in space. The impact on falls in trials that included a moderate (two of three criteria) or high (all three criteria) challenge to balance was 22%, whereas there was no overall impact on falls from programs that did not include these components. Examples of exercises that challenge balance and how these can be progressed are given in Box 1. We also found greater impacts from programs that were of a higher dose and did not include a walking program. We postulate that walking programs may increase the exposure to environmental fall hazards and also walking programs do not focus specifically on improving balance. As a result of this work and the findings of

Table 1
Fall prevention interventions for community-dwelling older people.

Intervention	**Pooled effects in community-dwelling populations.** Pooled rate ratios from Gillespie et al[2] unless otherwise indicated.	**Difference between pooled effects in subgroups defined according to risk status or intervention delivery.** Pooled rate ratios and subgroup comparisons from Gillespie et al[2]
Exercise		
• multiple component group-based exercise[a]	0.71 (0.63 to 0.82); 16 trials, 3622 participants	No significant difference in effect size between subgroups defined by risk of falling ($p = 0.86$) • selected for higher risk of falling, 0.70 (0.58 to 0.85); 9 trials, 1261 participants • not selected 0.72 (0.58 to 0.90); 7 trials, 2361 participants
• gait, balance or functional training in a group	0.72 (0.55 to 0.94); 4 trials, 519 participants	
• multiple component at home[a]	0.68 (0.58 to 0.80); 7 trials, 951 participants	
• resistance training at home	0.95 (0.77 to 1.18); 1 trial, 222 participants	
• Tai Chi	0.72 (0.52 to 1.00); 5 trials, 1563 participants	Suggestion of greater impact in groups not selected for higher risk of falling ($p = 0.06$) • selected for higher risk of falling 0.95 (0.62 to 1.46); 2 trials, 555 participants • not selected for higher risk of falling 0.59 (0.45 to 0.76); 3 trials, 1008 participants
Multifactorial interventions[a]	0.76 (0.67 to 0.86); 19 trials, 9503 participants	No evidence of difference in effect by risk of falls ($p = 0.50$) • selected for higher risk of falls 0.77 (0.66 to 0.90); 17 trials, 5954 participants • not selected: 0.57 (0.23 to 1.38); 2 trials, 3549 participants Intervention may be more effective in the subgroup that received an assessment and active intervention compared with the subgroup that received assessment followed by referral or provision of information ($p = 0.05$) for risk of falling but not for rate of falls ($p = 0.36$). • assessment plus active intervention delivery 0.74 (0.61 to 0.89); 11 trials, 6338 participants • assessment plus referral for intervention delivery 0.82 (0.71 to 0.95); 9 trials, 3376 participants
Home safety interventions	0.81 (0.68 to 0.97); 6 trials, 4208 participants	Home safety interventions were more effective in the higher risk subgroup ($p = 0.0009$) and when delivered by OT • selected for higher risk of falling 0.62 (0.50 to 0.77); 3 trials, 851 participants • not selected 0.94 (0.84 to 1.05); 3 trials, 3357 participants • delivered by OT 0.69 (0.55 to 0.86); 4 trials, 1443 participants • not delivered by OT 0.91 (0.75 to 1.11); 4 trials, 3075 participants
Vision assessment and eye examination plus intervention	1.57 (1.19 to 2.06); 1 trial, 616 participants	
Medications/supplements		
• nutritional supplementation	Risk ratio 0.95 (0.83 to 1.08); 3 trials, 1902 participants	
• vitamin D	1.00 (0.90 to 1.11); 7 trials, 9324 participants	Greater impact in people with lower Vitamin D than unselected populations ($p = 0.01$) • selected for low Vitamin D 0.57 (0.37 to 0.89); 2 trials • not selected 1.02 (0.93 to 1.13); 5 trials, 9064 participants
• calcitriol versus placebo	0.64 (0.49 to 0.82); 1 trial, 213 participants	
• hormone replacement therapy versus placebo	0.88 (0.65 to 1.18); 1 trial, 212 participants	
• hormone replacement therapy + calcitriol versus placebo	0.75 (0.58 to 0.97); 1 trial, 214 participants	
• medication review	Risk ratio 1.03 (0.81 to 1.31); 2 trials, 445 participants	
• GP prescription-modification program	Risk ratio 0.61 (0.41 to 0.91); 1 trial, 659 participants	
Cognitive behavioural therapy	1.11 (0.80 to 1.54); 2 trials, 350 participants	
Increased knowledge	0.88 (0.75 to 1.03); 4 trials, 2555 participants	

Effect sizes are shown as rate ratios and 95% CI unless otherwise specified. Comparisons including less than 200 people are not reported. Shaded rows indicate interventions that lead to a statistically significant reduction in falls.
[a] Please see text for more details on typical components of these interventions
OT = occupational therapist

Box 1. Examples of balance-challenging exercises suitable for prescription to older people and methods of progressing exercise intensity. Adapted from Tiedemann et al[11]

Exercise	Progression
Graded reaching in standing	Narrower foot placement Reaching further and in different directions Reaching for heavier objects Reaching down to a stool or the floor Standing on a softer surface (eg, foam rubber mat) Stepping while reaching
Stepping in different directions	Longer or faster steps Step over obstacle Pivot on non-stepping foot
Walking practice	Decrease base of support (eg, tandem walk) Increase step length and speed Walking in different directions Walking on different surfaces Walk around and over obstacles Heel and toe walking
Sit to stand	Don't use hands to push off Lower chair height Softer chair Add weight (vest or belt)
Heel raises	Decrease hand support Hold raise for longer One leg at a time Add weight (vest or belt)
Step-ups: forward and lateral	Decrease hand support Increase step height Add weight (vest or belt)
Half squats sliding down a wall	Decrease hand support Hold the squat for longer Move a short distance away from the wall Add weight (vest or belt) One leg at a time

Box 2. Recommendations for exercise to prevent falls among community-dwelling older people. Adapted from Sherrington et al[8]

Exercise must provide a moderate or high challenge to balance.
Exercises should aim to challenge balance in three ways:
- reducing the base of support
- moving the centre of gravity
- reducing the need for upper limb support.

Exercise must be of a sufficient dose to have an effect.
Exercise should be undertaken for at least 2 hours per week.

Ongoing exercise is necessary.
The benefits of exercise are rapidly lost when exercise is ceased.

Falls prevention exercise should be targeted at the general community as well as those at high risk of falls.
There is a larger relative effect from programs offered to the general community than programs offered to high-risk groups, yet, high-risk groups actually have more falls, so a greater number of falls can be prevented in this population.

Falls prevention exercise may be undertaken in a group or home-based setting.
Group sessions should be supplemented with additional home-based exercise in order to obtain the recommended exercise dose.

Walking training may be included in addition to balance training but high-risk individuals should not be prescribed brisk walking programs.
Walking training may be included in a program as long as it is not at the expense of balance training.

Strength training may be included in addition to balance training.
Effective strength training overloads the muscles by providing an amount of resistance that ensures that an exercise can only be done 10 to 15 times before muscles fatigue.

Exercise providers should make referrals for other risk factors to be addressed.
Older people who have fall risk factors not amenable to change with exercise (such as visual problems and certain medications) should receive a full assessment at a falls clinic or ask their general practitioner for appropriate referrals.

other trials we developed eight recommendations to guide the provision of exercise to prevent falls that are shown in Box 2.

While our review and the Cochrane review have taken different approaches to the classification of exercise interventions, the results are not necessarily inconsistent because most multiple component programs (found to be effective in the Cochrane review) included a challenge to balance, and the Tai Chi intervention (found to be effective in the Cochrane review) was also classified in our review as providing a challenge to balance.

There is little direct evidence about the differential impact of different approaches to exercise because most studies with falls as an outcome have not been large enough to detect the effects of different intervention approaches. One notable exception is the study by Kemmler and colleagues,[12] which found greater impact on falls of high versus lower intensity group exercise interventions (rate ratio from Cochrane review[2] 0.60, 95% CI 0.47 to 0.76).

The intervention programs used in many of the trials included in the reviews involved individualised exercise prescription based on assessment of an individual's abilities and limitations. As a range of programs have been found to prevent falls, the current evidence supports the availability of a range of programs and individualised exercise prescription according to an individual's physical functioning and interests. Several of the trials' authors have published manuals to guide the implementation of the program tested in the trial. For example, the Otago Exercise Programme is a home-based program that has been found in a meta-analysis of several trials to able to reduce the rate of falls by 35% in community-dwelling older people recruited via general practice (GP).[13] Its manual is now freely available online. Online training for the Otago Exercise Programme is offered through the North Carolina Area Health Education Center.

An interesting approach to exercise prescription that has recently been found to be effective in the prevention of falls[14] is the LiFE program developed by Clemson and colleagues, where participants are taught how to integrate the exercises into their daily routine. For example, participants are taught to practise standing on one leg while waiting for the jug to boil or while cleaning their teeth, and are encouraged to perform squats while bending to pick up washing from the washing basket.

The role of exercise as a single intervention in populations defined by a particular risk factor not amenable to change by exercise is less clear. The Otago Exercise Programme is clearly effective in the prevention of falls in general community-dwelling older people,[13] yet, in factorial studies by its developers, it did not appear to have the same impact in people with severe visual impairment[15] or in people taking psychoactive medications.[16] In contrast, the interventions tested in the non-exercise arms of these studies – a home safety intervention for people with visual impairment and gradual reduction of psychoactive medications for those taking these medications – were effective. It may be that certain risk factors are 'dominant' in certain populations and falls can only be prevented in such a population by addressing this risk factor.

Similarly, the role of exercise as a single intervention in people that are at a very high risk of falls is less clear. It is often assumed that people at greater risk of falls will obtain greater benefits from interventions. Certainly, an intervention of similar relative effectiveness will prevent more falls in high-risk populations who experience a greater absolute number of falls. However, our meta-analysis actually found smaller relative benefits from exercise as a single intervention in higher-risk people.[8] This differs from the finding of the Cochrane review that multiple component exercise was equally effective in trials that selected people at an increased risk of falls and trials in the general unselected population. This difference between the findings of the two reviews may be because our meta-analysis also included people in residential care, so had a greater spectrum of risk, and because we included Tai Chi in the same analysis as other forms of group exercise. Tai Chi was found in the Cochrane review to be less effective in higher-risk populations. The caution about the application of exercise as a single intervention to high-risk groups is also emphasised by our recent trials in which those in the intervention groups showed enhanced mobility but no significant reduction in falls. This was the case in: frail older people with a program targeting frailty rather than falls that included home exercise (incidence rate ratio (IRR) 1.12, 95% CI 0.78 to 1.63, $p = 0.53$);[17,18] long-term stroke survivors with a weekly exercise class (IRR 0.96, 95% CI 0.59 to 1.51);[19] and older people recently discharged from hospital with a home exercise program.[20] In the latter trial, there was a significantly higher rate of falls in the exercise group (IRR 1.43, 95% CI 1.07 to 1.93, $p = 0.017$).[20] It may be that the increase in mobility led to enhanced confidence, which in turn led to increased risk taking and more falls. Perhaps the post-hospital population is one in which people have not adjusted to a recently increased risk of falls, so are prone to increased risk with increased mobility. It may be that a more intensive, supervised exercise intervention is required in these high-risk groups. Previous trials with intensive centre-based programs have shown benefits for older people with a recent history in injurious falls[21] and hip fractures.[22]

It would also be worth investigating the addition of a safety intervention to a home exercise program that is shown to enhance mobility. Greater education about falls and safe mobility may enable mobility to be enhanced without falls being increased. The *Stepping On* program focuses on empowering the individual to take responsibility for falls prevention by encouraging better understanding about environmental hazards and other risk factors for falls, as well as the importance of exercise. This program has been found to reduce the rate of falls by 31% when delivered in seven sessions using a group discussion-based format for community-dwelling older people that also involved exercise with the addition of an occupational therapy (OT) home visit.[23] This approach informed our current trial with people after fall-related fracture (ACTRN12610000805077).

Interventions targeted at single risk factors

As outlined in Table 2, several trials have found that single interventions can prevent falls when targeted at people with particular risk factors addressed by the intervention. There is evidence to support interventions, including: a multifaceted podiatry intervention for people with disabling foot pain; insertion of a cardiac pacemaker for people with cardioinhibitory carotid sinus hypersensitivity; cataract removal for those with operable cataracts; and gradual reduction in psychoactive medications. There is also evidence that Vitamin D can prevent falls in those with low Vitamin D (but not in an unselected population)[2] and that a review of person's medications by a GP can prevent falls.

Multifactorial interventions

As a range of risk factors can cause falls, another common approach is to assess for the presence of risk factors and target interventions to the risk factors identified. It is difficult to draw conclusions about the optimal approach from meta-analyses of multifactorial interventions because the many trials in this area have included a range of approaches. Two examples of particularly successful multifactorial interventions are from earlier trials.[24,25] The study by Tinetti and colleagues[24] included community-dwelling people aged over 70 who were independently ambulant but had at least one of the targeted risk factors for falling (postural hypotension, sedative/hypnotic use, use of more than four medications, inability to transfer, gait impairment, strength or range of motion loss, and domestic environmental hazards); it did not include people who were able to undertake vigorous activity. The intervention program targeted these risk factors in a systematic way by using adjustment of medications, behavioural instructions, and/or exercise programs. There was a 30% lower fall rate in the intervention compared to the control group (adjusted IRR 0.69, 95% CI 0.52 to 0.90). In another early trial, Close and colleagues[25] recruited community-dwellers aged 65 years and older who presented to an accident and emergency department with a fall. Intervention group participants underwent a detailed medical and OT assessment with referral to relevant services if indicated, which resulted in marked reductions in the risk of falling and of recurrent falls, as well as significantly lower risk of hospitalisation and functional decline.

Several more recent multifactorial interventions have been less successful. For example, Elley and colleagues[26] assessed a GP-based program for previous fallers, which involved a home-based falls risk assessment by a nurse with referral to community services and exercise where indicated, and found that it didn't prevent more falls than usual care (IRR 0.96, 95% CI 0.70 to 1.34). It may be that intervention effects have become diluted over time as fall prevention interventions get applied more commonly to control groups, so between-group differences are less stark. There is also some evidence that interventions provided as part of studies have greater impacts than referral-based programs,[27] presumably due to better adherence to interventions.

The best approach to the delivery of multifactorial interventions is controversial. It has been suggested that single interventions are as effective as multiple interventions at a population level and are cheaper to deliver.[28] It has also been suggested that tailoring may

Table 2
Fall prevention interventions for community-dwelling older people targeting specific risk factors.

Intervention	**Effects in community-dwellers with a particular risk factor or condition.** From Gillespie et al[2] unless otherwise indicated.
Medication review	Home healthcare patients aged 70+ taking one of four high-fall-risk medications 1.12 (0.58, 2.13); 1 trial, 317 participants
Cataract removal	People with operable cataracts 1st eye: 0.66 (0.45 to 0.95); 1 trial, 306 participants 2nd eye: 0.68 (0.39 to 1.17); 1 trial, 239 participants
Replacing bifocal, trifocal, or progressive lens glasses with single lens glasses when walking outdoors	People who wear bifocal, trifocal, or progressive lens and walk outdoors $\geq$ 3 x per week Subgroup who regularly leave the house 0.60 (0.42 to 0.87); 1 trial, 261 participants
Podiatry (foot exercises, orthoses, shoes)	People with disabling foot pain 0.64 (0.45 to 0.91); 1 trial, 305 participants
Pacemaker	People with carotid sinus hypersensitivity 0.73 (0.57 to 0.93); 3 trials, 349 participants

Effect sizes are shown as rate ratios and 95% CIs unless otherwise specified. Comparisons including less than 200 people are not reported. Shaded rows indicate interventions that lead to a statistically significant reduction in falls.

not be essential because multiple intervention programs (ie, where more than one intervention is delivered to groups of people without screening and targeting) can also be successful.[29]

A fall prevention approach that physiotherapists may find useful is to start with exercise prescription for all older clients, given the importance of exercise as a risk factor for falls, but add additional interventions where fall risk factors not amenable to exercise intervention are detected.

Hospital and residential care

The 2012 Cochrane systematic review of interventions to prevent falls in care facilities and hospitals included 60 trials (60 345 participants).[30] In relation to exercise interventions in care facilities (13 trials), the results were inconclusive. The authors suggested that exercise programs might increase falls in frail residents and reduce falls in less frail residents, leading to no overall effect. The review authors also concluded that vitamin D supplementation is effective in reducing the risk of falls in care facilities and that multifactorial interventions may reduce the number of falls.

A particularly successful intervention in residential care involved staff and resident education on fall prevention, advice on environmental adaptations, progressive balance and resistance training, and hip protectors.[31] This program also appeared to prevent femoral fractures when disseminated across the state of Bavaria.[32] A group in New Zealand attempted to replicate this program without increasing staff levels and did not find it to be effective. In fact, they found an increase in falls in the intervention group and concluded that, at low intensity, the program may actually be worse than usual care.[33] This suggests that real investment is required to prevent falls and fractures in residential aged care.

In longer-stay subacute hospital settings, multifactorial interventions appear to reduce the rate of falls.[34] In more acute hospital settings, patient education interventions seem to be the most effective interventions in those without cognitive impairment.[35] One study[36] found a one-on-one patient education program, targeted at those without cognitive impairment, to be effective in preventing falls in a rehabilitation settings and some carryover of this impact to fall prevention in people with cognitive impairment, presumably due to changes in staff behaviour and awareness.[37]

Prevention of fractures

Falls that lead to fractures and other serious injuries are usually of greater concern to individuals than non-injurious falls. Low bone mineral density has been identified as a risk factor for fractures and there is evidence that fractures can be prevented by medications that enhance bone mineral density. Of course, many fractures are caused by falls so it is also likely that interventions known to prevent falls can also prevent fractures. Unfortunately, confirmation of this would require trials of many thousands of people and such a trial is yet to be completed; however, at least one is underway. There is evidence from meta-analyses that exercise interventions can prevent fractures. A meta-analysis of the Otago Exercise Programme trials[13] found a similar impact on injurious falls (IRR 0.65, 95% CI 0.53 to 0.81) than on all falls (IRR 0.65, 95% CI 0.57 to 0.75). The Cochrane review found that the impact of exercise interventions on fractures was substantial (RR 0.34, 95% CI 0.18 to 0.63; six trials, 810 participants). It is possible that the true effect is smaller than this, because selective outcome reporting influences this estimate. Thus, in future, all trials of interventions to prevent falls should report fractures as well as fall outcomes.

Implications for practice

As it is clear that well-designed exercise interventions prevent falls in the general older population, physiotherapists should be offering and supporting such interventions. This may involve one or more of: individualised prescription of home-based programs; referral to community group programs known to be suitable; offering group programs in a private practice or hospital department; and raising community awareness by educating about the importance of exercise in the prevention of falls (eg, talks to groups of older people or fellow health professionals, and articles for local newspapers).

As other interventions, which are not usually delivered by physiotherapists, have also been found to prevent falls for people with particular risk factors, physiotherapists can also screen patients for these risk factors and refer for specialised intervention (ie, medication management, podiatry, OT home visits for high-risk people, cataract removal, assessment of suspected carotid sinus hypersensitivity).

Implications for future research

Further research is needed to establish the optimal approaches to fall prevention in people with particular conditions (eg, stroke, frailty) and people after hospital discharge. The effectiveness and cost-effectiveness of the delivery of fall prevention interventions in the context of usual health services also requires more investigation. The impact of fall prevention interventions on fractures also requires urgent investigation.

Conclusions

Current evidence indicates that: group exercise, home safety and multifactorial interventions prevent falls in community-dwelling older people at an increased risk of falls; and group and home-based exercise and multifactorial interventions also prevent falls in unscreened groups. Therefore, falls assessment tools can be used to predict who will fall and to tailor interventions but may not be needed in order to decide who should do group or home exercise because all older people are likely to obtain benefits from these interventions.

More falls are prevented in high-risk people with interventions of the same relative effectiveness, but it is not necessarily the case that high-risk people will benefit more from interventions. This can be considered when prioritising limited resources. Single interventions targeting cataracts, foot pain and psychoactive medications can prevent falls in people with these risk factors. Greater understanding of fracture prevention in all groups and of optimal fall prevention strategies in high-risk groups is needed. Physiotherapists are very well placed to make an important contribution to the urgent global challenge of preventing falls in older people.

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Further reading

Otago Exercise Program www.acc.co.nz/PRD_EXT_CSMP/groups/external_providers/documents/publications_promotion/prd_ctrb118334.pdf

North Carolina Area Health Education Center www.aheconnect.com/newahec/cdetail.asp?courseid=cgec3