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Invited Topical Review

Physiotherapy in the prevention of falls in older people

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KEY WORDS

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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

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