

# **Environmental Interventions for preventing falls in older people living in the community - Cochrane review and meta-analysis: An Overview**

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## **Introduction**

Falls and fall-related injuries among older people continue to be a serious public health issue, with 30% of community-dwelling people over 65 experiencing at least one fall every year [1]. Falls in older people can have serious consequences, including a loss of independence, disability, and reduced quality of life and are associated with increased morbidity, mortality and admissions to care facilities [1]. Fall risk factors are well established in the literature and include physical, environmental, psychological and behavioural factors [2, 3]. A major proportion (50%) of hospitalised falls in community-dwelling older people occur in and around the home, on a level surface (60%), such as a slip, trip or stumble [1, 4] and are commonly associated with an environmental hazard [5, 6]. The most frequently identified hazards are mats, floor surfaces, steps/stairs, obstacles, and the absence of grab rails in the bathroom [7]. Environmental interventions aim to improve an older individual's safety in the home, outdoors, and in public places to reduce their risk of falling. Strategies can include the assessment and provision of assistive devices (walking aids), modifications to the environment (fastening carpets or installing better lighting), behavioural adaptations (avoiding rushing), and mobility/transfer training [8]. A broad range of interventions to prevent falls across different settings has been evaluated [9]. A recent Cochrane Review and meta-analysis by Clemson and colleagues focused on the effectiveness of environmental interventions for preventing falls in older people living in the community [10]. An overview of the key findings follows.

## **Selection criteria, types of interventions and outcome measures**

The review included randomised controlled trials (RCTs) that evaluated the effect of environmental interventions, compared to usual care or control, on the incidence of falls in older people (60 years and over) living in the community, excluding multicomponent interventions. The interventions were grouped into four categories based on the Prevention of Falls Network Europe (ProFaNE) taxonomy: home fall-hazard reduction, assistive technology, education on environmental fall risk and home modifications [11]. The primary outcome was the rate of falls (number of falls; falls per person-year). There were several secondary outcomes, including the number of fallers (risk of falling).

## **Environmental intervention types and outcomes**

### ***1. Home fall-hazard reduction***

Home fall-hazard reduction intervention includes environmental assessment, adaptation, and modifications to reduce fall hazards in and around the home. It's a comprehensive process that raises older person's awareness of their environment and provides information on negotiating it and essential problem-solving skills [8, 12, 13]. Home fall-hazard reduction interventions have been conducted as single interventions and as part of multidisciplinary and multifactorial interventions to reduce falls in older people [8, 9, 14]. Occupational therapists usually deliver these interventions and include environmental audit tools to identify fall risk hazards and risky behaviours with subsequent recommendations [8, 9].

### **Outcomes:**

The review concluded that home fall-hazard reduction interventions are effective in reducing the rate of falls and the number of people experiencing a fall. (12 trials, 5,293 participants). This was evidenced by:

- 26% fewer falls in the home fall-hazard reduction group compared to controls. RR = 0.74 (95% CI 0.61 to 0.91);  $P < .001$
- An 11% reduction in fall risk (number of people experiencing a fall). RR = 0.89 (95% CI 0.82 – 0.97)

#### **Subgroup analysis – Intervention delivered to high-risk fallers:**

A subgroup analysis found that when home fall-hazard interventions were delivered to participants at high risk of falling. (I.e. history of falling in the past year, recent hospitalisation for a fall, having a visual impairment or functional limitations), there is a greater effect on fall outcomes. The authors found:

- 38% fewer falls in the home fall-hazard reduction group compared to controls. RR = 0.62 (95% CI 0.56 – 0.70); 9 studies, 1,513 participants and
- a 26% reduction in the risk of falls (people experiencing a fall). RR 0.74 (95% CI 0.65 – 0.85); 9 studies, 1473 participants.

Notably, the authors found no evidence that home fall-hazard reduction interventions are effective in reducing the rate of falls (RR 1.05, 95% CI 0.96 -1.16; 6 studies, 3,780 participants) or the number of people experiencing a fall (RR 0.99, 95% CI 0.92 – 1.07; 6 studies, 9,780) in those people not considered to be at high risk of falls.

#### **Subgroup analysis – Intervention tailored to fall prevention and delivered by an Occupational Therapist:**

When the included study interventions were categorised based on the level of tailoring to fall prevention, the authors found there were significantly fewer falls (31%) in the high tailoring to fall prevention group and a 5% and not statistically significant reduction in falls in the limited tailoring to fall prevention interventions. Similar results were found when the studies were grouped by who delivered the intervention. Interventions delivered by Occupational Therapists found a significant 32% reduction in falls and a statistically non-significant 9% reduction in falls in the interventions provided by other personnel.

## **2. Home modifications**

Home modifications as a single or standalone intervention aim to remove barriers to function and improve task performance [10, 15]. For example, adding supports such as handrails, access ramps, and toilet and shower modifications for easier access or installing better lighting. The focus is mainly on improving the independence of individuals with functional impairments or reducing demands on carers [10, 15]. Home modification interventions differ from home fall-hazard reduction interventions, which focus specifically on fall prevention and offer a more intensive approach that may include home modifications within a package of individualised and targeted strategies [10, 12].

### **Outcomes**

Clemson and colleagues found no studies that assessed home modifications as a standalone intervention for task enablement and functional independence, which reported falls as an outcome. The authors concluded that it is unknown if home modifications as a single intervention reduce falls. Simple home modification as a standalone intervention aimed at functional independence, for example, installing supports such as handrails, may not include a sufficient focus on fall prevention [10, 12].

## **3. Assistive technology**

Assistive technology is an umbrella term that refers to any item, device, equipment or system that supports individuals to perform everyday tasks that they would otherwise not be able to perform or to increase the ease or safety with which an individual can perform a task [16]. Examples of single-strategy assistive

technologies aimed at fall prevention include the provision of mobility aids (walking stick), body-worn aids (orthotic footwear), sensory aids (eyeglasses) and self-care and assistive devices (automatic nightlights) [10].

## **Outcomes**

Eight randomised controlled trials with a total of 2,425 participants comparing the provision of assistive technology with usual care or control were included. Studies were grouped across three intervention themes: vision improvement (3 trials, 1,489 participants), footwear and foot devices (3 studies, 184 participants), and self-care and assistive devices (2 studies, 467 participants). Data from the vision improvement studies were pooled together, while data from the footwear and foot devices and self-care and assistive devices studies were not pooled due to limited data and the diversity of interventions within each theme.

**Vision Improvement:** All three vision improvement interventions included a vision assessment by either an optometrist or trained assessor and either provided glasses or referred for a vision intervention (e.g. cataract referral) [17]; referred for usual eye care or general practitioner [18]; or provided participants with single lens glasses or updated multifocal lens if required [19]. The authors concluded that vision improvement interventions make little or no difference to the rate of falls (RR = 1.12, 95% CI 0.84 -1.50; 3 studies, 1489 participants) or the number of people who fall (RR = 1.0, 95% CI 0.79 – 1.50; 3 studies, 1489), based on very low certainty evidence. A high level of heterogeneity could not be explained with subgroup analysis according to participant baseline fall risk.

**Footwear and foot devices, and self-care and assistive devices:** Three studies evaluated the effectiveness of footwear and foot device interventions. Strategies included balance enhancing insoles [20], bilateral ankle-foot orthosis [21] and an 'over shoe' device for use when walking on icy surfaces in winter [22]. Self-care (frozen meals delivered either weekly or daily) and assistive devices (bed transfer safety system) interventions were evaluated in two studies [23, 24]. Most of these trials provided low to very low certainty evidence (due to limited data and high risk of bias) of little or no effect on the rate of falls or risk of falling.

## **4. Education on environmental fall risks**

Education on environmental fall risks is often combined with other fall prevention strategies, but as a standalone intervention, involves generalised information or learning activities to increase knowledge of environmental fall risks or enable self-assessment audits of environmental hazards, with the aim of reducing falls in the home [10]. For instance, information on common environmental fall-risk hazards, self-assessment home hazard checklists and strategies for addressing hazards to prevent falls.

## **Outcomes**

The one included study was a randomised controlled trial (n=130) investigating the effect of an educational interactive session using a model mock-up of a typical Japanese home to raise awareness of home hazards followed by a self-home audit in community-dwelling older adults [25]. A further 15 papers were excluded due to study design, education as part of a multifactorial or multicomponent intervention, younger age cohort or did not meet the review intervention descriptors. Due to limited evidence from the one small trial, it is uncertain if providing education on environmental fall risk alone reduces the rate of falls (RR 0.63, 95% CI 0.37 – 1.07; 1 study, 110 participants) or the number of people falling (RR 0.84, 95% CI 0.64 – 1.11; 1 study, 110 participants).

## **Summary of findings and concluding comments**

Falls are common and can lead to serious injury and death. Most falls occur in and around the home, on a level surface, with more than 30% of falls involving environmental hazards. Clemson and colleagues evaluated

the available literature on environmental interventions for fall prevention. The key study findings and implications for practice are summarised in Table 1. Observational studies (Lord 2006, Pighills 2021) demonstrate that the presence of an environmental hazard alone does not lead to falls. Instead, falls tend to occur due to the interplay between one’s functional ability, obstacles in their environment and the activities being performed. This is further complemented by results from this Cochrane review, which found that better outcomes are achieved with home fall hazard reduction interventions that are individualised with tailoring to fall prevention and delivered by clinicians such as occupational therapists.

Table 1. Study findings – Implications for practice summary

Implications for practice	
✓	Home fall-hazard interventions are effective in reducing the rate of falls and the number of fallers when targeted to people at higher risk of falling. E.g. individuals with a history of falling in the past year, recent hospitalisation or requiring support with daily activities.
✓	A successful home fall-hazard approach uses multiple strategies to raise the person's awareness of potential hazards and utilises adaptations to the home along with behavioural safety strategies to prevent falls [8].
✓	Greater effect on reducing falls when tailored to fall prevention and delivered by an occupational therapist.
✗	Home fall-hazard interventions are ineffective when targeted at people not assessed as having a high risk of falling. E.g. the general community of older people.
✗	No studies have specifically evaluated home modification as a standalone intervention for fall prevention. Standalone home modification interventions adapt the permanent features of a home without the assessment and guidance that characterise a comprehensive home hazard reduction intervention.
?	The authors are uncertain if assistive devices (such as special footwear, bed alarms or updating glasses prescription) reduce the risk of falling. There was limited, low-quality evidence that vision improvement interventions make little or no difference to fall rates or risk.
?	There is insufficient evidence (from one trial) to conclude if education about fall risk effectively reduces the rate or risk of falls in older people living in the community.

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