Environmental interventions to prevent falls in community-dwelling older people: a meta-analysis of randomized trials

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CRD summary
This review evaluated the effectiveness of environmental interventions in reducing falls in community-dwelling older people. The authors concluded that environmental interventions can reduce falls with significant effect, particularly in high-risk groups. The authors' conclusions reflected the evidence and are likely to be reliable.

Authors' objectives
To evaluate the effectiveness of environmental interventions in reducing falls in community-dwelling older people.

Searching
Medline, EMBASE and CINAHL were searched from January 1990 to July 2007. Search terms were reported. Citation indices and bibliographies of review articles and of retrieved articles from the databases searches were searched.

Study selection
Randomised trials with a community-dwelling study population aged mostly 65 and over were eligible for inclusion in the review. The intervention had to be solely an environmental intervention (defined as adaptations or modifications to the physical environment, changes in individuals' behaviour when negotiating and interacting with the environment or the management of the environment by organisational change and decision making). There was no restriction on how the intervention was delivered or who delivered it. Studies of populations in hostels, institutions or care homes or that included an environmental intervention as a component of a multifaceted intervention were excluded. The primary outcome of interest was the rate of falls or proportion of fallers.

Studies included in the review were carried out in four different countries (Australia, France, Germany and New Zealand). Location of recruitment of participants also varied (electoral roll, hospital inpatients, local day centre, outpatients' clinic, low vision and ophthalmic clinics). Average age of participants was 79.6 years. The percentage of fallers in the past year varied between the studies. Providers of the intervention included occupational therapists, research nurses, trained assessors and an ergotherapist.

Three reviewers independently selected the studies for inclusion in the review. It was not reported how disagreements were resolved.

Assessment of study quality
Study quality was assessed using 10 criteria, which included method of randomisation, allocation concealment (the authors considered these two the most important criteria), intention to treat analysis, assessor blinding and contamination bias. Study quality was measured on a 10-point score (10 indicated highest quality). The authors did not state how many reviewers performed the quality assessment.

Data extraction
Data were extracted in order to calculate relative risks (RR) and 95% confidence intervals (CI). Two reviewers independently performed the data extraction. The authors stated that four investigators carried out a reliability check in the first three trials and compared data extraction; any discrepancies were resolved by discussion with other investigators.

Methods of synthesis
Relative risks (RRs) were combined in a meta-analysis using the random-effects model. Heterogeneity was assessed using the Cochran Q and I² tests. Publication bias was assessed using the Egger's test. Subgroup analyses were performed according to baseline risks of falling and whether or not an occupational therapist conducted the intervention. Sensitivity analysis was performed by removing one study at a time and removing lower-quality studies or...
studies with extreme treatment effects from the meta-analysis.

**Results of the review**

Six studies were included in the meta-analysis (n=3,298 participants). Sample sizes ranged from 60 to 1,879 participants. Quality scores ranged from 6 to 10; three studies scored 10. Publication bias was reported to be absent. Follow-up ranged from 12 to 18 months.

The use of an environmental intervention was associated with 21% reduction in falls (RR 0.79, 95% CI 0.65 to 0.97). However, statistically significant heterogeneity was present ($I^2=69\%$). Sensitivity analysis revealed that the removal of a study where patients were recruited at low vision and ophthalmic clinics resulted in a meta-analysis with an $I^2$ of 20%. Subgroup analysis revealed that the use of environmental intervention in participants with a high risk of falling (four studies, 570 participants) was associated with 39% reduction in falls (RR 0.61, 95% CI 0.47 to 0.79). There was no evidence of statistically significant heterogeneity. High-intensity interventions (n=4) were highly effective (RR 0.68, 95% CI 0.50 to 0.91). Non high-intense interventions (n=2) were not effective (RR 0.96, 95% CI 0.84 to 1.09).

**Authors’ conclusions**

The authors concluded that home assessment interventions that were comprehensive, well-focused and incorporated an environmental-fit perspective with adequate follow-up can successfully reduce falls with significant effects. The highest effects were associated with interventions that were conducted with high-risk groups.

**CRD commentary**

The review addressed a clear research question and was supported by detailed inclusion criteria. The search strategy was adequate, but there were no attempts to identify unpublished material and so relevant studies might have been missed. However, publication bias was assessed and reported to be absent. The validity assessment was appropriate for the included study designs and was used in interpreting the results of the review. The review process was carried out with sufficient attempts to minimise reviewer error and bias, although it was unclear how the validity assessment was performed. The authors’ conclusions reflected the evidence presented and are likely to be reliable.

**Implications of the review for practice and research**

**Practice**: The authors stated that environmental interventions undertaken by appropriately trained individuals should be offered to at-risk populations.

**Research**: The authors stated that research was needed to determine whether environmental fall strategies can be adapted for people with Parkinson's disease, stroke and cognitive impairment. Further research was needed to investigate the efficacy of specific groups of dual interventions that were well planned and integrated to enhance the opportunity for increasing benefit.

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