Interventions for preventing falls in acute- and chronic-care hospitals: a systematic review and meta-analysis

Coussement J, De Paepe L, Schwendimann R, Denhaerynck K, Dejaeger E, Milisen K

CRD summary
The review found no conclusive evidence that hospital fall prevention programmes could reduce the number of falls or patients who fell, although some individual interventions significantly reduced falls. In view of some potential limitations arising from the review process, the low quality of included trials, and the varied nature of the interventions, the authors' conclusions should be treated with caution.

Authors' objectives
To evaluate the safety and effectiveness of interventions for preventing falls in acute-care and chronic-care hospitals.

Searching
MEDLINE, CINAHL, INVERT (database of nursing periodicals in Dutch), and the Cochrane Library were searched from January 1966 to June 2006 for publications in English, Dutch and French. Search terms were reported. Bibliographies of each retrieved article were handsearched.

Study selection
Primary studies of the effectiveness of fall prevention programmes in acute-care and chronic-care hospitals were eligible for inclusion. Eligible studies had to have a prospective design with parallel controls, for example, randomised controlled trials (RCTs) or controlled trials. Studies were excluded if they focused only on the effect of intermediate outcomes (such as balance or strength), or were of fall prevention programmes in emergency departments or divisions for ambulatory treatment.

The primary outcome was the number of falls or patients falling.

All the trials took place in hospitals, mostly in geriatric rehabilitation units and geriatric care units. One trial was in acute and rehabilitation units, and two trials solely in acute units (geriatric wards and internal medicine units). Settings differed greatly by length of stay and patient's condition; the mean length of stay was over 1.5 years in long-stay wards, 36.9 days in rehabilitation wards, 11.7 days in acute wards, and 19.7 days in the study in both rehabilitation and acute wards. The mean age of the patients ranged from 70.6 to 85.2 years.

Interventions varied and could be unifactorial or multifactorial. Unifactorial interventions included vitamin D supplements, identity bracelets, exercise or physiotherapy, carpet versus vinyl flooring, or bed alarms. Multifactorial interventions all included a risk assessment with a targeted intervention, followed by education, exercise or physiotherapy, along with two to four of the following: fall alert cards with brochures, hip protectors, identity bracelets, medication review, environmental review, medical examination, eyesight correction, and nurse assistance with daily living activities.

The length of the trial periods ranged from 12 weeks to one year. In all but one trial, several fall risk factors were assessed in a standardised manner (details were provided).

The authors did not state how many reviewers performed the selection.

Assessment of study quality
Methodological quality was assessed by two reviewers independently with disagreements resolved after discussion with two other reviewers. Ten criteria were scored on a scale of 0 to 2 giving a total possible quality score of 20. The scores giving for each criterion were: not clear or not mentioned (0); partially met (1); or completely met (2). The criteria were: clearly defined inclusion/exclusion criteria; randomisation; comparable treatment groups at entry; identical standard programmes for both groups; 'fall incident' clearly defined and staff trained in definition; blinded treatment providers; blinded outcome assessors; blinded patient; identical appraisal of outcomes; and intention-to-treat analysis.
Data extraction
The numbers of events were extracted in order to calculate relative risk (RR) and 95% confidence intervals (CI). The relative risk of fall (RR_{fall}) was defined as the ratio of the number of falls per 100 occupied bed days in the intervention group to the corresponding number in the control group. The relative risk for the number of patients who fell (RR_{fallers}) was defined as the ratio of the proportion of patients who fell in the intervention group to corresponding number in the control group.

It appeared that one reviewer performed the extraction.

Methods of synthesis
Relative risks were pooled using a logarithmic transformation and the restricted maximum likelihood method. Details were provided on how their variance was calculated. The sensitivity of the pooled relative risks to an array of assumed intraclass correlation coefficients was examined when trials used cluster randomisation. One trial used two separate interventions and these were analysed separately.

Results of the review
Eight studies were identified (n=3,948 patients), including six RCTs (n=2,714 patients, range 70 to 1,654) and two controlled trials with parallel controls (n=825 patients and n=409 patients). There was one very high quality RCT scoring 19 out of 20; one RCT scored 14; four trials with scores of 9 to 11; and two RCTs with low scores of 5 and 6 (including the largest trial). Excluding the highest scoring trial, the mean quality score was 9.3. There were four trials with unifactorial interventions and four trials with multifactorial interventions.

Number of falls: A pooled analysis was only possible for the four multi-factorial studies, which found a significant reduction in the number of falls for the intervention groups (RR_{fall} 0.74, 95% CI 0.58 to 0.96) but, after adjustment for clustering, the effect was no longer significant (RR_{fall} 0.82, 95% CI 0.65 to 1.03). One of three trials with unifactorial interventions found a significant reduction in number of falls for the addition of vitamin D to the usual calcium carbonate dietary supplement of 49% (0.03 versus 0.08 falls per person/week); the relative risk was not calculable. Two multifactorial trials showed a significant reduction in falls (30%, RR_{fall} 0.70, 95% CI 0.54 to 0.89; 41%, RR_{fall} 0.59, 95% CI 0.49 to 0.70).

Number of patients falling: The number of patients who fell was reported for three multifactorial and three unifactorial trials; the pooled analysis was not significant (RR_{fallers} 0.87, 95% CI 0.70 to 1.08). The authors reported there fewer patients fell in the intervention groups than in the control groups in four trials, but the effect was not significant. However, the reduction in patients who fell appeared to be significant in one poor quality multifactorial controlled trial (RR_{fallers} 0.70, 95% CI 0.50 to 0.98), although it was no longer significant after controlling for length of stay.

A limited number of trials also reported results for patient who fell recurrently, numbers of physical injuries, time to first fall, and adverse events. Trial power data were reported for the detection of effective fall prevention strategies.

Authors' conclusions
The review found no conclusive evidence that hospital fall prevention programmes could reduce the number of falls or patients falling. More studies are needed to confirm the tendency observed in individual studies that targeting a patient's most important risk factors for falls actively helps in reducing the number of falls. These interventions only seemed to be useful on long-stay care units.

CRD commentary
The review addressed a well-defined question in terms of participants, interventions, study design and relevant outcomes. Relevant databases were searched, but only for studies published in English, Dutch and French; it appeared that unpublished studies were not considered, so some relevant studies may have been missed. Publication bias was not assessed. Although validity assessment was carried out with efforts to reduce error and bias, it was not reported whether this process applied to other aspects of the review process. Only one reviewer extracted the data and there were several discrepancies between the tables, text and conclusions.
Trial quality was assessed using suitable criteria. The authors reported that no trial had a significant result for patients who fell (fallers) in the text, yet the table reported one significant result for relative risk (although after adjustment it was no longer significant). The mean age of patients differed slightly between the tables and text. Relevant trial details were reported, but there were no details on loss to follow-up and little on the gender of patients. The statistical method used for the meta-analysis seemed appropriate, but statistical heterogeneity was not assessed. Relevant adjustments were made for confounders.

The authors acknowledged that the quality of most of the included trials was low and that the interventions and methods of measuring fall risk varied greatly. Their recommendation for further research seemed appropriate.

In view of some potential limitations arising from the review process, the low quality of the included trials, and the heterogeneous nature of the interventions, the authors’ conclusions should be treated with caution.

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

**Practice:** The authors suggested that the kind of setting might play a fundamental role in the effectiveness of fall prevention programmes.

**Research:** The authors identified a need for further studies which target a patient’s most important risk factors for falls. They also recommended further research on: primary hospital fall-prevention programmes in an ‘acute’ setting; counting the numbers of patient who fell and those who fell recurrently; the fall reduction effect of individual components of multifactorial studies; the cost effectiveness of programmes; interventions involving healthcare workers from other disciplines where nurses could play a central role. They recommended better methodological quality assessment measures for this type of complex intervention study.

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