Do hip protectors decrease the risk of hip fracture in institutional and community-dwelling elderly: a systematic review and meta-analysis of randomized controlled trials

CRD summary
This well-conducted and well-reported systematic review concluded that there is little evidence to support the use of hip protectors in reducing hip fractures outside the nursing home setting, and the potential benefit to populations residing in nursing homes requires confirmation. This conclusion is supported by the evidence presented.

Authors' objectives
To determine the efficacy of hip protectors in the prevention of hip fractures in community-dwelling and institutionalised elderly patients.

Searching
MEDLINE (from 1966), the Cochrane Database of Systematic Reviews, ACP Journal Club Online (from 1991), DARE, EMBASE (from 1980), CINAHL (from 1982) and AgeLine (from 1978) were searched up to September 2004 without language restrictions; the search terms were reported. References of included studies and identified Cochrane Systematic Reviews were checked, and experts in the field were contacted.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) and statistically adjusted cluster RCTs with a mean or median follow-up of at least 6 months were eligible for inclusion. Cluster-randomised trials with no appropriate statistical consideration of the effects of clustering were excluded from the review. Trial duration ranged from 12 to 18 months. A methodological panel was assembled to formulate criteria for the exclusion of studies of low quality; consensus was required for all decisions. Studies in which patients who dropped out or died were replaced with other participants were excluded.

Specific interventions included in the review
Studies of hip protectors were eligible for inclusion. Most studies evaluated the Safehip brand of protector. Some studies also used educational cointerventions or other measures to promote adherence. No studies used sham hip protectors. Compliance with hip protectors ranged from 31 to 70%, although the definition of compliance varied. Control groups were not specified.

Participants included in the review
Studies of ambulatory adults with a mean age of 50 years or older were eligible for inclusion. Studies of protective sports equipment were excluded. The participants resided in community or institutional dwellings (nursing homes, residential homes or seniors' hostels). The mean age of the participants was 80 years; some studies included females only, while others included males and females. Rates of previous hip fracture ranged from 10 to 100% in studies of community-dwelling residents, and from 22 to 36% in studies of institutionalised residents.

Outcomes assessed in the review
Studies had to report the occurrence of hip fracture (or proximal femoral fracture) confirmed by clinical diagnosis and radiological findings to be eligible for inclusion. Mortality and rates of skin ulcers were also reported.

How were decisions on the relevance of primary studies made?
Two independent reviewers assessed the eligibility of the studies.

Assessment of study quality
A methodological committee was assembled to formulate quality criteria. Studies were assessed on the basis of method of randomisation, use of sham hip protectors and use of intention-to-treat analysis. Two independent reviewers assessed the methodological quality of the included studies.

**Data extraction**

Two independent reviewers extracted data from the included studies. Any discrepancies were resolved by consensus. Data were extracted on the occurrence of hip fractures, to calculate a risk difference (RD) and relative risk (RR) with 95% confidence intervals (CIs). In the event of missing data, either data were abstracted from a Cochrane Systematic Review (see Other Publications of Related Interest) or the study authors were contacted.

**Methods of synthesis**

How were the studies combined?
The studies were grouped by residential status (institutionalised versus community-dwelling) and method of randomisation (individual versus cluster) and combined using a random-effects meta-analysis. Analyses of cluster-randomised trials were adjusted for clustering effect, and combined with the individual randomised trials using a modified fixed-effect meta-analysis.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the chi-squared test (threshold of p<0.1). A post hoc subgroup analysis was performed on studies conducted in residential nursing homes only.

**Results of the review**

Seven RCTs (n=6,884) were included. Six were individually randomised and one was a cluster-randomised trial.

Methodological quality.

Five studies used centralised methods of randomisation, no studies used a sham control, and all studies allowed for intention-to-treat analysis. Losses to follow-up ranged from 2 to 69%.

Community-dwelling elderly (4 RCTs, n=5,696).

No statistically significant difference in the occurrence of one or more hip fractures was shown between hip protectors and control; the RD was 0% (95% CI: -1, 1, p=0.37) and the RR was 1.07 (95% CI: 0.81, 1.42, p=0.55). There was no evidence of statistical heterogeneity (p=0.61 and p=0.55, respectively).

Institutionalised elderly (2 RCTs, n=248; 1 cluster RCT, n=942).

In the 2 individual RCTs, no statistically significant difference in the occurrence of one or more hip fractures was shown between hip protectors and control; the RD was -7% (95% CI: -24, 11, p=0.45) and the RR was 0.49 (95% CI: 0.06, 3.97, p=0.51). There was evidence of statistical heterogeneity (p=0.03 and p=0.06, respectively).

In the cluster-randomised trial, no statistically significant difference in the occurrence of one or more hip fractures was shown between hip protectors and control; the RD was -3.5% (95% CI: -7.3, 3.0, p=0.072).

When combining the individually- and cluster-randomised trials (n=1,425), no statistically significant difference in the occurrence of one or more hip fractures was shown between hip protectors and control; the RD was -3.7% (95% CI: -7.3, 0.1) and the RR was 0.56 (95% CI: 0.31, 1.01).

The subgroup analysis of nursing home residents showed that hip protectors were associated with a statistically significant decrease in the risk of hip fractures compared with control; the RD was -4.4% (95% CI: -8.09, -0.76) and the RR was 0.50 (95% CI: 0.28, 0.91), based on 1,014 participants in 2 studies.

No studies evaluated health-related quality of life.
Authors’ conclusions
There was little evidence to support the use of hip protectors outside the nursing home setting. Further research is needed to confirm the potential benefit of hip protectors for residents of nursing homes.

CRD commentary
The review addressed a clear research question and the inclusion criteria were well defined. Several sources were searched for relevant studies, and attempts made to limit language and publication bias. Methods were used to minimise reviewer error and bias in the study selection, data extraction and validity assessment processes. Methodological quality was assessed and used as part of the inclusion criteria. This ensured that only studies of high methodological rigour were included in the review. Adequate details were presented on the included studies, and the methods used in the analysis appear appropriate. Differences between the studies were investigated and potential reasons for variation between the studies were investigated when found. In summary, this was a well-conducted and well-reported systematic review and the cautious conclusions can be considered reliable.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that further research is needed to confirm the effectiveness of hip protectors in reducing the risk of hip fracture in elderly nursing home residents. To address this, the authors proposed the following: appropriately designed and analysed trials in residents of nursing homes; secondary research on existing trial data using individual patient data analysis, with statistical adjustment for clustering when appropriate and the use of intra-cluster correlation coefficients; the use of hierarchical modelling incorporating Bayesian methodology. Further research is also required to assess the effects of hip protectors on patients’ quality of life and the effects of educational cointerventions to improve adherence and acceptance.

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Other publications of related interest

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.