Lifestyle interventions to prevent osteoporotic fractures: a systematic review

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CRD summary
This well-conducted review assessed the effectiveness of lifestyle interventions in preventing osteoporotic fracture in individuals at risk of osteoporosis. The authors concluded that multifactorial interventions may reduce the incidence of hip fractures when delivered by residential care staff or health visitors, but further research is required. This cautious conclusion is likely to be reliable.

Authors' objectives
To assess the clinical effectiveness of lifestyle interventions in the prevention of osteoporotic fractures in high-risk individuals.

Searching
MEDLINE, EMBASE, the Cochrane Library (Issue 3, 2003) and Current Controlled Trials were searched from 2000 to the present. In addition, the references of identified studies and systematic reviews were checked, and trials registers of several relevant organisations and conference databases of ISI proceedings were searched. No language restrictions were employed.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs), with at least 8 weeks' follow-up and an intention-to-treat analysis, were eligible for inclusion. Trials with parallel, crossover, factorial and cluster randomisation designs were all eligible for inclusion.

Specific interventions included in the review
Studies of active lifestyle interventions designed to reduce the risk of osteoporotic fracture compared with placebo, sham therapy, usual care or no treatment, were eligible for inclusion. Studies were excluded if they evaluated various forms of calcium, vitamin D or nitroglycerin treatment, primarily evaluated interventions such as hip protectors for the prevention of fracture following a fall, or permitted variation in the regimen of the osteoporotic medication during the trial period. The included studies assessed exercise, multifactorial interventions (including environmental modifications, exercise programmes and review of medical conditions, medication and aids) and exposure to sunlight. The comparison groups in the included studies were no intervention, standard care and sham therapy. The duration of the interventions ranged from 11 weeks to 4 years.

Participants included in the review
Studies of people at risk for osteoporosis in primary or secondary care, including healthy elderly people and postmenopausal women, were eligible for inclusion. Studies of participants who were not at risk of osteoporosis were excluded. The included studies enrolled elderly participants and postmenopausal women. The proportion of participants with previous fractures varied widely between studies (ranging, where reported, from 0 to 100%).

Outcomes assessed in the review
Studies that reported a fracture end point were eligible for inclusion. Studies that only reported high trauma fractures were excluded. The primary outcomes were fracture at any site, spinal fracture, hip fracture and wrist fracture. A secondary outcome was withdrawal from treatment, which was a surrogate outcome for tolerability of treatment. The duration of follow-up in the included studies ranged from 34 weeks to 10 years.

How were decisions on the relevance of primary studies made?
Two reviewers independently assessed the studies for relevance. Any differences were resolved by discussion or by referral to a third reviewer.
Assessment of study quality
Two reviewers independently assessed study validity using the following criteria: blinding of the outcome assessors, randomisation, allocation concealment and loss to follow-up.

Data extraction
Two reviewers independently extracted the data. Any differences were resolved by discussion or by referral to a third reviewer. Rates of fractures and withdrawals from treatment were extracted from each study and relative risks (RRs) with 95% confidence intervals (CIs) were calculated for fractures at each site. The authors of the primary studies were contacted for additional data.

Methods of synthesis
How were the studies combined?
Where appropriate, the studies were combined in meta-analyses using a random-effects model, according to intervention and outcome assessed. An accompanying narrative synthesis was also provided.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the I-squared statistic. Differences between the studies were further discussed in the narrative synthesis.

Results of the review
Six RCTs with over 1,656 participants were included in the review.

Study quality was not high. None of the studies reported allocation concealment, only two reported blinding of the outcome assessor, and only three reported withdrawals from treatment. Losses to follow-up, where reported, ranged from 2 to 41%.

Exercise.
Three studies (involving at least 322 postmenopausal women) were identified. There was no significant difference between the intervention and control groups in the incidence of spinal fracture (3 studies; RR 0.52, 95% CI: 0.17, 1.60); statistically significant heterogeneity was detected (I-squared 57%). One trial (n=92) reported no significant difference between the exercise and control group for wrist fractures (RR 1.78, 95% CI: 0.39, 0.86) or fractures at any site (RR 0.91, 95% CI: 0.34, 2.50).

Multifactorial interventions.
Two studies (1,076 patients aged over 65 years, 36% male, living in residential care homes or own home) were identified. Two trials reported hip fractures. Interventions were associated with a non statistically significant reduction in hip fractures compared with control (RR 0.37, 95% CI: 0.13, 1.03, p=0.06); no statistically significant heterogeneity was detected (I-squared 0%). One trial (n=674) reported fractures at any site. There was no significant difference between the groups (RR 1.00, 95% CI: 0.50, 2.00).

Exposure to sunlight.
One study (258 chronically hospitalised disabled stroke patients aged over 65 years, 40% male) was identified. There was no significant difference between the groups in the incidence of hip fractures (RR 0.17, 95% CI: 0.02, 1.35).

Withdrawal from treatment.
The majority of studies either did not report withdrawals or reported no withdrawals. The exception was the trial of exposure to sunlight in which there was no difference between the groups in the number of withdrawals (8% in both groups).
Authors' conclusions
Multifactorial interventions may reduce the risk of hip fractures when delivered by residential care staff and health visitors. It was unclear whether exercise interventions and exposure to sunlight reduce the risk of osteoporotic fractures; further research is required.

CRD commentary
The review question and the inclusion criteria were extremely clear. The search was extensive and the authors made appropriate attempts to reduce the likelihood of publication and language bias, which can result in the exclusion of relevant studies. The authors used appropriate methods to minimise reviewer bias and error in the study selection, validity assessment and data extraction processes. The validity assessment used appropriate criteria and the results of this assessment were reported. The decision to employ limited meta-analysis seemed appropriate for some homogeneous meta-analyses. Overall, this was a well-conducted review. The authors' cautious conclusions are an accurate reflection of the results of the review and are likely to be reliable.

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

Research: The authors recommended that larger, longer and better quality RCTs of lifestyle interventions be undertaken. These should evaluate osteoporotic fractures at any site, as well as the key sites of spine, hip and wrist, and also evaluate withdrawals from treatment. The authors further recommended that the benefits of lifestyle changes for people currently receiving pharmacological treatment be considered.

Funding
National Institute for Clinical Excellence, on behalf of the National Collaborating Centre for Nursing and Supportive Care.

Bibliographic details

PubMedID
15928799

DOI
10.1007/s00198-005-1942-0

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Exercise; Female; Fractures, Bone /etiology /prevention & control; Humans; Life Style; Male; Middle Aged; Osteoporosis /complications /prevention & control; Randomized Controlled Trials as Topic; Sunlight

AccessionNumber
12006003598

Date bibliographic record published
31/07/2007

Date abstract record published
31/07/2007
Record Status
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.