Physical activity, falls, and fractures among older adults: a review of the epidemiologic evidence
Gregg E W, Pereira M A, Caspersen C J

Authors' objectives
To assess the relationship between physical activity and the risk of falls and osteoporotic fractures among older adults.

Searching
MEDLINE and Current Contents were searched from 1975 to 1998 using the terms 'physical activity', 'exercise', 'falls' and 'fractures' as subject terms and keywords. The reference lists of retrieved articles were examined for further studies.

Study selection
Study designs of evaluations included in the review
The authors did not specify any inclusion or exclusion criteria relating to study design. Both observational studies and controlled trials were included in the review.

Specific interventions included in the review
The authors included studies that attempted to measure physical activity or exercise that was performed as part of leisure and occupation, but not those evaluating a person's ability or their estimated fitness for carrying out a physical activity. For intervention studies of physical activity and falls, only those in which physical activity was a primary component of the intervention were included.

Physical activities included in the review were: walking activity; house and yard activity; weight-bearing activity; lifetime physical activity; recreational activity; job activity over 20 years; teenage physical activity; heavy outdoor work or exercise; recent walking or cycling; activity at age 50 for the hip, spine and wrist; and household labour.

Participants included in the review
The authors stated that they excluded studies of physical activities and fall-related injuries in young and middle-aged adults. However, though the majority of studies included only elderly participants, one study included participants as young as 35 years of age.

Outcomes assessed in the review
Falls and osteoporotic fractures were the outcomes of interest. Studies were considered to evaluate osteoporotic fractures if they evaluated hip, wrist or vertebral fractures.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
No formal assessment of quality was undertaken.

Data extraction
The authors do not state how many of the reviewers performed the data extraction.

For all studies, the relative risks and odds ratios were presented, with the sedentary or least active individuals serving as reference groups. For case-control studies, data were extracted on fracture site, population (size, nationality, age range), physical activity measure, odds ratios with 95% confidence intervals, and control for confounding.
Methods of synthesis
How were the studies combined?
The results of all the studies were combined in a narrative summary. Forest plots of relative risks and 95% confidence intervals were plotted for the RCTs of physical activity interventions and falls, and for the prospective population-based studies of physical activity and osteoporotic fracture. The characteristics of case-control studies evaluating the association between physical activity and risk of osteoporotic fracture were tabulated.

How were differences between studies investigated?
The included studies were grouped by study design and outcome measure (falls or fractures). There was a narrative discussion of the differences between the studies in each section.

Results of the review
The authors did not state the overall number of studies that were included in the review, although 47 articles appear to have been included. There were 12 randomised controlled trials (RCTs) of exercise programmes to reduce falls; 5 prospective observational studies evaluating the association of usual physical activity with the risk of falling; 9 ‘prospective’ studies and 17 case-control studies evaluating the association between physical activity and fracture; and 8 ‘other’ studies examining the association of physical activity with other fracture sites commonly attributed to osteoporosis.

Physical activity and risk of fall.
The results from prospective, observational studies evaluating the association of usual physical activity with risk of falling were equivocal, although they may suggest a U-shaped association, in which the most inactive and active persons may be at highest risk. However, these inconsistent findings may be partially explained by differences in how physical activity was defined and measured. These observational studies also had several methodological limitations in terms of subjective measurement of physical activity and inadequate controlling for confounders.

The results from 12 RCTs of the use of exercise programmes to reduce falls were also mixed. Five of these studies were evaluated as part of a review by the Cochrane Collaboration on the use of various interventions to prevent falls in older people (see Other Publications of Related Interest). The authors concluded that exercise interventions alone were not effective in reducing the risk for falls among older adults. This review included 6 additional studies not included in the Cochrane review; of these, 4 found exercise training to be beneficial with regards to the risk of falls, whilst 2 found no benefit.

Physical activity and risk of hip fracture.
Most case-control studies of physical activity and hip fracture have shown that women with hip fractures are more likely to report being inactive in the recent past, and at earlier times in their lives, than the controls. The reductions in the odds of fracture among women engaging in moderate physical activity, compared with controls, typically ranged from 20 to 60%. However, analyses conducted among men, although reporting similar trends, tended to be underpowered. In addition, all of the studies were vulnerable to the potential biases inherent in the case-control design.

At least 8 prospective studies evaluated the association between physical activity and hip fracture risk, of which 6 found significant risk reductions among either men or women. There was variation between these studies in terms of the type of physical exercise and the overall relative risk of hip fracture. Nevertheless, the consistency, magnitude of effect, and diversity of populations across these prospective studies suggested that a physically active lifestyle can help reduce the incidence of hip fractures in the population.

Other osteoporotic fracture sites.
Few epidemiologic studies have examined the association of physical activity with other fracture sites commonly attributed to osteoporosis. One prospective study showed that among women, but not men, high levels of physical
activity were related to a significant 50% increased risk of non-weight-bearing fracture sites; these included the wrist, proximal humerus, hand and finger. One case-control study conducted among European residents found that women who walked at least 30 minutes a day significantly reduced their odds of vertebral fracture by 20%; there were no significant findings among men. Another prospective study found that women who engaged in high-intensity activities, such as tennis and aerobics, were 33% less likely to have a vertebral fracture than those who did not. There were no overall significant findings for the remaining studies of these fracture sites.

Authors' conclusions
Epidemiologic studies suggest that higher levels of physical activity during leisure time can prevent hip fractures. In addition, RCTs suggest certain exercise programmes may reduce the risk of falls.

CRD commentary
This was a poorly described review, and whilst it was adequately conducted, it contained certain flaws. The authors reported searching two databases and gave search terms and dates. However, they did not report any additional methods used to obtain relevant papers, e.g. scanning reference lists, handsearching and contacting experts.

The inclusion and exclusion decisions were based on criteria relating to the interventions, outcomes and participants, but not study design. No formal quality assessment was undertaken, although potential biases of those study designs included were discussed in the text. It was unclear how many reviewers were involved at any stage of the review. In addition, the overall number of included studies was not given, and there was little information provided on the RCTs and prospective studies. There were several sources of heterogeneity among the included studies, perhaps due to the broad inclusion criteria; some of these sources were discussed in the narrative summary.

The authors' conclusions appear to follow from the evidence presented.

Implications of the review for practice and research
Practice: The authors state that there is strong evidence from observational studies that a physically active lifestyle reduces the risk of hip fracture, and that older adults should be encouraged to maintain a lifestyle with regular activity.

Research: The authors state that future research needs to evaluate the types and quantity of physical activity needed for optimal protection from falls, and to identify which populations will most benefit from exercise.

Bibliographic details

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10968291

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Accidental Falls /prevention & control /statistics & numerical data; Activities of Daily Living; Aged; Aged, 80 and over; Case-Control Studies; Confounding Factors (Epidemiology); Exercise; Female; Fractures, Bone /epidemiology /etiology; Humans; Incidence; Leisure Activities; Male; Middle Aged; Osteoporosis /complications; Prospective
Studies; Randomized Controlled Trials as Topic; Risk Factors

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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.