Supplemental calcium for the prevention of hip fracture: potential health-economic benefits

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Supplemental calcium for the prevention of hip fracture.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Male and female American adults of differing ages and ethnic backgrounds.

Setting
Community. The study was carried out in New Jersey, USA.

Dates to which data relate
Effectiveness and resource use data were collected from studies published between 1992 and 1998. Cost data were derived from 1994 and 1998 sources. The price year was 1995.

Source of effectiveness data
Effectiveness data were derived from 3 clinical trials, the National Health and Nutrition Examination Survey, 1988-1994, the 1995 National Hospital Discharge Survey from the National Center for Health Statistics, Centers for Disease Control and Prevention, and the US Bureau of the Census.

Modelling
No modelling was undertaken.

Outcomes assessed in the review
The review assessed the following outcomes: the relative risk of hip fractures and all non-vertebral fractures, the uptake of calcium supplements, the prevalence of calcium-associated risk (PCAR), the preventable fraction, the number of patients discharged from hospital, the length of stay, and the discharge destinations.

Study designs and other criteria for inclusion in the review
Estimates were derived from three double-blinded, placebo-controlled, clinical trials and other published sources. Studies were included if they were published in English and reported the direct relationship between supplemenation
with calcium with or without vitamin D and the observed risk of hip fracture. Studies which reported only the association between calcium supplementation and bone mineral density (BMD) were excluded.

Sources searched to identify primary studies
A MEDLINE search was conducted. Additionally, the authors searched the references in each of the three intervention trials as well as those in the literature review in the report from the National Academy of Sciences.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Individual data were included.

Number of primary studies included
3 clinical trials and 3 other sources were included.

Methods of combining primary studies
Meta-analysis. The authors calculated Mantel-Haenszel combined relative-risk estimates.

Investigation of differences between primary studies
Not stated.

Results of the review
The combined relative-risk estimate was 0.53 (95% CI: 0.31 - 0.9) for hip fractures and 0.62 (95% CI: 0.47 - 0.82) for all non-vertebral fractures.

Approximately 2% of adults aged over 50 years had taken some form of calcium supplement during the previous month. This led to a PCAR of nearly 98% and a preventable fraction of 0.46 for all older Americans.

The number of patients aged over 50 years discharged from hospital was 290,327 for hip fractures and 553,689 for all non-vertebral fractures.

The mean length of stay for hip fracture patients was 8.4 days.

About half of the women aged over 65 years were sent to a long-term care facility, whereas nearly 57% of women aged over 85 years were sent to a long-term care facility.

75% of patients aged 50 to 64 years were discharged to their homes.

Measure of benefits used in the economic analysis
The number of preventable hospital discharges was used as the primary measure of benefits. Potential cost savings, i.e. the difference between preventable total expenditure and the cost of calcium, was used as the secondary measure of benefits.

Direct costs
It was not clear whether or not direct costs were discounted. However, quantities and costs were reported separately.
Direct costs included costs of in-hospital and post-hospital care and the costs of calcium supplementation. The quantity/cost boundary adopted was that of the health service and other agencies. The estimation of quantities and costs was based on actual data. 1990 itemised costs of hip fracture, as estimated by the US Congress Office of Technology Assessment, were inflated to 1995 dollars using the medical care component of the Consumer Price Index. The cost of supplements was based on the 1998 unit price. The price year was 1995.

**Statistical analysis of costs**
Not reported.

**Indirect Costs**
Not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
Not reported.

**Estimated benefits used in the economic analysis**
The number of preventable hospital discharges was 84,168 among women aged over 75 years and 40,847 among women aged over 85 years.

The preventable total expenditures amounted to $1,662 million among women aged over 75 years and $815 million among women aged over 85 years.

For a trial duration of 34 months, 208,430 non-vertebral fractures could have been avoided in adults aged over 50 years.

**Cost results**
The cost of calcium for 2.83 years amounted to $1,185 million among women aged over 75 years and $328 million among women aged over 85 years.

The cost of avoiding a hip fracture was $33,118 for the entire US population aged over 65 years, $14,075 for women aged over 75 years, and $8,037 for women aged over 85 years.

**Synthesis of costs and benefits**
The net benefit of calcium supplementation amounted to $50.62 among women aged over 75 years and $186.20 among women aged over 85 years.

The trends were similar for white women aged over 75 years.

For a trial duration of 14 months, the intervention became cost-effective for all adults aged over 65 years in the USA with a net per capita benefit of $11.08.

**Authors' conclusions**
The data support encouraging older adults to increase their intake of dietary calcium and to consider taking a daily calcium supplement. Even small increases in the usage rate of supplementation are predicted to yield significant savings and to reduce the morbidity and mortality associated with hip fracture at an advanced age.
CRD COMMENTARY - Selection of comparators

The rationale for the choice of the comparator was clear. You, as a user of this database, should verify whether this health technology is relevant to your own setting.

Validity of estimate of measure of benefit

Relevant measures of benefit were used. Effectiveness data were mostly derived from only three studies. Although these studies were of sufficient size and duration, they were carried out in different geographic areas and the data from each trial was subject to a fair degree of heterogeneity. The authors acknowledged, for example, the wide variation in estimates of calcium supplement use, and measurement and design errors in the source studies. The authors were not able to assess to what extent women at risk of osteoporosis take estrogen or bisphosphonate. These factors would clearly have an impact on the reliability of the results.

Validity of estimate of costs

Only direct costs were included. Indirect costs, such as productivity lost or costs falling to patients, were not considered. It is difficult to assess the robustness of the cost results as no sensitivity analysis was carried out. The data used for itemised cost estimates did not include prescriptions or assistive devices and total direct costs may have been underestimated; a point raised by the authors themselves. Cost estimates were derived from American sources, whereas effectiveness estimates related to three different countries.

Other issues

Although this study focused on the potential of calcium supplementation to reduce the risk of hip fractures, there is a similar potential for reduction in the risk of all non-vertebral fractures. However, it is difficult to estimate total costs for non-vertebral fractures. Adequate comparisons with other relevant studies were made and the generalisability of the results to other settings was discussed. The authors do not appear to have presented their results selectively and, in addition, pointed out the caveats associated with their findings. The study enrolled elderly American adults and this was reflected in the authors’ conclusions.

Implications of the study

The potential of calcium supplementation to reduce the risk of all non-vertebral fractures needs to be examined in more detail.

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