Cost and effectiveness of hip protectors among the elderly
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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
The use of hip protectors for the prevention of hip fractures in the elderly.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis; Cost-utility analysis.

Study population
The study population comprised two hypothetical cohorts of 500,000 men and women, aged 65 years and over.

Setting
The setting was the community and secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness evidence was obtained from studies published between 1990 and 2000. The resource use data were obtained from studies published between 1989 and 1997. The price year was 1999.

Source of effectiveness data
The sources of the effectiveness data were a review of completed studies and a survey of expert opinion. In addition, the authors made assumptions about the effectiveness.

Modelling
A deterministic state-transitional model was developed to follow the two hypothetical cohorts through to death. The authors stated that they followed the recommendations of the US Department of Health and Human Services Panel of Cost-Effectiveness in Health and Medicine (see Other Publications of Related Interest).

Outcomes assessed in the review
The outcomes assessed in the review were:

- the incidence of hip fracture;
- the relative risk of mortality from hip fracture;
- hip protector efficacy;
hip protector use (compliance);
the quality of life prefracture; and
the loss in quality of life associated with wearing a hip protector.
All the outcomes were assessed separately for men and women.

Study designs and other criteria for inclusion in the review
The rates of hip fracture incidence were derived from survey data. The relative risk of hip fracture when wearing a hip protector was derived from the two largest randomised studies available. The other inclusion and exclusion criteria were not reported.

Sources searched to identify primary studies
Not reported.

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

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
The effectiveness data were obtained from eleven studies.

Methods of combining primary studies
The primary studies were combined in the narrative.

Investigation of differences between primary studies
Not reported.

Results of the review
The incidence of hip fracture per 100,000 ranged from 501.10 to 3,958.30 in women, and from 168 to 2,256.2 in men, and depended on the person’s age.

The relative risk of mortality from hip fracture ranged from 1.6 to 3.3 in women, and from 3.1 to 4.2 in men, and depended on the person's age.

Hip protector efficacy was 56%.

The loss in quality of life due to hip fracture was 0.14 for women and men.

The prefracture quality of life ranged from 0.80 to 0.83 for women, and from 0.82 to 0.84 for men, and depended on the person's age.

Methods used to derive estimates of effectiveness
The authors made some assumptions. In addition, they surveyed a convenience sample of gerontologists and elderly
individuals using visual analogue scales, in order to estimate the quality of life associated with wearing hip protectors.

**Estimates of effectiveness and key assumptions**

Hip protector use (compliance) was 1.

The loss in quality of life due to wearing a hip protector was 0.005 for women and 0.01 for men.

**Measure of benefits used in the economic analysis**

The outcome measures used in the economic analysis were the number of hip fracture-related deaths avoided and the number of quality-adjusted life-years (QALYs) gained. The baseline (prefracture) quality of life estimates were gender and age-specific values derived from the US population. The loss in quality of life due to hip fracture was derived from the Functional Capacity Index, which is an injury preference-based measure that predicts long-term functional limitations associated with a health condition. The loss in quality of life due to using hip protectors was elicited from a convenience sample of gerontologists and elderly individuals using a visual analogue scale.

**Direct costs**

The resource quantities and the unit costs were generally not reported separately. The exception was the number of hip protectors used, which was assumed to be one per year. A societal perspective was adopted, with productivity losses assumed to be part of the quality of life estimates. The direct costs included in the analysis were for hip protectors, and the mortality and morbidity associated with hip fractures, such as hospitalisation, emergency visits and rehabilitation. The direct cost data were obtained from published studies. The lifetime costs were extrapolated from the model. Discounting was conducted at a rate of 3%, which was appropriate. The price year was 1999. The costs were adjusted for inflation using the Consumer Price Index.

**Statistical analysis of costs**

No statistical analysis of costs was reported.

**Indirect Costs**

The indirect costs were not included.

**Currency**

US dollars ($).

**Sensitivity analysis**

Extensive one-way, multi-way and multivariate sensitivity analyses, as well as best- and worst-case scenarios and a threshold analysis, were conducted on the principal input parameters in the model. The source of the ranges explored was given. Most of the effectiveness parameters used 95% confidence intervals as the ranges in the sensitivity analysis. There were three exceptions:

- hip protector efficacy (43 - 69%), which was justified by reference to the literature;
- compliance (0.1 - 0.9), which came from assumptions; and
- the loss in quality of life due to hip fracture or hip protector use (+/-30%).

The ranges for the costs were generally varied by +/-30%. The exceptions were frequency of replacement, which was assumed to be 2 or 3, and the cost of nonfatal fractures, which was derived from the literature. The authors stated that "only the variables which change substantially" were reported.
Estimated benefits used in the economic analysis
The total incremental effectiveness in lives (i.e. the number of hip fracture-related deaths avoided) was 5,906 for women and 5,962 for men. The number of QALYs gained was 32,000 for women and -26,000 for men, where the negative number indicates that the inconvenience of wearing hip protectors exceeds the benefits in mortality and morbidity. The duration of benefits was lifetime or up to 100 years of age. The discount rate was 3%.

Cost results
The total incremental cost in millions was -$1,215 for women and -$135 for men, indicating cost-savings for both men and women. The duration of the intervention was lifetime or up to 100 years of age. The discount rate was 3%.

Synthesis of costs and benefits
The costs and the benefits were combined using incremental cost-effectiveness ratios. In all the age groups of women considered, net savings and QALY gains occurred, such that the hip protector intervention dominated. For men aged 65 to 74 years, the intervention was dominated (positive costs and QALY losses occurred). The result was $39,000 dollars saved per QALY lost for men aged 75 to 84 years, and $16,000 spent per QALY gained for men aged 85 years and older.

The results of several analyses, including threshold analyses, were presented.

Authors’ conclusions
The use of hip protectors among women was associated with large cost-savings and gains in quality-adjusted life-years (QALY), even when accounting for the inconvenience of using the protectors. Among men, hip protectors were also associated with cost-savings, albeit of a smaller magnitude, but there were net losses of QALYs due to the inconvenience associated with the protectors.

CRD COMMENTARY - Selection of comparators
The selection of the comparator would be justified if no intervention represented current practice for the primary prevention of hip fractures. You should decide if this is a widely used health technology in your own setting.

Validity of estimate of measure of effectiveness
The validity of the measure of effectiveness is likely to be increased by the authors’ use of up-to-date evidence from the literature, to obtain the input parameters for the model. Moreover, the input parameters were clearly and comprehensively reported in the study. However, the authors did not state that a systematic review of the literature had been undertaken. They did not discuss the methodology used to select the studies for inclusion. Also, whilst the authors made assumptions about some estimates, other were derived by a survey, the methodology of which was not reported.

Validity of estimate of measure of benefit
The benefit was derived from the model. Unfortunately, although the authors stated that a particular standard was followed, no details were provided and no reference to the method was given.

Validity of estimate of costs
In general, the costing was well reported and comprehensive. All categories of direct cost seem to have been included. In addition, within each category of cost, all the relevant costs appear to have been included in the analysis. However, the perspective was incorrectly stated as societal since no indirect costs were included. The price year was reported, discounting was conducted, and the prices were adjusted for inflation. Comprehensive sensitivity analyses were carried out to account for the uncertainty in the data, although not all the results were available. The costing could, however, have been improved by reporting the quantities separately from the costs. Also, by reporting more information on the elements entering the costs of fatal and nonfatal hip fractures.
Other issues
The issue of generalisability was addressed through extensive sensitivity analyses. Comparisons could not be made with similar studies, as this was the first study of hip protectors. The authors acknowledged that they presented their results selectively, although this is difficult to avoid with a sensitivity analysis. However, they could have provided access to a full report. The authors reported some limitations to their study. Firstly, the uncertainty surrounding some of the data, which was then accounted for in the sensitivity analyses. Secondly, the availability of data in 10- or 15-year intervals, thus limiting the calculations of benefits and costs to the same age intervals. Finally, the authors assumed that life expectancy after a nonfatal hip fracture equals life expectancy for an age- and gender-matched individual who has not suffered a hip fracture. This means that the benefits may be carried over too long a period and the findings may be overly optimistic, although discounting future benefits will account for this to some extent.

Implications of the study
The authors recommend hip protectors for the prevention of hip fractures for women over 65 years and men over 85 years.

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Other publications of related interest

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