Perimenopausal bone density screening: will it help prevent osteoporosis?

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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
Bone mineral density (BMD) screening by measurement at femoral neck and lumbar spine using energy X-ray absorptiometry (DXA) and in the distal radial trabecular bone using peripheral quantitative computed tomography (pqTC). Selective hormone replacement therapy (HRT) using Prempac C 0.625 mg daily (if uterus intact) and Premarin alone (if hysterectomy) in the prevention of osteoporotic fractures.

Type of intervention
Screening; primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Hypothetical cohort of 100,000 British women aged 45 years.

Setting
Hospital outpatient clinic. The economic study was undertaken in the United Kingdom.

Dates to which data relate
The effectiveness data were obtained from studies published in 1991 and 1995. Resource use data were partly based on information from a study published in 1995. Treatment costs (HRT) refer to 1993 price levels.

Source of effectiveness data
The effectiveness data were based on published studies.

Modelling
A life table model was used to evaluate the expected outcomes for a hypothetical cohort of 100,000 women from an initial age of 45 years until the age of 110 years.

Outcomes assessed in the review
Age specific rates of osteoporotic hip, Colles' and vertebral fractures. Efficacy of 10 years completed HRT in preventing osteoporotic fractures.

Study designs and other criteria for inclusion in the review
Not stated.
Sources searched to identify primary studies
Not stated.

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

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

Number of primary studies included
Each parameter estimate was based on a single study.

Methods of combining primary studies
Not applicable.

Investigation of differences between primary studies
Not applicable.

Results of the review
A typical cohort of 100,000 45 year old British women would be expected to sustain 11,171 hip fractures, 12,245 vertebral fractures, and 14,026 Colles' fractures in their residual lifetime. Compliant HRT users experience a 50% reduction in all future fracture rates.

Methods used to derive estimates of effectiveness
Authors’ opinion.

Estimates of effectiveness and key assumptions
Non-compliants, who would stop HRT at one year, were assumed to derive no benefit from such incomplete therapy. 72% of the target population were assumed to attend HRT counselling. Increments in fracture risk selected were 2.0, 2.5 and 3.0 per standard deviation decrease in bone mass for fractures of forearm, hip, and vertebra, respectively. A stepwise reduction in relative risk from 2.5 to 1.5 was assumed for femoral neck (but not intertrochanteric) fractures for age bands 45-64, 65-84, and aged over 84.

Measure of benefits used in the economic analysis
The measure of benefits in the economic analysis was the number of fractures averted. No valuation of health states was undertaken.

Direct costs
Direct costs included cost of screening and drug cost (HRT). Treatment costs of fractures averted were considered as savings from the HRT. Costs were estimated from the health services (NHS) point of view. Cost estimates were based on earlier published studies, and resource use was not reported separately. HRT treatment costs were calculated using NHS prices for 1993, but the overall price date was not stated. Future costs were discounted by 6%. Total costs were calculated for a hypothetical cohort of 100,000 women.
Currency
UK pounds Sterling (£).

Sensitivity analysis
Changes in sensitivity and specificity were analysed by using different thresholds (cut-off points) for bone mass density (25th, 50th and 75th percentile) and varying the site of measurement (spine, hip, forearm, or combination of any two or all three sites). The effect of improving the rate of compliance (from an initially assumed 10% to 30% and further to 50%) on cost effectiveness was analysed. The effect of a change in unit cost of HRT was also studied, but not reported.

Estimated benefits used in the economic analysis
Assuming 50% compliance, for example, universal treatment with HRT was estimated to prevent 6,740 fractures, and selective HRT given to those falling below the 75th percentile of BMD at femoral neck would prevent 5,860 fractures over the residual lifetime of the cohort. In this case the universal treatment would prevent an extra 880 fractures. A more complete presentation of benefits was provided in the form of a diagram. The health effects were not discounted. Possible side-effects from the hormone therapy were not considered in the analysis.

Cost results
The total costs of the selective treatment strategy (50% compliance, <75th percentile of BMD in femoral neck) were estimated to be £6,590,000, while the universal treatment with HRT was estimated to cost £8,100,000. Costs were discounted by 6%. The cost from the drug therapy (HRT) occurred over the 10 year period for compliant subjects, whereas non-compliant subjects were assumed to abandon the therapy after 1 year (on average). Fracture costs occurred over the remaining life expectancy of the cohort. The costs of the adverse effects of drug therapy were not included in the estimated costs.

Synthesis of costs and benefits
With the lowest compliance rate (10%) the universal HRT strategy had the lowest average cost-effectiveness ratio. Given better compliance or higher costs of HRT (by 10%) this would not have been the case. Numerical data for these analyses were not presented in the paper: a numerical example was given only for an extreme case. Assuming 50% compliance (the high estimate) average cost effectiveness was estimated to be £1,130 per fracture prevented for the selective strategy (BMD <75th percentile in femoral neck) and £1,200 per fracture prevented for the universal treatment strategy (price year not given). The incremental cost effectiveness of the universal strategy was £1,710 per additional fracture prevented. Costs were discounted by 6%, but health benefits were not discounted.

Authors’ conclusions
If BMD measurement does not influence compliance, then universal treatment with HRT is likely to prevent more fractures, at a similar or lower average cost per fracture averted, than selective therapy. However, if BMD screening leads to increased compliance, or if more expensive forms of treatment were used, then the model suggests a favourable impact of screening on the numbers and/or net cost of fractures prevented.

CRD COMMENTARY - Selection of comparators
No justification was given for the comparators used.

Validity of estimate of measure of benefit
The model parameters were mostly based on single previously published studies. No systematic, objective method was used to locate source studies. Some estimates seemed to be based on assumptions made by authors. The authors stated that the assumed efficacy (50%) of HRT in preventing all fractures may appear over optimistic, but, despite this uncertainty in one of the key parameters in the model, it was not subjected to a sensitivity analysis.
Validity of estimate of costs
Resource quantities were not reported separately from the costs. Estimation of BMD measurement and fracture treatment costs were based on earlier studies, but it was not made clear what methodology was used in the estimation or to which price year they related.

Other issues
The authors’ conclusions appear to be cautious. However, the justification for the conclusions could not be thoroughly assessed due to the non-systematic presentation of the effectiveness and cost data. The conclusions were based on average cost-effectiveness ratios rather than incremental analysis, which would have been more appropriate. The only numerical example of cost-effectiveness provided in the paper was a special case favouring the selective treatment strategy. The cost estimates were based on NHS prices and hence may not be generalisable outside the UK. No comparison with other cost-effectiveness studies in fracture prevention was made. It should also be noted that in the cost-effectiveness analysis costs were discounted by 6% while health effects were not discounted, thus effectively preventing comparison with other studies.

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