Half the burden of fragility fractures in the community occur in women without osteoporosis: when is fracture prevention cost-effective?


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 anti-resorptive drug therapy to reduce the fracture rate among postmenopausal women at high risk of fracture only (i.e. women with osteoporosis), or the additional treatment of those postmenopausal women at low risk (i.e. women without osteoporosis). Several strategies were considered for women with osteoporosis, either treatment without previous screening for osteoporosis or treatment after screening. Screening was performed by measuring bone mineral density (BMD). Two alternative frequencies for BMD screening among women with osteoporosis were considered: every 2 years and every 5 years.

Type of intervention
Primary prevention and screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised women over 50 years of age in Australia.

Setting
The setting might have been primary and/or secondary care. The economic study was carried out in Australia.

Dates to which data relate
The effectiveness data were gathered from a study conducted between February 1994 and February 1996. Projections on resource use were made on the estimated population of Australia in 2000. The costs were inflated to year 2000 Australian dollars.

Source of effectiveness data
The data were derived from an earlier study (Sanders et al 1998, see 'Other Publications of Related Interest' below for bibliographic details).

Link between effectiveness and cost data
The retrospective costing appears to have been carried out on the same study sample as that used in the effectiveness analysis (Henry et al. 2000).

Study sample
Power calculations were not reported. The intervention group consisted of women aged 50 years or older with incident
fractures recorded during the study period. After the exclusion of pathological fractures, 1,224 women older than 50 were identified with incident fractures. Those with lack of BMD measurement (n=358), those that died (n=142) during the ascertainment period, those unable to give consent (n= 95), or could not be contacted (n=61) or had fractures as the result of motor vehicle accidents (n=60), were excluded. The remaining 587 women formed the intervention group. The controls comprised 817 women aged 50 years or older who were randomly selected from the electoral roll after age stratification. The participation rate was 77% in the control group and 48% in the intervention group. According to the authors, the population from which the study sample was drawn was typical of Australia in terms of age, gender and socioeconomic levels.

Study design
This was a case-control study that was carried out in multiple centres (including two radiological practices and one hospital), and was based on the incidence fracture records of the centres considered in the study. No blinding prior to BMD measurement was reported. The women appear to have been followed up during the whole study period (i.e. 2 years).

Analysis of effectiveness
The analysis of the clinical study was based on data from women with available BMD estimates. The outcomes reported were the incidence of osteoporosis, the incidence of prevalent fracture in the last 10 years, and the incidence of osteoporosis plus prevalent fracture in the last 10 years in the intervention versus control groups. The results were reported overall and by age group. Osteoporosis was defined as a BMD T score of less than or equal to -2.5 standard deviations (SDs) at the lumbar spine and/or femoral neck.

Effectiveness results
The incidence of osteoporosis was:

56% in the intervention group (i.e. 20% among those aged 50 to 59, 46% among those aged 60 to 69, 59% among those aged 70 to 79, and 69% among those 80 or older); and

23% in the control group (i.e. 6% among those aged 50 to 59, 22% among those aged 60 to 69, 36% among those aged 70 to 79, and 51% among those aged 80 or older).

The incidence of prevalent fractures in the last 10 years was:

27% in the intervention group (i.e. 20% among those aged 50 to 59, 25% among those aged 60 to 69, 26% among those aged 70 to 79, and 31% among those aged 80 or older); and

16% in the control group (i.e. 11% among those aged 50 to 59, 15% among those aged 60 to 69, 19% among those aged 70 to 79, and 24% among those aged 80 or older).

The incidence of osteoporosis plus prevalent fracture was:

17% in the intervention group (i.e. 8% among those aged 50 to 59, 12% among those aged 60 to 69, 18% among those aged 70 to 79, and 22% among those aged 80 or older); and

6% in the control group (i.e. 1% among those aged 50 to 59, 7% among those aged 60 to 69, 9% among those aged 70 to 79, and 17% among those aged 80 or older). The prevalence of osteoporosis among postmenopausal women without fractures was around half of that for those with fractures.

Methods used to derive estimates of effectiveness
Several assumptions were formulated in order to derive the effectiveness of anti-resorptive drug therapy in reducing fractures.
Estimates of effectiveness and key assumptions
The authors assumed that the immediate reduction in fracture rate among women with a BMD T score below -2.5 would vary between 30 and 50% with therapy. The authors also assumed that fracture rates would be reduced by 20% in women without osteoporosis.

Measure of benefits used in the economic analysis
The measure of benefit used was the number of fractures averted. In addition, the numbers-needed-to-treat (NNTs) to avert a fracture by age group for the groups of patients with osteoporosis, with prevalent fracture in the last 10 years, and with osteoporosis and prevalent fractures in the last 10 years were reported. The number of fractures averted by treatment was calculated by applying the assumed effectiveness of the anti-resorptive treatment to the number of postmenopausal women in Australia with osteoporosis (the latter being estimated by extrapolating age-stratified osteoporosis prevalence to the randomly selected sample used in the clinical analysis). The NNT per averted fracture was calculated by dividing the number of women with osteoporosis in the population for each age group by the number of averted fractures.

Direct costs
The direct costs considered in the economic analysis appear to have been those of the health service. These included the daily cost of drug therapy, visits to the consultant physician and follow-up visits for prescription renewal. In addition, for those alternatives that included BMD screening, screening-related costs were also included. The quantities and the costs were not analysed separately. The resource use data appear to have been collected from the clinical study, although the sources of the unit cost data were not reported. The quantities were estimated from population statistics. The price year was not specified but the costs were inflated to 2000 Australian dollars using the annual Consumer Price Indices. Discounting was not carried out, although it was not relevant as the costs estimated were annual costs.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included.

Currency
Australian dollars (AUD). The 2000 average exchange rate was AUD 1 = UK 0.38 = EUR 0.63 = US$0.58.

Sensitivity analysis
One-way sensitivity testing, in which drug efficacy was varied from 30 to 50%, was performed. Sensitivity testing on the costs was also performed, under the assumption that BMD screening of the population was conducted at 2 and 5 yearly intervals. The method used to select the ranges for sensitivity testing was not specified.

Estimated benefits used in the economic analysis
From a total of 50,000 potential fractures in Australia, 13,800 (27%) would be averted by treating high-risk postmenopausal women (i.e. those with osteoporosis) while 18,000 would be averted if all postmenopausal women were treated.

For the group of women with osteoporosis, the NNT was 91 for 50- to 59-year-olds, 76 for 60- to 69-year-olds, 48 for 70- to 79-year-olds, and 28 for women aged 80 years or older.

For the group of women with prevalent fractures in the last 10 years, the NNT was 155 for 50- to 59-year-olds, 95 for 60- to 69-year-olds, 57 for 70- to 79-year-olds, and 31 for women aged 80 years or older.
For the group of women with prevalent fractures and osteoporosis, the NNT was 34 for 50- to 59-year-olds, 82 for 60- to 69-year-olds, 39 for 70- to 79-year-olds, and 30 for women aged 80 years or older.

Cost results
The total cost of treating all women aged over 50 years was estimated to be AUD 2,000 million annually.

If treatment were confined to the high-risk group (i.e. women with osteoporosis), the annual cost would be AUD 459 million. Further costs related to the identification of women with osteoporosis were AUD 114 if the screening programme was conducted every 2 years and AUD 46 million if it was conducted every 5 years.

Synthesis of costs and benefits
Cost-effectiveness ratios were estimated as the cost of treatment per averted fracture.

The cost of treatment for averting one fracture was AUD 111,000 if all women were treated. The cost ranged from AUD 20,400 for the age group 80 years or older to AUD 66,600 for the age group 50 to 59 years.

The treatment of women in the 50 to 59 year group with osteoporosis alone cost AUD 125,200 per averted fracture for a population-based screening programme every 2 years, and AUD 90,100 for a screening interval of 5 years.

In women older than 80 years, the cost per averted fracture was AUD 22,700 if screening was performed every 2 years and AUD 21,300 if screening was performed every 5 years.

When the efficacy was assumed to be 30%, the highest costs per averted fracture were observed in the group aged between 50 and 59 years. The cost per averted fracture was AUD 111,000 if all women were treated, versus AUD 208,700 if only women with osteoporosis were treated at screening intervals of 2 years, and AUD 150,100 if screening was conducted every 5 years.

Under this assumption of 30% efficacy, the lowest costs per averted fracture were observed among women aged 80 years or older. The cost per averted fracture was AUD 34,100 if all postmenopausal women were treated, versus AUD 37,900 if only women with osteoporosis were treated at screening intervals of 2 years, and AUD 35,600 if screening was conducted every 5 years.

Authors' conclusions
The authors concluded that treatment focused on the group of women aged 70 years or older was cost-effective, independently of the criteria followed for treatment, given that this group carried most of the burden of fractures.

CRD COMMENTARY - Selection of comparators
The authors did not explicitly state any of the alternatives as being standard practice in their setting. The specific drug and doses to be administered were not reported in the paper. You should decide if any of the different alternatives tested represent current practice in your own setting.

Validity of estimate of measure of effectiveness
A case-control study was used. This is a valid method to study conditions with a low incidence rate. However, the authors did not apply any statistical tool to test the significance of differences between the case and control groups. The effectiveness of treatment or screening was based on authors' assumptions, which introduced considerable uncertainty into the clinical results. The authors appear to have justified these assumptions by reference to the medical literature, although it is possible that the available literature was used selectively. A sensitivity analysis was conducted. This tested different values for the assumptions formulated. The authors acknowledged the limitations of their study arising from non-recruitment bias which may have shown a lower prevalence of osteoporosis than that existing in clinical practice.
Validity of estimate of measure of benefit
The measure of benefit in terms of fractures averted was dependent largely on the relative efficacy of the anti-resorptive medication in those with and without osteoporosis, which in this study was derived from authors' assumptions (see 'Validity of estimate of measure of effectiveness' above). The NNT per averted fracture is a valid measure of benefit. The methods used to measure the NNTs appear to have been appropriate, although they were also dependent on authors' assumptions. The use of a more generic measure of benefit, such as quality-adjusted life-years, would have allowed comparability across different health care interventions. There was no justification given for not using this measure of health benefit.

Validity of estimate of costs
The perspective adopted in the study was not explicitly reported, but it appears to have been that of the Australian health care system. It is difficult to identify whether all the relevant costs were included. The unit costs and the resource quantities were not reported separately, which would hinder reflation exercises in other settings. Since annual costs were reported, discounting was appropriately not performed. The sources of the cost estimates were unclear, and the costs were not subject to sensitivity analysis. These limitations will make it difficult to replicate the study in different settings and also make it hard to assess the validity of the study findings.

Other issues
The authors made appropriate comparisons of their findings with those from others studies, but the issue of generalisability to other settings was not addressed.

Implications of the study
Although they made no recommendations for further research, the authors suggested that general population-based measures, such as exercise and dietary modification, may shift the risk for fractures in the whole population and this has yet to be tested.

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Other publications of related interest

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MeSH
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