Therapies for treatment of osteoporosis in US women: cost-effectiveness and budget impact considerations
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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.

CRD summary
This study examined the cost-effectiveness of various bisphosphonate treatments versus no intervention or parathyroid hormone for post-menopausal women with osteoporosis, who were at various levels of risk of fractures, based on age and history of previous vertebral fracture. The authors concluded that osteoporosis treatment with bisphosphonates was cost-effective, especially with risedronate in high-risk women. The methodology was valid, but some sources of data were only partially described. In general, the authors’ conclusions appear to be valid.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The objective was to examine the cost-effectiveness of various bisphosphonate treatments versus no intervention or parathyroid hormone, for post-menopausal women with osteoporosis, at various levels of risk of fractures, based on age and history of previous vertebral fracture. A budget impact analysis using US population statistics was also undertaken.

Interventions
The following treatments were compared: three bisphosphonates, which were risedronate, alendronate, and ibandronate; parathyroid hormone; and no treatment. Bisphosphonate treatment was administered for three years, while parathyroid hormone was given for 18 months.

Location/setting
USA/primary and secondary care.

Methods
Analytical approach:
The analysis was based on a Markov model with a 10-year time horizon. The authors stated that the perspective of the health care system was adopted.

Effectiveness data:
The clinical evidence came from a selection of known, relevant studies including randomised controlled trials (RCTs), observational studies, and epidemiological databases. These were augmented with expert opinion on treatment duration, offset, and discontinuation rates. Drug efficacy was taken from RCTs, but no head-to-head comparisons were found. Hip fracture incidence rates came from the Nationwide Inpatient Sample 2001 hospital discharge database and mortality rates for hip fractures came from Medicare claims. The key clinical inputs were the data on treatment efficacy.

Monetary benefit and utility valuations:
The utility valuations were derived from published studies, the details and methods of which were not reported.

Measure of benefit:
Quality-adjusted life-years (QALYs) and hip fractures were the summary benefit measures and a 3% annual discount rate was applied.
Cost data:
The economic analysis included the costs of drugs and those costs incurred in the year after a hip or vertebral fracture, which consisted of hospitalisations (acute in-patient stay and rehabilitation), physician visits, emergency department visits, home health care, disability care, non-medical home care, out-patient care, nursing home stay, and other long-term costs. These were derived from official price lists and published sources, but the details of these were not given. All costs were in US dollars ($) and the price year was 2005. Future costs were discounted at an annual rate of 3%.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the model inputs, time horizon, therapy efficacy and offset (the percentage of maximum effect after cessation of therapy), utility valuations, fracture costs, and therapy discontinuation. Alternative ranges of values were either based on published evidence or determined arbitrarily by the authors. A probabilistic sensitivity analysis was performed using triangular distributions for the efficacy variables.

Results
In women with low bone mineral density, who were aged 65 years and had a previous vertebral fracture (the base case), the expected costs per patient were $8,696 with no therapy, $10,136 with risedronate, $10,548 with alendronate, $11,879 with ibandronate, and $20,800 with parathyroid hormone. The QALYs per patient were 6.580 with no therapy, 6.646 with risedronate, 6.647 with alendronate, 6.624 with ibandronate, and 6.608 with parathyroid hormone. The vertebral fractures per 1,000 patients were 413 with no therapy, 341 with risedronate, 331 with alendronate, 327 with ibandronate, and 364 with parathyroid hormone. The hip fractures per 1,000 patients were 137 with no therapy, 105 with risedronate, 110 with alendronate, 137 with ibandronate, and 137 with parathyroid hormone.

In the incremental cost-effectiveness analysis, alendronate, ibandronate, and parathyroid hormone were dominated (less effective and more costly than the comparator) and the incremental cost per hip fracture avoided over no therapy for risedronate was $45,865. In the cost-utility analysis, ibandronate and parathyroid hormone were dominated and the incremental cost per QALY gained was $22,068 with risedronate over no therapy, and $362,845 with alendronate over risedronate.

Similar results were found for other age and risk groups (age 65 or 75 years and with or without previous fracture). Risedronate was dominant compared with the other interventions and the cost-effectiveness of risedronate compared with no therapy ranged from dominant to $66,722 per QALY.

The sensitivity analysis showed that the time horizon was an influential model input, although both ibandronate and parathyroid hormone were dominated in all scenarios. The probabilistic analysis, on changes in efficacy parameters, showed that risedronate dominated alendronate in almost 44% of simulations when using QALYs. Risedronate was dominant over both ibandronate and parathyroid hormone in 100% of simulations when using hip fractures averted as the summary benefit measure.

The budget impact analysis indicated that treating the 5.7 million women, who were not receiving active therapy, with bisphosphonates would cost an additional $5,563 million (21% increase in total costs) and would result in an additional 83,159 QALYs (0.45% increase) and 390,049 fewer fractures (35% decrease).

Authors' conclusions
The authors concluded that osteoporosis treatment with bisphosphonates was cost-effective, especially with risedronate in high-risk women.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear in that all of them were available treatments for osteoporotic women. The authors stated that possible concomitant calcium or vitamin D treatments were not considered.

Effectiveness/benefits:
It appears that a selective approach was used to identify the most relevant sources of evidence. Epidemiological data
were from national databases, which should be valid given the large number of patients involved, but administrative data may not always be suitable for modelling studies. The efficacy data were from RCTs, which are widely used for these estimates; the authors stated that, as no head-to-head trials were identified, those with similar populations were selected. Given the uncertainty around these parameters, extensive sensitivity analysis was conducted on the efficacy data. Few details of the other sources of evidence were provided. Both generic and disease-specific measures were used, each of which has an advantage for clinicians and decision-makers. QALYs capture the global impact of the interventions on the patients’ health.

Costs:
The categories of costs were consistent with the economic perspective, but few details on their sources, the types of costs, unit costs, and quantities of resources used were reported, which reduces the transparency of the economic analysis. Other characteristics of the analysis such as the price year, discounting, and use of alternative estimates were reported.

Analysis and results:
The analytic approach used to synthesise the costs and benefits was appropriate as an incremental analysis was conducted. The issue of uncertainty was appropriately investigated using different approaches. The results were clearly reported and discussed and the authors compared their findings with those from other studies highlighting the potential differences in methods and patient populations. In general, other published studies drew similar conclusions.

Concluding remarks:
The methodology was valid, but some sources of data were only partially described. In general, the authors’ conclusions appear to be valid.

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