Comparison of accuracy and cost effectiveness of clinical criteria and BUA for referral for BMD assessment by DXA in osteoporotic and osteopenic perimenopausal subjects

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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 broadband ultrasound attenuation (BUA) for referral of osteoporotic and osteopenic perimenopausal women, for bone mineral density assessment by dual-energy X-ray absorptiometry (DXA).

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population consisted of osteoporotic and osteopenic perimenopausal women aged 50 to 54 years, fulfilling at least one clinical criterion.

Setting
The study setting was hospital and community. The economic study was carried out in the United Kingdom.

Dates to which data relate
The effectiveness, resource use, and cost data were collected in 1993. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was conducted prospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
There were no baseline characteristics provided to enable comparison with the population. Power calculations were not reported.

Study design
The study was a diagnostic test accuracy evaluation. Patients were followed-up until referral.
Analysis of effectiveness
The primary health outcome used was accuracy, i.e. the sum of the number of true positives and true negatives, divided by the total number. For BUA, a positive was defined as being above or below a threshold level which varied with the ultrasound intensity. DXA was used as the 'gold' standard to indicate osteoporosis or osteopenia, according to World Health Organisation criteria.

Effectiveness results
For osteoporotic women alone, CC(1 - 6) provided an accuracy of 30.7%, increasing to 64.3% when CC(1) was excluded.

For osteoporotic and osteopenic women combined, the accuracy for CC(1-6) was 60.3%, decreasing to 55.7% when CC(1) was excluded.

The accuracy of BUA for osteoporosis alone was 72.8% at a threshold level of 75 dB/MHz, and for osteoporosis and osteopenia, 63.8% at a threshold of 82 dB/MHz.

BUA identified a higher proportion of osteoporotic women than CC: the difference was 0.42 (95% confidence interval, CI: 0.37 - 0.47) and 0.09 (95% CI: 0.03 - 0.14) against CC (1 - 6) and (2 - 6), respectively.

BUA also identified a slightly higher proportion of osteoporotic and osteopenic women: the difference was 0.04 (95% CI: -0.02 - +0.09) and 0.08 (95% CI: 0.02 - 0.14) against CC (1 - 6) and (2 - 6), respectively.

Clinical conclusions
BUA provided a superior means of DXA referral, in terms of accuracy, than that achieved with CC. Their accuracy, however, was far similar when osteopenic women were also considered.

Measure of benefits used in the economic analysis
The measure of benefit was the number of true positives.

Direct costs
The DXA and ultrasound costs incorporated system depreciation over 5 years. The direct costs related to DXA, ultrasound and transportation. The cost of ultrasound was £4.85 per patient, based on 4 patients measured per hour over a 6.5-hour day. The cost data were derived from the local health authority. The price year was not reported.

Statistical analysis of costs
The authors provided estimates of total costs.

Indirect Costs
The indirect costs were not included.

Currency
UK pounds sterling (€).

Sensitivity analysis
Sensitivity analysis was conducted on the relative cost of DXA and BUA measurements.
Estimated benefits used in the economic analysis
The number of true positives found in osteoporotic and osteopenic women (n = 310, prevalence = 51.8%) was 265 for CC (1 - 6) and 129 for CC (2 - 6). In osteoporotic women (n = 47, prevalence = 7.8%), it was 45 and 23 for CC (1 - 6) and (2 - 6), respectively. No results were given for BUA.

Cost results
The cost for a DXA scan at hip and spine was 45. No other results were given.

Synthesis of costs and benefits
The cost per correctly identified osteoporotic patient was 573.50 by DXA alone, 325 by BUA, 458 by CC(1 - 6), and 416 by CC(2 - 6). When osteopenic women were incorporated, the costs were 87, 83.50, 78 and 74, respectively. For the identification of either osteoporotic or osteopenic women from the general population by DXA, the prevalence-compensated cost (cost per true positive, multiplied by prevalence) was 45, irrespective of age cohort. For the identification of osteoporotic women, BUA became cost-effective if the cost of DXA was four or more times higher than the cost of BUA measurement. For the identification of either osteoporotic or osteopenic women, BUA was never more cost-effective than CC.

Authors' conclusions
BUA provides a valuable population pre-screen for the identification of osteoporotic women, but is of less value for osteopenic women. If both osteoporotic and osteopenic women are to be identified for clinical management incorporating DXA, then neither BUA nor clinical criteria are satisfactory referral methods.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used, namely current referral methods. You, as a user of the database, should decide if these health technologies are relevant to your setting.

Validity of estimate of measure of effectiveness
The analysis was based on a diagnostic test accuracy evaluation, which was appropriate for the study question. It is unclear whether the study sample was representative of the study population, since baseline characteristics were not reported.

Validity of estimate of measure of benefit
The benefits were estimated from the effectiveness analysis. Whilst the number of true positives was important, its weight in comparison to true negatives was not compared, for example by effect of delayed treatment versus inappropriate treatment on quality of life.

Validity of estimate of costs
The cost of DXA was given, but those for BUA and clinical diagnosis were not; also the price year was not reported. The cost estimates were derived from one local health authority, thus limiting the generalisability of the cost results. The most important problem was the lack of incremental analysis, i.e. the change in cost by changing benefit, in this case any extra cases detected. A higher average (cost per case detected) can mean either higher cases detected and possibly higher costs (but less in proportion to benefit increase), or lower benefit (cases detected), if the costs are proportionately lower again. Also, using "prevalence"-adjusted costs is potentially misleading in that, for a test, the relevant measure is the rate of positives (as well as negatives) correctly detected. Therefore, if prevalence is the same in the population as in the test (as was presumed here), the cost should be given per true positive per individual tested, rather than as cost per true positive per prevalence rate. In fact, prevalence might well be different and therefore affect cost-effectiveness.
Other issues
The authors made appropriate comparisons of their findings with those from other studies, and addressed the issue of generalisability to other settings. The authors did not present their results selectively. The study considered osteoporotic and osteopenic perimenopausal women aged 50 to 54 years, and this was reflected in the authors’ conclusions.

Implications of the study
The authors state that BUA provides a valuable population pre-screen for the identification of osteoporotic women, although less so for osteopenic women. If both osteoporotic and osteopenic women are to be identified for clinical management incorporating DXA, then neither BUA nor clinical criteria are satisfactory referral methods. A question not addressed by this study was whether ultrasound has an independent role in the assessment of fracture risk for perimenopausal women who do not have the benefit of referral for DXA.

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