Cost effectiveness analysis of BMD referral for DXA using ultrasound as a selective pre-screen in a group of women with low trauma Colles' fractures

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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 quantitative ultrasound (QUS) for the measurement of bone mineral density in women with low trauma Colles' fractures. The intervention aimed to detect the presence of osteoporosis.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised women attending an Accident and Emergency Department with low trauma Colles' fractures. This patient group represented a potential target for osteoporosis treatment.

Setting
The setting was an emergency department. The economic study was carried out at the Accident and Emergency Department of the Cardiff Royal Infirmary, Cardiff, UK.

Dates to which data relate
The effectiveness evidence and resource use data were gathered from July 1996 and September 1997. No price year was reported.

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

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

Study sample
Power calculations to determine the sample size were not performed. A sample of 100 consecutive women attending the study hospital during the period July 1996 to September 1997 was identified. The women were aged between 50 and 80 years (mean age: 69). All were offered osteoporosis screening, but only 46 accepted and were used in the analysis.
**Study design**
This was a screening test evaluation study, which was carried out in a single centre. All of the patients underwent assessment by QUS and then DXA. The patients were not followed after the assessment.

**Analysis of effectiveness**
All of the patients included in the study were accounted for in the analysis. The primary health outcome assessed in the effectiveness analysis was the number of osteoporotic women identified. The QUS test positive was defined according to Langton et al. (see Other Publications of Related Interest), as a BUA of below 60 dB/MHz. The test positive for DXA, the ‘gold’ standard, was defined as a WHO T-score of below -2.5 at either spine or total hip. A graph of the sensitivity and specificity of QUS at various thresholds of BUA, ranging from 20 to 100 dB/MHz, was also shown.

**Effectiveness results**
The number of osteoporotic women identified with DXA after BUA assessment was 27. Of these, 25 had a BUA of less than 60 dB/MHz and 2 had a BUA above 60 dB/MHz.

**Clinical conclusions**
The authors concluded that the threshold of 60 dB/MHz was appropriate for the detection of patients with osteoporosis, only after including the cost data. (see ‘Author’s Conclusions’ section).

**Measure of benefits used in the economic analysis**
The benefit measure used in the economic analysis was the number of osteoporotic women identified with the screening strategy. This was derived directly from the effectiveness analysis.

**Direct costs**
No discounting was carried out due to the short time horizon of the study. The economic analysis included only the costs of the screening (DXA and QUS). The cost/resource boundary adopted was that of the hospital. The unit costs were given. The costs were estimated using actual data, which was derived from the study hospital. The costs of the tests were also estimated from a published study. No price year was reported.

**Statistical analysis of costs**
No statistical analysis of the costs was carried out.

**Indirect Costs**
The indirect costs were not included.

**Currency**
UK pounds sterling (€).

**Sensitivity analysis**
A sensitivity analysis was conducted using a cost of 4.85 for QUS instead of 15.00.

**Estimated benefits used in the economic analysis**
As already reported, the number of osteoporotic women identified with DXA after BUA assessment was 27. Of these, 25 had a BUA of less than 60 dB/MHz and 2 had a BUA above 60.
Cost results
The cost of the test was 15 for QUS and 45 for DXA.

Synthesis of costs and benefits
The cost per osteoporotic women identified with QUS was the sum of the total cost of performing ultrasound on all patients and the cost of performing DXA on those with a BUA below the specific threshold, divided by the number of osteoporotic patients identified. This cost was calculated to be 78. On the basis of DXA measurement alone, the cost per osteoporotic patient was the cost of performing DXA for all patients divided by the number of osteoporotic patients identified. This was calculated to be 77. When the cost of QUS was lower than that estimated by the authors, such as that reported in the literature (4.85), the cost per identified patient was 59.

Authors' conclusions
The quantitative ultrasound (QUS) assessment did not prove to be a cost-effective strategy as a pre-screen for dual-energy X-ray absorptiometry (DXA) at the costs estimated at the authors’ institution. The intervention could only have been cost-effective at lower costs, as proposed in the literature.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. DXA was selected as it represented the 'gold' standard for the screening of osteoporosis. You should assess whether it represents a widely used screening intervention in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness analysis was based on a diagnostic test evaluation, which was carried out in a single centre. However, the study was not designed to assess the cost-effectiveness of BUA followed by DXA, only if test positive, versus DXA alone. This is because it was clear from the outset that QUS would lack accuracy. Therefore, any cost-savings resulting from the use of QUS to avoid unnecessary DXA would need to balance the possibility of missing cases and potential harm with the harm of DXA. The only data available here were the cost and number of cases detected. Therefore, any cost-savings would only arise as a result of some of the women testing QUS negative being osteoporotic and missing treatment. All patients underwent both interventions, and thus the same sample of patients was used for both interventions, thereby controlling for selection bias. Power calculations and statistical analyses were not performed. Only 46 of the 100 eligible patients participated in the study. There was no comparison of the women enrolled and those who refused to participate.

Validity of estimate of measure of benefit
The benefit measure was derived from the effectiveness analysis. It was chosen to measure the main outcome of the intervention, that is the ability to detect the presence of disease. However, as already stated, there was no measure of the consequences of missing osteoporotic cases.

Validity of estimate of costs
It appears that the analysis of the costs was carried out from the perspective of the hospital, and only the costs of the interventions were included. Again, there was a lack of accounting for the consequences of not treating osteoporotic cases missed by QUS. The unit costs were given. However, statistical analyses of the costs were not carried out. The price year was not given, thus hindering any reflation exercise to other settings. The costs were somewhat specific to the study setting.

Other issues
The authors made few comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was not addressed, and sensitivity analyses were not carried out. Consequently, the
external validity of the analysis was quite low. A sample of women with low trauma Colles' fractures was enrolled, as this patient population represented a potential target for osteoporosis treatment, which the authors pointed out. This was reflected in the conclusions of the study. Finally, the authors noted that the conclusions of the study appear sensitive to small variations in the cost of the tests.

**Implications of the study**
The authors highlighted that the QUS approach had no advantage over a DXA-based strategy for all women at risk for osteoporosis. This was not only because the cost per identified osteoporotic patient was higher, but also because, even at a lower cost, "QUS is less useful in monitoring response to therapy, such patients may still require DXA for monitoring therapy response, and this would compromise this potential saving". Generally, as already highlighted, the study was not designed to assess the cost-effectiveness of QUS.

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**Other publications of related interest**

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