Cost-effectiveness of the diagnostic evaluation of vertigo

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
Using various diagnostic tests in the diagnostic evaluation of patients with vertigo of unknown origin (after history and physical examination). The diagnostic strategies considered were audiometric testing, dynamic platform posturography, electronystagmography (ENG), magnetic resonance imaging (MRI) scan of the head, and blood tests.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
Patients (over 18 years of age) with a diagnosis of vertigo of unknown origin (after history and physical examination).

Setting
Academic tertiary referral practice. The economic study was conducted in Houston, Texas, USA.

Dates to which data relate
Effectiveness data were derived from a sample of patients examined between 1 January 1994 and 31 December 1994. The date of resource use data was not reported. The price year was not explicitly specified.

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

Link between effectiveness and cost data
Costing was not performed on the same patient sample as that used in the effectiveness analysis and was conducted retrospectively.

Study sample
Power calculations were not used to determine the sample size. The study sample consisted of 171 patients whose charts were reviewed. A total of 192 charts were initially selected from a sample of 300. A total of 21 patients (11%) were excluded from the study.

Study design
This was a retrospective cohort study, carried out in a single centre. The duration of the follow-up corresponded to the
time required for the diagnostic tests to be performed. No loss to follow-up was reported. A panel of experts consisting of two neurologists and a general otolaryngologist were used to rate the hypothetical utility (usefulness) of various test outcomes.

**Analysis of effectiveness**
The principle used in the analysis of effectiveness (intention to treat or treatment completers only) was not explicitly specified. The clinical outcome measures used were the utility (measured based on two theoretical states of "perfectly useful" and "perfectly useless" test results) and probabilities of normal audiogram, hearing loss on audiogram, positive glycerol test, normal ENG result, abnormal ENG result with non-localising findings, localising findings on ENG, normal/non-localising posturography, posturography showing peripheral deficit, posturography showing malingering, normal MRI scan, abnormal MRI scan when no lesion identified, lesion identified on MRI, normal blood tests, abnormal blood tests, and positive FTA-ABS (fluorescent treponemal antibody-absorption test) blood test.

**Effectiveness results**
The baseline values used as input parameters for the model are shown below.

- **Normal audiogram**: utility, 0.15 (range: 0.05 - 0.40); probability, 0.461 (range: 0.20 - 0.80).
- **Hearing loss on audiogram**: utility, 0.30 (range: 0.10 - 0.50); probability, 0.503 (range: 0.20 - 0.80).
- **Positive glycerol test**: utility, 1.0 (range: 0.70 - 1.0); probability, 0.036 (range: 0.01 - 0.20).
- **Normal ENG result**: utility, 0.45 (range: 0.20 - 0.75); probability, 0.25 (range: 0.05 - 0.50).
- **Abnormal ENG result with non-localising findings**: utility, 0.65 (range: 0.40 - 0.90); probability, 0.481 (range: 0.30 - 0.70).
- **Localising findings on ENG**: utility, 0.75 (range: 0.50 - 1.0); probability, 0.269 (range: 0.20 - 0.50).
- **Normal/non-localising posturography**: utility, 0.25 (range: 0.10 - 0.50); probability, 0.645 (range: 0.30 - 0.80).
- **Posturography showing peripheral deficit**: utility, 0.50 (range: 0.25 - 0.80); probability, 0.342 (range: 0.20 - 0.70).
- **Posturography showing malingering**: utility, 0.8 (range: 0.50 - 1.0); probability, 0.013 (range: 0.01 - 0.10).
- **Normal MRI scan**: utility, 0.45 (range: 0.20 - 0.80); probability, 0.741 (range: 0.50 - 0.85).
- **Abnormal MRI scan when no lesion identified**: utility, 0.45 (range: 0.20 - 0.80); probability, 0.222 (range: 0.10 - 0.40).
- **Lesion identified on MRI**: utility, 1.0 (range: 0.80 - 1.0); probability, 0.037 (range: 0.03 - 0.20).
- **Normal blood tests**: utility, 0.05 (range: 0.05 - 0.40); probability, 0.80 (range: 0.70 - 0.95).
- **Abnormal blood tests**: utility, 0.30 (range: 0.10 - 0.60); probability, 0.18 (range: 0.05 - 0.20); and
- **Positive fluorescent treponemal antibody-absorption test (FTA-ABS) blood test**: utility, 0.40 (range: 0.20 - 0.80); probability, 0.02 (range: 0.01 - 0.10).

**Clinical conclusions**
Because clinicians "value" diagnostic tests differently, they assigned different utilities to the same test outcomes. In every case, however, the utility values were fairly close for a given test outcome and there were no large discrepancies between clinicians' utility ratings.
Modelling
A decision analytic model in DATA (TreeAge Software) was used to estimate the expected costs and effects associated with each diagnostic strategy.

Measure of benefits used in the economic analysis
The measure of benefits was the usefulness (utility) of the diagnostic tests in the process of managing the patients. Utility was measured by the three clinicians using values between 0 and 1 for the test outcomes based on theoretical states of "perfectly useful" and "perfectly useless" test results.

Direct costs
Costs were not required to be discounted since the time frame of the study was limited to the time needed for the diagnostic tests to be performed and interpreted. Resource use data were not reported separately from the costs. Cost items were reported separately. The cost analysis covered the cost of testing and professional interpretation of each test. The perspective adopted in the cost analysis was that of a third-party payer. Cost data were not based on actual costs data, but on average charges (instead of true costs). The date of the price data was not explicitly specified.

Indirect Costs
Not considered.

Currency
US dollars ($).

Sensitivity analysis
A set of one-way sensitivity analyses was conducted on almost all parameters of the model to identify the sensitive factors affecting the ratings of the diagnostic strategies according to the cost-effectiveness ratio. The threshold values were identified for the sensitive parameters.

Estimated benefits used in the economic analysis
The reader is referred to the utility values reported in the Effectiveness Results section above.

Cost results
The average costs were as follows: audiogram, $150 (range: $75 - 300); ENG, $600 (range: $200 - 1000); posturography test, $300 (range: $150 - 600); MRI, $1500 (range: $800 - 2000); and blood tests, $250 (range: $150 - 600).

Synthesis of costs and benefits
The expected value of cost/utility was considered as the measure of cost-effectiveness.

The values for audiogram were $1,000 for normal audiogram, $500 for hearing loss on audiogram, and $150 for positive glycerol test.

The values for the posturography test were $1,200 for normal/non-localising posturography, $600 for posturography showing peripheral deficit, and $375 for posturography showing malingering, respectively.

The ENG test had cost-effectiveness ratios of $1,333 for normal ENG, $923 for abnormal ENG with non-localising findings, and $800 for localising findings on ENG.
The corresponding values for MRI scan were $3,333 for normal MRI scan, $3,333 for abnormal MRI scan when no lesion identified, and $1,500 for lesion identified on MRI.

The strategy of using blood tests produced cost-effectiveness ratios of $5,000 for normal blood tests, $833 for abnormal blood tests, and $625 for positive FTA-ABS.

The sensitivity analyses demonstrated that the cost of an audiogram, the cost of an ENG, the cost of posturography, and the utility of hearing loss on an audiogram were the sensitive parameters of the model with threshold values of $224, $367, $201, and 0.14, respectively. A further analysis was performed to find the optimal sequence of the diagnostic tests among the three most cost-effective tests (audiogram, ENG, and posturography in descending order in terms of cost-effectiveness). The result of this analysis showed that the best sequence was audiogram followed by posturography (if required) followed by ENG (if required). The optimal sequence was sensitive to the cost of an audiogram, the cost of posturography, and the utility of normal audiogram, which had threshold values of $333, $172, and 0.38, respectively.

**Authors' conclusions**
The use of cost-effectiveness analysis, the estimation of the utility of test outcomes, and techniques of sensitivity analysis should help to guide the clinician's decision making on appropriate testing for patients with vertigo.

**CRD COMMENTARY - Selection of comparators**
No single diagnostic test was specifically regarded as the comparator.

**Validity of estimate of measure of benefit**
The internal validity of the benefit results will have limitations given the retrospective nature of the study design. The method of deriving utility scores for the outcomes of test results is a deviation from standard methodology in economic evaluations and is based on the subjective utility of the clinicians. However, it is novel and may be helpful in a diagnostic area which employs a variety of tests and approaches.

**Validity of estimate of costs**
Quantities were not reported separately from the costs. Adequate details of methods of cost estimation were not given. The retrospective nature of the cost analysis could have adversely affected its internal validity.

**Other issues**
The authors' conclusion seems to be justified given the uncertainties explored in the extensive sensitivity analyses. Regarding the issue of generalisability, the authors acknowledged that caution should be exercised before generalising the results to a larger population of patients with vertigo. Appropriate comparisons were not made with other studies.

**Implications of the study**
The authors acknowledged that the data from this analysis do not permit the development of policy, practice guidelines or clinical pathways. The findings and methods offered in the present study, rather, should be used to stimulate further analyses for this study population.

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