Cost-effectiveness of a novel molecular test for cytologically indeterminate thyroid nodules

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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 assessed the cost-effectiveness of a novel molecular test to diagnose cytologically indeterminate thyroid nodules for surgery. The authors concluded that the new molecular test was cost saving and more beneficial than the usual analysis of cytology alone. The methods were valid and transparent, and the results were clearly reported. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study assessed the cost-effectiveness of a novel molecular test to diagnose cytologically indeterminate thyroid nodules for surgery.

Interventions
The molecular test was given to all patients with thyroid nodules and an indeterminate fine-needle aspiration biopsy (FNAB) result. The test used aspirated material, typically collected with two passes of a 25- to 27-gauge needle, to evaluate the messenger ribonucleic acid expression for 142 genes. These data were analysed, using a proprietary algorithm, to class the nodules as either molecularly benign or suspicious. The comparator was conventional cytology.

Location/setting
USA/secondary care.

Methods
Analytical approach:
The analysis was based on a Markov model, with a five-year time horizon. The authors stated that it was carried out from the perspective of society, but limited to the perspective of the US health care system.

Effectiveness data:
Most of the clinical inputs were from a variety of published sources, including literature reviews, government publications, professional society guidelines, and clinical trials. The key data were from published decision analyses on similar questions in thyroid nodule management. Some data were from a panel of six medical and surgical thyroid experts working at the Johns Hopkins Medical Institutions. The sensitivity and specificity of the diagnostic tests were the main inputs.

Monetary benefit and utility valuations:
The utility values for the model states were from published literature or the opinions of the expert panel. The panel used the time trade-off method to estimate the utility weights.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:
The economic analysis included the costs of surgery, in-patient care, out-patient care (clinic visits, ultrasound scans, and radioiodine scans), the treatment of complications, and follow-up (additional clinic visits, laboratory tests, imaging procedures, and medications). Most of these costs were from nationally representative sources, such as the Centers for
Medicare and Medicaid Services, and the Agency for Healthcare Research and Quality. Some data, such as the costs of complications, were based on published estimates. All costs were in US dollars ($) and were discounted at an annual rate of 3%. The price year was 2010.

Analysis of uncertainty:
One-way sensitivity analyses were carried out to examine how robust the model outcomes were to variations in all the inputs; the ranges of values were from published sources and expert opinion. A probabilistic sensitivity analysis was performed, using 10,000 Monte Carlo simulations and assigning normal or beta distributions to the parameters.

Results
Over five years, the projected costs per patient were $12,172 with usual care, and $10,719 with the molecular test. The QALYs per patient were 4.50 with usual care, and 4.57 with the test. The test was dominant as it was more effective and less expensive than usual care. Fewer patients with benign nodules underwent unnecessary surgery with the molecular test (14%, versus 57% without it).

The cost of the test was the most influential input and the test was no longer dominant at a cost of $4,600 ($3,200 in the base case). Other drivers of the analysis were the probability of an initial decision to undergo surgery, the specificity of the molecular test, and the prevalence of cancer in patients with cytologically indeterminate nodules. The test remained the preferred strategy in almost all scenarios.

The test was dominant in 92.5% of simulations in the probabilistic sensitivity analysis.

Authors' conclusions
The authors concluded that the new molecular test was cost saving and more beneficial than the usual analysis of cytology alone, for cytologically indeterminate thyroid nodules.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the new diagnostic strategy was compared with the conventional approach in the authors' setting, which was cytology alone and this is likely to be the usual care in other settings.

Effectiveness/benefits:
No systematic search was reported to identify the relevant sources of evidence. The authors stated that the sources were heterogeneous and included literature reviews, clinical trials, and national guidelines, but they did not specify which studies were used for each parameter. An objective assessment of these sources is not possible. Some data were based on expert opinion. The methods used to pool data from various sources were not reported. QALYs were an appropriate benefit measure because thyroid surgery affects a patient's quality of life. The utility values were from published sources and the clinical experts. The methods used to elicit the preferences in the published studies were not reported, but the utility weights from experts were obtained using a valid instrument. The authors acknowledged that the values from experts might differ from those from patients.

Costs:
The authors stated that the perspective was societal, but they could not assess productivity losses and non-medical costs, and so they took a US health care perspective. They assumed that a societal perspective would further favour the test. Conventional US sources were used and appear to have been relevant to a US health care third-party payer (Medicare) perspective. Most of the costs were presented as category totals, and the resource quantities were not reported. The price year was clearly stated, allowing reflation exercises. The impact of variations in the economic inputs was investigated in the sensitivity analyses.

Analysis and results:
The expected costs and benefits of the two diagnostic strategies were clearly reported. An incremental approach was used to synthesise the clinical and economic outcomes of the model. Appropriate sensitivity analyses were carried out to assess uncertainty and the results were extensively reported. Conventional discounting was applied to both the costs and benefits. A clear description of the decision model was given. The results appear to be specific to the US setting, but might be transferable to other settings with similar costs.
Concluding remarks:
The methods were valid and transparent, and the results were clearly reported. The authors' conclusions appear to be robust.

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