Cost-effectiveness of interferon-gamma release assay versus chest X-ray for tuberculosis screening of employees

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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 chest X-ray examination, versus interferon-gamma release assay, for the detection of active tuberculosis in employees aged 40 years or older, who had received the bacillus Calmette-Guerin (BCG) vaccination. The author concluded that the QuantiFERON-TB Gold test provided value for money, for vaccinated Japanese employees. The cost-effectiveness framework was conventional and the author’s conclusions appear to be robust, but some methods were not clearly presented.

Type of economic evaluation
Cost-utility analysis

Study objective
This study assessed the cost-effectiveness of chest X-ray examination, versus interferon-gamma release assay, for the detection of active tuberculosis in employees aged 40 years or older, who had received the bacillus Calmette-Guerin (BCG) vaccination.

Interventions
The three strategies were no screening, chest X-ray, and the interferon-gamma release assay QuantiFERON-TB Gold (QFT).

If the QFT was positive, latent tuberculosis infection was detected, and a chest X-ray was performed. If the X-ray was negative, patients were given a six-month course of isonicotinyl hydrazide (isoniazid). All patients with a positive chest X-ray were given the standard six-month protocol for active tuberculosis. Without screening, people with active tuberculosis were identified by the presence of symptoms.

Location/setting
Japan/primary care.

Methods
Analytical approach:
The analysis was based on a Markov model, with a lifetime horizon. The author stated that a societal perspective was adopted.

Effectiveness data:
A search of the literature in the PubMed database was carried out to identify the relevant sources of evidence. The accuracy of the screening tests was a key input for the model and this was from meta-analyses of studies conducted in developed countries. Other sources included meta-analyses, Japanese life tables, and cohort studies of Japanese patients. The efficacy of treatment for tuberculosis was based on long-term cohort studies.

Monetary benefit and utility valuations:
The utility values were from a published study, identified by the literature search in PubMed.

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 screening, six-months of isoniazid chemoprevention, the treatment of active tuberculosis, and productivity lost. The costs of a chest X-ray included the physician visit, and radiology technician's time. The cost of QFT included taking blood, the screening kit, physician visit, and laboratory technician's time. Most of these costs were from published literature. Productivity lost was estimated using data from the Japanese Ministry of Health, Labour, and Welfare. The price year was 2009. All costs were in US $ and were discounted at a rate of 3% per annum.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the model inputs. The ranges of values were based on published data. A first-order probabilistic sensitivity analysis was performed, using Monte Carlo simulation, and cost-effectiveness acceptability curves were created.

Results
The estimated lifetime costs were $262.84 with QFT, $448.38 with no screening, and $543.50 with chest X-ray. The QALYs were 22.87049 with QFT, 22.85452 with no screening, and 22.85453 with chest X-ray. QFT was dominant as it was cheaper and more effective than the comparators.

The base-case findings did not change in the sensitivity analyses. The probabilistic sensitivity analysis showed that QFT was most cost-effective in 100% of simulations.

Authors' conclusions
The author concluded that the QFT provided value for money for the detection of tuberculosis, in vaccinated Japanese employees.

CRD commentary
Interventions:
The selection of the comparators was appropriate. The usual diagnostic method was chest X-ray and QFT was a new alternative that was more precise than another conventional test, namely the tuberculin skin test.

Effectiveness/benefits:
The test accuracy was from meta-analyses of published studies that should have included the most relevant evidence. The author stated that no Japanese study was found, but it was likely that the results for other countries would apply to Japan. The other sources of data were partly described; no clinical trials were available for the treatment efficacy. Local estimates were used for the epidemiology. QALYs were an appropriate summary benefit measure for assessing the impact of tuberculosis on patients' health, but the derivation of the utility values was not reported.

Costs:
The economic analysis adopted a broad perspective and a wide range of costs was included. These were presented as category totals and were not individual items. No resource quantities were reported and the data sources were not fully described. More information is needed to objectively assess the validity of the analysis. The impact of variations in the cost estimates was presumably tested in the sensitivity analyses. The price year was reported, allowing reflation exercises.

Analysis and results:
The results of the base case were clearly reported. An incremental approach was used to identify the best strategy; the calculation of incremental cost-utility ratios was not required as QFT was dominant. Appropriate methods were used to assess uncertainty, but the method details and the results of these sensitivity analyses were not reported. It appears that a first-order probabilistic analysis was conducted. The author acknowledged some limitations to the analysis, which mainly related to the poor quality of some data sources and the need for some assumptions that might have overestimated the prevalence of latent tuberculosis. The results appear to be specific to the Japanese context and to vaccinated employees.

Concluding remarks:
The cost-effectiveness framework was conventional and the author's conclusions appear to be robust, but some methods...
were not clearly presented.

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