Cost-effectiveness of a new interferon-based blood assay, QuantiFERON-TB Gold, in screening tuberculosis contacts

Marra F, Marra CA, Sadatsafavi M, Moran-Mendoza O, Cook V, Elwood RK, Morshed M, Brunham RC, FitzGerald JM

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
The objective was to assess the cost-effectiveness of QuantiFERON-TB Gold (QFT-G) compared with the tuberculin skin test in diagnosing latent tuberculosis infection. The authors concluded that the selective and targeted use of QFT-G was cost-effective. The methods were satisfactory, but more details on how the clinical estimates were obtained should have been reported. The results were reported in detail and the authors’ conclusions appear to be valid for the scope of the analysis.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to assess the cost-effectiveness of QuantiFERON-TB Gold (QFT-G) compared with the tuberculin skin test in diagnosing latent tuberculosis infection in those who had been in contact with people with active tuberculosis.

Interventions
Three interventions were investigated: tuberculin skin test alone; QFT-G alone; and tuberculin skin test followed by QFT-G. These interventions were part of screening strategies in different subgroups and populations at risk and the authors compared a total of 27 strategies. They determined the nine most likely screening strategies and details of these were presented.

Strategy one was the tuberculin skin test for all contacts.
Strategy two was QFT-G for contacts who had been vaccinated with Bacillus Calmette-Guerin (BCG) and tuberculin skin test for others.
Strategy three was tuberculin skin test followed by QFT-G for BCG-vaccinated contacts and tuberculin skin test for others.
Strategy four was QFT-G for non-Canadian born, Canadian-born aboriginal, and BCG-vaccinated contacts and tuberculin skin test for others.
Strategy five was QFT-G for non-Canadian born and Canadian-born aboriginal contacts and tuberculin skin test for Canadian-born non-aboriginal contacts.
Strategy six was tuberculin skin test followed by QFT-G for non-Canadian born, Canadian-born aboriginal, and BCG-vaccinated contacts and tuberculin skin test for others.
Strategy seven was tuberculin skin test followed by QFT-G for non-Canadian born and Canadian-born aboriginal contacts and tuberculin skin test for Canadian-born non-aboriginal contacts.
Strategy eight was tuberculin skin test followed by QFT-G for all and Strategy nine was QFT-G for all.

Location/setting
Canada/out-patient secondary care.

Methods
Analytical approach:
A state-transition, discrete-time Markov model was used to compare the costs and outcomes of the three screening
interventions, in the different sub-populations, over a 20-year period. The authors reported that the perspective was that of the third-party payer.

Effectiveness data:
The effectiveness and clinical data were from a number of sources, including: single published studies, published meta-analyses, the authors’ assumptions, and population-based cohort studies. The main clinical estimates were the sensitivity and specificity of the tests, which were derived from published studies and authors’ assumptions.

Monetary benefit and utility valuations:
Quality of life estimates were elicited from a consecutive sample of 116 patients with latent tuberculosis infection and 116 patients with active tuberculosis, using the Short Form (SF-6D) health survey. No patients had experienced major hepatotoxicity, so the quality of life for this health state was taken from a published study of liver transplant patients, who had also completed the SF-6D.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary measure of benefit.

Cost data:
The direct medical costs included: the costs of tuberculin skin test and QFT-G screening, which included staff time, equipment, consumables, and commercial kits; physician visits; latent tuberculosis infection treatment; hospital stays; contact investigations; and management of latent tuberculosis infection or active tuberculosis. The unit costs were from a number of sources including the British Columbia Medical Association payment schedules and Canadian studies. Hospital costs were from a large tertiary referral hospital. All costs were updated to 2005 prices using the Consumer Price Index. As they could be incurred over a 20-year period, future costs were discounted at an annual rate of 3%. All costs were reported in Canadian dollars (CAD).

Analysis of uncertainty:
To assess whether the model was robust, a series of one- and two-way sensitivity analyses were performed by modifying a number of variables including the costs, the sensitivity, and the specificity.

Results
The combination of three screening approaches and nine subgroups created 27 strategies that were evaluated. Only the cost-effectiveness results of the most likely strategies were reported and all strategies were compared with the base case, which was the tuberculin skin test for all contacts (Strategy one). Compared with this strategy, the incremental costs, QALYs, and cost-utility ratio (the additional cost per QALY gained) for the eight strategies were presented. Strategies were also ranked by incremental net monetary benefit.

Strategy one resulted, on average, in costs of CAD 442.6 and 15.1143 QALYs. The most cost-effective strategy was strategy two (QFT-G for BCG-vaccinated contacts and tuberculin skin test for others), which resulted in an incremental net monetary benefit of CAD 3.70 per contact investigated, at a willingness-to-pay threshold of CAD 50,000. The incremental cost was CAD -0.61 and the incremental QALYs were 0.0001. This strategy was dominant, which means it had lower costs and higher effectiveness.

Strategy three (tuberculin skin test followed by QFT-G for BCG-vaccinated contacts and tuberculin skin test for others) was the next most cost-effective, with an incremental net monetary benefit of CAD 2.89, and it was also dominant, with incremental costs of CAD -2.54 and incremental QALYs of 0.0000.

Strategies four, five, six, and nine produced incremental cost-utility ratios that ranged from CAD 31,930 to CAD 135,672 and Strategies seven and eight were dominated.

The sensitivity analysis showed that a higher prevalence of recent infection, a faster conversion of QFT-G, a higher rate of tuberculosis reactivation, a reduction in utility, or a greater adherence to preventive treatment resulted in QFT-G becoming cost-effective in more subgroups.
Authors' conclusions
The authors concluded that the selective and targeted use of QFT-G appeared to be cost-effective.

CRD commentary
Interventions:
The screening interventions and strategies were reported in detail. The justification for using the tuberculin skin test for all contacts as the comparator was that it was the current practice in the authors’ settings.

Effectiveness/benefits:
For each clinical and effectiveness parameter the base value, the range used in the sensitivity analysis, and the source from which the estimate was obtained were reported, but how these sources were identified was not reported, which means it is not clear if all the relevant information was identified and used.

Costs:
The perspective was appropriately reported as that of the third-party payer. It appears that all the cost categories and costs relevant to this perspective were included. The authors’ adequately reported the sources from which costs were obtained. They also clearly reported the price year, time horizon, and discount rate used, but they inflated the costs using the consumer price index and not its medical component, which would have been more appropriate.

Analysis and results:
A Markov model was used to synthesise all the evidence and it was reported in detail, with diagrams. An exhaustive series of one- and two-way sensitivity analyses were performed, but no probabilistic analysis was undertaken. In the UK, the latter is considered to be the gold standard for evaluating the overall model uncertainty. In their discussion, the authors highlighted the limitations of their study.

Concluding remarks:
The methods were satisfactory, but the authors should have reported more details on how the clinical and effectiveness estimates were obtained. The results of the study were reported in detail and the authors’ conclusions appear to be valid for the scope of the analysis.

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