Cost effectiveness analysis of school based Mantoux screening for TB infection
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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
Four different strategies for screening for tuberculosis (TB) infection among school children were examined. The strategies were:

- targeted screening of overseas born (OSB) children aged 14 years;
- universal screening of children aged 14 years;
- targeted screening of OSB children aged 6 years; and
- universal screening of children aged 6 years.

The children were tested for TB infection using the Mantoux (tuberculin) test.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised school children aged 6 or 14 years.

Setting
The setting was a school. The economic study was carried out in central Sidney and Southwestern Sidney, Australia.

Dates to which data relate
The effectiveness and resource use data were derived from studies published between 1986 and 1998. The costs were reported in 1997 to 1998 prices.

Source of effectiveness data
The effectiveness evidence was derived from published studies and from the authors' assumptions.

Modelling
A decision tree model was constructed to estimate the costs and benefits of the four screening strategies and the no screening option. The model was populated with data from the published studies and authors' assumptions.
Outcomes assessed in the review
The outcomes assessed from the published studies and used as model inputs were:

the proportion of children born overseas;
the screening coverage rates;
the proportion of children diagnosed as infected;
the proportion of children with Mantoux reactions initially classified as significant and referred for clinical assessment;
the proportion of those children referred for clinical assessment, classified as Mantoux positive or not infected;
the efficacy of the Bacille Calmette-Guerin (BCG) vaccination against TB;
the proportion of cases that would complete the course of preventive therapy;
the lifetime risk of progressing from childhood TB infection to adult TB disease; and
the probability of death for an adult TB case.

Study designs and other criteria for inclusion in the review
A few of the primary studies were official reports published in Australia. Most of the evidence was derived from studies whose designs were not reported.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not reported.

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
The effectiveness evidence was derived from fourteen primary studies.

Methods of combining primary studies
A narrative method was used to combine the studies. Most of the outcome measures were stated to have been conservatively estimated from the primary studies

Investigation of differences between primary studies
Not reported.

Results of the review
The proportion of children born overseas was 24.30% for those aged 6 years and 32.20% for those aged 14 years.

The screening coverage rates were 71% for children aged 6 years and 78.70% for those aged 14 years.
The proportions of 6-year olds diagnosed as infected were 17.90% for OSB and 2.80% for Australian born children. The corresponding figures for 14-year olds were 27.40% for OSB and 2.50% for Australian born children.

The proportions of 6-year olds with Mantoux reactions, initially classified as significant and referred for clinical assessment, were 29.20% for OSB and 3.40% for Australian born children. The corresponding figures for 14-year olds were 39.10% for OSB and 3% for Australian born children.

The proportions of those 6-year olds referred for clinical assessment, who were then classified as Mantoux positive, were 61.20% for OSB and 83.70% for Australian born children. The corresponding figures for 14-year olds were 70% for OSB and 83.30% for Australian born children.

The proportions of those 6-year olds referred for clinical assessment, who were then classified as not infected, were 38.80% for OSB and 16.30% for Australian born children. The corresponding figures for 14-year olds were 30% for OSB and 16.70% for Australian born children.

The efficacy of the BCG vaccination was 50%.

The proportion of cases who would complete the course of preventive therapy was 60%.

The lifetime risk of progressing from childhood TB infection to adult TB disease was 5%.

The probability of death for an adult TB case was 0.0766.

**Methods used to derive estimates of effectiveness**
The authors made some assumptions to support the data estimated from the literature.

**Estimates of effectiveness and key assumptions**
Some of the assumptions made by the authors were as follows:

- adult cases of TB would occur at age 30;
- all except 5% of those OSB cases would be offered a preventive therapy (6-month course of isoniazid);
- preventive therapy would reduce the lifetime risk by 90%;
- all adult cases would be treated;
- for each case of disease, 6.53 contacts would have a Mantoux test, 1.5 would have a chest X-ray, 0.8 would be given preventive therapy, and 0.06 additional cases would be treated.

**Measure of benefits used in the economic analysis**
The benefit measures used in the economic analysis were the numbers of adult TB cases prevented and the deaths avoided. Both were derived from the decision model and a 5% discount rate was used.

**Direct costs**
A 5% discount rate was used due to the long time horizon of the analysis. The unit costs and the quantities of resources were reported separately for most of the cost items included in the analysis. The cost/resource boundary adopted was that of the health care system. The analysis of the costs included the costs of screening, follow-up therapy, treatment, and contact tracing per case of adult pulmonary TB disease. The costs were estimated using actual data derived from Medicare rates and pharmacy data. The quantities of resources used were estimated using published studies. The costs were reported in 1997 to 1998 prices. The costs from earlier periods were inflated to 1997 to 1998 prices using the health services sub-group of the Consumer Price Index.
Statistical analysis of costs
No statistical analyses of the costs were carried out.

Indirect Costs
The indirect costs were not included in the analysis.

Currency
Australian dollars (Aus$).

Sensitivity analysis
One-way sensitivity analyses were carried out to test for uncertainty around the estimated parameters included in the decision model. These were the discount rate (the costs and benefits were both discounted at 3%, or only the costs or only the benefits were discounted), the efficacy of the vaccine (increased from 50 to 80%), and the lifetime risk of TB (raised from 5 to 10%).

Estimated benefits used in the economic analysis
In the population of 17,472 children aged 6 years, the no screening strategy resulted in 70.39 adult cases of TB and 5.39 deaths.

With universal screening, 48.7 adult cases of TB occurred and 21.8 cases were prevented, while 3.73 deaths occurred and 1.66 deaths were prevented.

With targeted screening, 58.85 adult cases of TB occurred and 14.5 cases were prevented, while 4.28 deaths occurred and 1.11 deaths were prevented.

In the population of 16,138 children aged 14 years, the no screening strategy resulted in 96.33 adult cases of TB and 7.38 deaths.

With universal screening, 64.4 adult cases of TB occurred and 31.92 cases were prevented, while 4.93 deaths occurred and 2.45 deaths were prevented.

With targeted screening, 66.07 adult cases of TB occurred and 30.25 cases were prevented, while 5.06 deaths occurred and 2.32 deaths were prevented.

All the figures reported above were undiscounted.

In the population of 6-year-old children, the incremental (discounted) number of cases of TB prevented was 4.51 with targeted screening over no screening, and 2.22 with universal screening over targeted screening. The corresponding figures in the population of 14-year-old children were 13.02 with targeted screening over no screening, and 0.73 with universal screening over targeted screening.

Cost results
In the population of 6-year-old children, the screening costs were Aus$413,913 with universal screening and Aus$223,473 with targeted screening. The treatment savings were Aus$30,174 with universal screening and Aus$20,233 with targeted screening. This resulted in a net cost of Aus$383,739 for the universal screening programme and Aus$203,240 for the targeted screening programme.

In the population of 14-year-old children, the screening costs were Aus$409,949 with universal screening and Aus$299,221 with targeted screening. The treatment savings were Aus$65,630 with universal screening and Aus$62,201 with targeted screening. This resulted in a net cost of Aus$344,319 for the universal screening programme.
and Aus$237,020 for the targeted screening programme.

In the population of 6-year-old children, the incremental (discounted) net cost was Aus$203,240 with targeted screening over no screening, and Aus$180,499 with universal screening over targeted screening. The corresponding figures in the population of 14-year-old children were Aus$237,020 with targeted screening over no screening, and Aus$107,299 with universal screening over targeted screening.

Synthesis of costs and benefits
An incremental cost-effectiveness analysis was carried out to combine the costs and benefits of the programmes.

In the population of 6-year-old children, the cost per prevented case of TB disease was Aus$45,064 with targeted screening over no screening, and Aus$81,306 with universal screening over targeted screening. The corresponding figures in the population of 14-year-old children were Aus$17,965 with targeted screening over no screening, and Aus$146,985 with universal screening over targeted screening.

Consequently, targeted screening was more cost-effective than universal screening in both study populations. Targeted screening in children aged 14 years represented by far the most cost-effective strategy.

The authors estimated that, since the average life expectancy of a child aged 14 years was estimated to be 75 years, the discounted cost per life-year saved for 14-year-old children would be Aus$129,125 with targeted screening.

The estimated cost-effectiveness ratios were sensitive to variations in the discount rate and lifetime risk of TB, although the ranking of the screening options did not change.

Authors' conclusions
Targeted screening for school children aged 14 years proved to be the most cost-effective strategy for tuberculosis (TB) disease. However, it did not compare favourably with other health programmes, due to the high cost per life-year saved. Also, the targeting of a group on the basis of their birth origin could lead to discriminatory attitudes, and ethical considerations have to be taken into account.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. The four screening strategies represented feasible alternative options, while the no screening strategy was used as the basic comparator. You should assess which screening programme is currently carried out in your own setting.

Validity of estimate of measure of effectiveness
The analysis of the effectiveness mainly used data derived from published studies, although a formal review of the literature was not performed. Instead, the authors provided a narrative overview of the literature and official reports published in Australia. Potential differences between the primary studies were not taken into account and the design of the studies was not reported. The estimated outcome measures were then supported by the authors' assumptions. Sensitivity analyses were, however, performed on the effectiveness data, although these were quite limited in the parameters selected. In addition, only one-way analyses were conducted.

Validity of estimate of measure of benefit
The main benefit measure used in the economic analysis was the number of cases of TB prevented with the programmes. This was obtained using a decision model. Future benefits were discounted at different rates. The authors also assessed the life-years gained with the most cost-effective programme.

Validity of estimate of costs
It appears that all the categories of costs relevant to the perspective adopted were included in the analysis. The unit costs and the quantities of resources used were reported for most of the cost items included. The quantities of resource use were derived from published studies. Sensitivity analyses were carried out only on the discount rate, which could limit the generalisability of the study's findings. In addition, the cost results might not be generalisable to other countries or settings since the cost data are specific to Australia. Finally, it appears that tariffs were used as a proxy for costs.

**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 explicitly addressed. In addition, few sensitivity analyses were carried out on the effectiveness side of the analysis. Consequently, the external validity of the analysis may be somewhat low. The study population comprised children aged 6 or 14 years and this was reflected in the authors' conclusions.

**Implications of the study**
According to the authors, the main implication of the study is that local authorities should consider the possible implementation of a school-based screening programme for TB disease. However, applicability to other settings, such as the UK, would depend on issues of generalisability and ethical considerations.

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