A Markov model to analyze cost-effectiveness of screening for severe combined immunodeficiency (SCID)
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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 universal neonatal screening for T cell lymphocytopenia to detect severe combined immunodeficiency (SCID), from a societal perspective. The authors concluded that universal screening for SCID was likely to be cost-effective. The methods were valid and the results were robust to wide changes in the model parameters. The authors’ conclusions appear to be appropriate.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
This study assessed the cost-effectiveness of universal neonatal screening for T cell lymphocytopenia to detect severe combined immunodeficiency (SCID).

Interventions
Universal newborn screening by measurement of T cell receptor excision circles was compared against no screening. Without screening, SCID was diagnosed when an infant developed infections.

Location/setting
USA/out-patient and hospital.

Methods
Analytical approach:
The analysis was based on a Markov model, with a 70-year time horizon. The authors stated that it was carried out from a societal perspective.

Effectiveness data:
The clinical inputs were from published literature, the US national marrow donor registry, surveys, and medical charts. The key inputs were the transition probabilities for children with an early or late diagnosis of SCID, and these were from a survey of 39 parents of children with SCID. The accuracy of screening (sensitivity and specificity) was an important parameter and the data were from published studies.

Monetary benefit and utility valuations:
The utility values were from published sources. The estimates were for paediatric conditions that produced similar limitations, such as cystic fibrosis, sickle cell anaemia, paediatric HIV or AIDS, and leukaemia.

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

Cost data:
The economic analysis included screening (machine time, labour, and reagents), tests to confirm diagnosis (blood count and lymphocyte phenotyping), late or early haematopoietic cell transplantation, hospital in-patient and out-patient visits, and intravenous immunoglobulin. Non-medical costs (travel, waiting, and care time) were included and were based on
official rates in the USA. The medical costs were from a hospital in Boston, Medicare databases, and data reported in the Healthcare Cost and Utilization Project. A cost-to-charge ratio was applied where relevant. All costs were in US $ and a 3% annual discount rate was applied. The price year was 2005.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the SCID incidence, the test sensitivity and specificity, the cost of T cell receptor excision circle measurement, the cost of diagnostic tests, and the ratio between the costs of early versus late haematopoietic cell transplantation. A second-order Monte Carlo simulation was carried out, using triangular distributions, for four inputs: the cost of screening, the incidence of SCID, the test sensitivity, and the test specificity.

Results
The projected costs were $8.89 with no screening and $14.33 with screening. The life-years were 28.684523 with no screening and 28.684737 with screening. The QALYs were 28.684513 with no screening and 28.684708 with screening. The incremental cost per life-year gained with screening was $25,429 and the incremental cost per QALY gained was $27,907.

The sensitivity analysis confirmed that the base-case findings were robust. Screening was the preferred strategy at a threshold of $50,000 per QALY gained in all simulations, if the SCID incidence was at least one in 250,000. The results were sensitive to variations in the test specificity and test cost, but universal screening remained cost-effective within reasonable ranges of values.

At a threshold of $100,000 per QALY, the screening was cost-effective in 78% of simulations.

Authors’ conclusions
The authors concluded that universal screening for SCID was likely to be cost-effective.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear, as the proposed screening strategy was compared against no screening, which was the usual care in the USA and other settings.

Effectiveness/benefits:
The clinical inputs were from various sources and no systematic search was reported to identify them. The key data were from a survey of 39 parents of children with SCID in the USA, and this should have provided estimates relevant to the authors’ setting, but from few cases. The methods of the published studies were not reported, limiting the possibility of judging their validity. Extensive sensitivity analysis was conducted on the clinical parameters and the base-case findings were robust. Life-years and QALYs as the benefit measures were appropriate for SCID, which affects survival and quality of life. Little information on the instruments used to obtain the utility weights was given.

Costs:
The economic analysis used a broad perspective and all the relevant cost categories appear to have been included. Valid sources were used for these costs and they were standard US sources or US hospitals. A cost-to-charge ratio was applied for some items. The unit costs and resource quantities were reported for a few items. The impact of variations in selected costs was investigated in the sensitivity analyses. The price year was reported, allowing reflation exercises. All costs were discounted at a standard US rate.

Analysis and results:
The results were extensively presented. The projected costs and benefits were appropriately combined, using an incremental approach and usual cost-effectiveness thresholds. A conventional discount rate was applied. The uncertainty was satisfactorily investigated by varying uncertain inputs and the results were extensively illustrated. The authors stated that some of the benefits of universal screening were not considered and their inclusion could favour screening. The transferability of the findings was not discussed and the results might be specific to the USA, but the extensive sensitivity analysis might make them applicable to other countries.

Concluding remarks:
The methods were valid and the results were robust to wide changes in the model parameters. The authors’ conclusions appear to be appropriate.

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