Pulse oximetry as a screening test for congenital heart defects in newborn infants: a cost-effectiveness analysis

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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
The study objective was to assess the cost-effectiveness of pulse oximetry as an adjunct to clinical examination compared with clinical examination alone (routine practice). The authors concluded that pulse oximetry was likely to be cost-effective. The quality of the study methods was adequate. Despite the narrow measure of health outcome used (cost per timely diagnosis of congenital heart defects), the conclusion about the intervention cost-effectiveness appears to be appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to assess the cost-effectiveness of pulse oximetry as an adjunct to clinical examination as a screening test for congenital heart defects in newborn infants.

Interventions
Pulse oximetry as an adjunct to clinical examination was compared with clinical examination alone as a screening test for congenital heart defects in new born infants. Clinical examination included a mid-trimester anomaly ultrasound scan and a postnatal clinical examination.

Location/setting
UK/Inpatient secondary care.

Methods
Analytical approach:
A decision-analytic tree model was constructed to assess the costs and outcomes of the two interventions. The time horizon was one year. The authors reported that the perspective adopted was that of the UK NHS.

Effectiveness data:
Clinical and effectiveness data were mainly from a single test accuracy study (Ewer, et al. 2011, see ‘Other Publications of Related Interest’ below for bibliographic details), which was conducted in six large maternity units in the UK involving 20,055 newborn infants. Data was supplemented with results obtained from other published studies. The main measure of effectiveness was the accuracy of each test at detecting congenital heart defects. This information was derived from the study by Ewer, et al. (2011) and supplemented with other published studies.

Monetary benefit and utility valuations:
Not relevant

Measure of benefit:
Timely diagnosis of congenital heart defects, which was defined as diagnosis confirmed by echocardiogram before pre-operative collapse or death of the infant.

Cost data:
The direct costs included the pulse oximetry test, expedited and clinical examinations, non-cardiac examination, and
the cost of diagnostic echocardiogram. To establish the costs of the pulse oximetry test, a time and motion study was carried out alongside the test accuracy study (Ewer, et al. 2011). The time taken to carry out the test was recorded in the time and motion study. Other costs were taken from a published study. All costs were reported in UK £ and were inflated to 2009 prices using the Health and Community Health Services pay and price index.

Analysis of uncertainty:
A probabilistic sensitivity analysis was undertaken. One-way sensitivity analyses were carried out by varying test characteristics, thresholds, and costs. The results were presented in a cost-effectiveness acceptability curve.

Results
For pulse pulse oximetry as an adjunct to clinical examination, the number of timely congenital heart defects cases detected was 121.4 and the total cost of screening was £1,358,800 per 100,000 live births.

For clinical examination alone, the number of timely congenital heart defects cases detected was 91.5 and the total cost of screening was £614,000 per 100,000 live births.

Costs and benefits were combined using an incremental cost effectiveness ratio (the additional cost per additional timely diagnosis of congenital heart defects). When compared with clinical examination alone, the additional cost per additional case diagnosed of congenital heart defects per 100,00 live births was £24,900 with pulse oximetry as an adjunct to clinical examination.

At a willingness to pay threshold of £100,000 per timely diagnosis, the probability that pulse oximetry was cost-effective was 90%.

Authors' conclusions
The authors concluded that pulse oximetry as an adjunct to routine practice of clinical examination was likely to be a cost-effective intervention.

CRD commentary
Interventions:
The interventions were reported clearly and in detail. The selection of the comparator was clear, as the proposed strategy was compared to routine clinical examination (current practice) without pulse oximetry.

Effectiveness/benefits:
Clinical and effectiveness data were primarily taken from an single accuracy test study, and readers are referred to the primary study and the related HTA monograph for more details (Ewer et al 2011 and Ewer et al 2012, see 'Other Publications of Related Interest” below for bibliographic details). As a limitation to the accuracy test study, it was not possible to measure the accuracy of the comparator intervention (clinical examination alone); this was always performed after a negative pulse oximetry test and it was not possible for clinicians to be blind to the result of the test. Consequently, other published studies had to be used to obtain these estimates. The authors used a narrow outcome measure (case of timely diagnosis) rather than a broader outcome measure (such as quality-adjusted life-years, QALYs). This involved a policy judgement that decision makers were willing to attach a certain value (£24,900) for every additional timely diagnosis of congenital heart defects. Use of quality-adjusted life-years might have captured the impact of the intervention on quality of life, as well as allowing comparisons with other programmes. However, in their discussion, the authors’ implied that a case of timely diagnosis would generate at least five quality-adjusted life-years over the lifetime of the patient, rendering the intervention cost-effective at current willingness to pay threshold for an additional quality-adjusted life-year.

Costs:
The perspective adopted was explicitly reported as that of the UK NHS. The analysis only appeared to include the costs for screening and excluded other healthcare costs such as treatment of congenital heart defects. However, given that the outcome measure was cost per timely diagnosis of congenital heart defects, the fact that only screening costs were included was appropriate. The price year, time horizon and currency details were reported, as were the sources from which cost information was derived and readers are referred to the primary study and the related HTA monograph (Ewer et al 2011 and 2012) for more details.
Analysis and results:
Cost and outcome information were synthesised using a decision analytic tree model. Appropriate details of the model structure were provided, including a flow chart. The authors reported that a probability sensitivity analysis was undertaken, but did not report any of the methods used. The authors reported no further limitations to their study.

Concluding remarks:
The quality of the study methods was adequate. Despite a narrow measure of health outcome used, the authors’ conclusions about the cost-effectiveness of the intervention appear to be appropriate.

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