Estimates of the cost-effectiveness of pediatric bilateral cochlear implantation

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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 examined the cost-effectiveness of bilateral versus unilateral cochlear implants for profoundly deaf children aged one year. The authors concluded that bilateral cochlear implants were potentially cost-effective, but there was considerable uncertainty mainly in the value of health-related quality of life. The methods were valid and this ensures that the authors’ conclusions are robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of bilateral versus unilateral cochlear implants for profoundly deaf young children.

Interventions
The interventions were unilateral cochlear implant (with the option of an acoustic hearing aid for the other ear), and bilateral cochlear implants. Children received the unilateral or bilateral implants before their second birthday. Unilateral implantation was also compared against non-surgical intervention.

Location/setting
UK/secondary care.

Methods
Analytical approach:
The analysis was based on a probabilistic decision model with a lifetime horizon. The authors stated that the perspective of the UK NHS was adopted.

Effectiveness data:
The clinical data were from a selection of relevant published studies and some expert opinions. Most of the evidence came from a health technology assessment (HTA) of the cost-effectiveness of cochlear implants in young children that was conducted in the UK (Bond, et al. 2009, see ‘Other Publications of Related Interest’ below for bibliographic details). A key input of the model was the cumulative survival of the cochlear device.

Monetary benefit and utility valuations:
The utility values were estimated in two ways: using the time trade-off technique and the visual analogue scale (VAS). Time trade-off was used in the base case, while the VAS was used for an alternative scenario. The estimates were elicited from a representative sample of 180 people, including 32 clinicians or researchers, 82 undergraduate students, and 66 parents of disabled children (not hearing impaired) or members of the public.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 3.5%.

Cost data:
The economic analysis included the costs of cochlear implantation, maintenance, management of internal and external device failure, acoustic hearing aid, treatment of complications in an implanted ear, and processor upgrading. All
economic estimates were from the HTA report, which collected the data from published studies. The costs were in UK pounds sterling (£), for the price year 2007, and a 3.5% annual discount rate was applied.

Analysis of uncertainty:
A deterministic sensitivity analysis was undertaken on the costs of tuning and maintenance, which were increased by 25% and by 50% of their base values. Additional analyses were carried out considering utility estimates from each group, who provided them, separately (clinicians, students, and parents). Three thousand Monte Carlo simulations were run to estimate the projected costs and benefits of the alternative strategies in a hypothetical cohort of 3,000 children.

Results
Compared with a unilateral implant, bilateral implants led to a gain of 1.57 QALYs at an additional cost of £34,083, resulting in an incremental cost per QALY gained of £21,768. The probability of bilateral implants being cost-effective at a threshold of £30,000 per QALY was 0.48. This probability rose to 0.522 when the costs of a second implant were reduced by 40%. Lower probabilities of being cost-effective were observed in the other scenarios. The likelihood exceeded 0.5 if the threshold was increased to £31,695, but did not exceed 0.8 at any threshold.

Compared with non-surgical intervention, unilateral implants led to a gain of 3.59 QALYs at an additional cost of £71,350, resulting in an incremental cost per QALY gained of £19,861. The probability of unilateral implantation being cost-effective at a threshold of £30,000 per QALY was 0.604.

When utility values based on the VAS were used, compared with unilateral implants, bilateral implants led to a gain of 1.87 QALYs at an additional cost of £34,003, resulting in an incremental cost per QALY gained of £18,173. The probability of bilateral implantation being cost-effective at a threshold of £30,000 per QALY was 0.539. The incremental cost per QALY gained with unilateral versus nonsurgical intervention was £12,049 and the likelihood of it being cost-effective was 0.768.

The subgroup analysis revealed that, in general, the incremental cost per QALY of unilateral versus non-surgical implants increased from clinicians to students to parents, while for bilateral versus unilateral implants it decreased.

Authors' conclusions
The authors concluded that bilateral cochlear implants were potentially cost-effective for young deaf children, but there was considerable uncertainty mainly in the values associated with health-related quality of life.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear as the three feasible strategies for young deaf children were considered. The double comparison of bilateral versus unilateral implantation and unilateral implantation versus non-surgical intervention was appropriate as each strategy was compared against the next more complex and more effective intervention.

Effectiveness/benefits:
Most of the evidence was from a published HTA. Its methods were not reported, but the rigorous design should ensure the validity of the clinical data. Some assumptions were made, based on expert opinion, to adjust the data from the HTA, where necessary. The assessment of health-related quality of life was a primary aim of the study and the choice of the most appropriate instrument and its validity for deaf children were discussed in depth. The method used to convert the quality of life values to health utility estimates was reported. QALYs were a valid benefit measure for these patients, given the impact of being unable to hear on their quality of life.

Costs:
The cost categories reflected the perspective. All the economic data were from the published HTA and were presented as category totals, but the approach used to identify and calculate these costs was not described, limiting the transparency of the analysis. It is likely that typical UK sources were used. Some of the key cost categories were varied in the sensitivity analysis, with no large impact on the cost-effectiveness results. The price year and discounting were clearly reported.
Analysis and results:
An appropriate incremental approach was used to synthesise the costs and benefits and the results were clearly presented. Two criteria were used to identify the best strategy. The uncertainty was satisfactorily investigated using a probabilistic approach, which considered the overall uncertainty in all the model inputs. A clear description of the model was provided and conventional discounting was applied for both costs and benefits. The authors described in detail the potential limitations of their analysis, which mainly related to the uncertainty in the health utility values.

Concluding remarks:
The methods were valid and this ensures that the authors’ conclusions are robust.

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