Hearing-impaired children in the United Kingdom. IV: Cost-effectiveness of pediatric 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 paediatric cochlear implantation in hearing-impaired children with various clinical and demographic characteristics. The authors concluded that implantation was a cost-effective strategy from the perspective of the UK society. Greater value for money was associated with greater loss of hearing and younger children. Overall, the methodology appears to have been appropriate, although few details were reported for the cost analysis. The authors’ conclusions appear to be valid within the limits of the study design.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to carry out a cost-utility analysis of paediatric cochlear implantation in hearing-impaired children. Different groups of candidates for implantation were considered in order to identify their clinical and demographic characteristics, which might affect the cost-effectiveness of cochlear implants. Specifically, the analysis focused on three characteristics which were the age at implantation (three or six years), the duration of implant use, and the pre-operative average hearing level (AHL).

Interventions
The study compared cochlear implants with no implantation in children with hearing impairment.

Location/setting
UK/secondary care.

Methods
Analytical approach:
This economic evaluation was based on data derived from a single study. Two time horizons were considered: 15 years and a child’s lifetime. The authors stated that a societal perspective was adopted.

Effectiveness data:
The effectiveness data were taken from a cross-sectional survey of a large representative sample of children with hearing impairment. The parents of 8,876 children were invited to participate. There were 993 children with cochlear implants, 3,288 profoundly impaired (AHL over 95dB), 3,580 severely impaired (AHL 71 to 95dB), and 1,015 moderately impaired children (AHL 41 to 70dB). The AHL in children with cochlear implants was 15dB. A total of 3,274 parents consented to participate at the study (37% of those invited). The key clinical outcome was the utility score associated with each group of children.

Monetary benefit and utility valuations:
The utility valuations were derived from the cross-sectional survey using a modified version of the Health Utilities Index Mark III (HUI3) questionnaire. The gain in utility associated with implantation was estimated using linear regression taking account of possible confounding variables.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure. A 3% annual discount rate was
applied to those accrued in the future. Life expectancy was based on national statistics.

Cost data:
The costs were borne by the health sector, the education sector, and the child’s family. A breakdown of cost items was not given. The costs for the health care sector were derived from a previously published study which assessed the yearly cost of care for a child requiring acoustic hearing aids. The costs for the education sector were derived from another published source. And finally, those borne by families (out-of-pocket expenses and lost productivity associated with time away from normal parental activities) were derived from the cross-sectional survey and a study which had been submitted for publication. All costs were in Euros (EUR) and referred to the financial year 2001 to 2002. Future costs were discounted at an annual rate of 3%.

Analysis of uncertainty:
No analysis of uncertainty was performed, but several scenario analyses were included varying the age at implantation, the severity of impairment, and the duration of implant use.

Results
From a societal perspective, under the average conditions (a child with a mean AHL of 115dB, implanted at the age of six years) cochlear implantation led to EUR 57,359 additional costs with a 15-year time horizon and EUR 109,388 with a lifetime horizon. The QALYs gained were 2.238 over 15 years and 5,668 over a lifetime. The incremental cost per QALY gained was EUR 25,629 over 15 years and EUR 19,299 over a lifetime.

In general, more favourable figures were achieved with longer time horizons, for children with worse pre-operative AHL, and for children who were implanted when younger. The incremental cost per QALY for cochlear implants varied between EUR 10,798 for a child with AHL 125dB receiving the implant at three years, over a lifetime, and EUR 40,660 for a child with AHL 105 receiving the implant at six years, over 15 years.

These results were robust when alternative perspectives were considered and the incremental cost per QALY of cochlear implants always remained lower than EUR 50,000.

Authors' conclusions
The authors concluded that cochlear implantation, for children with hearing impairment, was a cost-effective strategy from the perspective of the UK society. The analysis showed that greater value for money was associated with greater loss of hearing and younger children.

CRD commentary
Interventions:
The selection of the comparators (implantation versus no implantation) was appropriate, but the authors did not provide a clear description of the two strategies. More information will, presumably, be available in the primary publications.

Effectiveness/benefits:
The clinical evidence was derived from self-reported data. Patients were identified through a cross-sectional survey, the methodology of which was not reported. The response rate and size of the sample were given, but the patients’ characteristics were not reported. Other details of the study were not given. The authors acknowledged that the use of a prospective study, such as a randomised trial, would have been more appropriate to ensure the validity of the clinical data, but that such a study was not feasible. The issue of potential bias due to differences between study groups was appropriately assessed using a logistic regression and taking account of potential confounding. It was also noted that the utility valuations were elicited at one point in time rather than over time. The approach used to elicit the quality of life was extensively described. The use of a linear regression analysis appears to have been appropriate. QALYs are a validated measure of benefit and are appropriate given the impact of the impairment on quality of life. However, the authors noted that the HUI3 measure was built on preferences expressed by a sample of the population of Ontario in Canada. These values might not be applicable to the UK population.

Costs:
The use of a broad perspective was appropriate since different payers were considered. The whole economic analysis
was not extensively reported as it was derived from other published studies. As a result, the specific categories of costs were not reported and the details on resource consumption were not given. This reduces the transparency of the economic analysis. The price year and the use of discounting were reported.

Analysis and results:
The costs and benefits were combined in an incremental ratio, which was appropriate given the greater benefits and additional costs of implants. The issue of uncertainty was not addressed, but the results of the analysis were clearly presented for different scenarios. The authors reported and discussed the findings from other studies. Some limitations of the analysis were pointed out. Besides the weakness of the study design, the authors noted that the implantation data were derived from children who were implanted before the year 2000. Thus, the study did not consider improvements in implantation in more recent years.

Concluding remarks:
Overall, the study methodology appears to have been appropriate, although few details were reported for the cost analysis. The authors’ conclusions appear to be valid within the limits of the study design.

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Other publications of related interest


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