A cost-utility analysis 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.

Health technology
The use of paediatric cochlear implants.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study was performed on children that were profoundly hearing-impaired, i.e. had a threshold hearing level greater than 95 decibels (dB), and were enrolled on the Nottingham Paediatric Cochlear Implant Programme.

Setting
The study setting was hospital. The economic study was carried out in the United Kingdom.

Dates to which data relate
The effectiveness, resource use, and cost data were collected in 1997 and 1998. The price year was 1997 to 1998.

Source of effectiveness data
The effectiveness data were derived from a literature review.

Outcomes assessed in the review
The primary health outcomes were hearing threshold and quality of life.

Study designs and other criteria for inclusion in the review
Longitudinal studies were included in the review.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.
Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Five primary studies were included in the review.

Methods of combining primary studies
The primary studies were combined in the narrative.

Investigation of differences between primary studies
Not stated.

Results of the review
Children who underwent cochlear implantation developed hearing levels equivalent to a threshold of 70 to 95 dB after 2 to 3 years of implant use. Cochlear implants improved the quality of life in adults by 0.23 points per annum.

Estimates of effectiveness and key assumptions
It was assumed that children receiving implants at 4 years of age would have a remaining life expectancy of 71 years (inclusive of the year of implantation). The evidence on quality-adjusted life-years (QALYs) was extrapolated from adults.

Measure of benefits used in the economic analysis
The measure of benefits was QALYs. The quality of life values were derived from adults and were discounted at a rate of 6%.

Direct costs
The direct costs were discounted at a rate of 6%. The quantities were reported separately, according to year only. The direct costs related to the costs by year: year 1, assessment and implantation; years 2 and 3, rehabilitation and maintenance; and year 4 onwards, maintenance only. The quantity/cost boundary adopted was that of society. The costs were estimated, based on charges to the health authorities by the Nottingham Paediatric Cochlear Implant Programme. The price year was 1997 to 1998.

Statistical analysis of costs
The estimates of mean costs were reported.

Indirect Costs
The indirect costs were local authority education costs based on a 1998 study. These included costs related to setting, the number of teaching staff, and any special equipment required. The average costs of educating a child were given for two levels of hearing impairment, i.e. greater than 95 dB and 70 to 95 dB, at years 4 and 7 of their education.

Currency
UK pounds sterling (£), with 1 = US$1.60.

Sensitivity analysis
No sensitivity analysis was conducted.

**Estimated benefits used in the economic analysis**
A QALY gain of 16.33 was associated with paediatric cochlear implants.

**Cost results**
The mean costs over compulsory school years amounted to 48,756.58 for cochlear implants. The results were not given for the no cochlear implant group.

The mean education savings amounted to 26,781.35. This generated a net mean cost of paediatric cochlear implantation of 21,975.23 over the compulsory school years.

The mean costs over 70 years of life amounted to 68,130.90.

The mean net costs over 70 years of life amounted to 41,349.55.

**Synthesis of costs and benefits**
The costs per QALY gained were 10,341 and 1,346 for benefits with and without discounting, respectively.

**Authors' conclusions**
Paediatric cochlear implantation is a cost-effective health care intervention in profoundly hearing-impaired young children.

**CRD COMMENTARY - Selection of comparators**
No justification was given for the comparator used. You, as a user of the database, should decide if these health technologies are relevant to your setting.

**Validity of estimate of measure of effectiveness**
The authors undertook a literature review to derive effectiveness estimates. This seemed appropriate, although they did not state whether a systematic review of the literature had been undertaken.

**Validity of estimate of measure of benefit**
The estimation of benefits was modelled. The instrument used to derive a measure of health benefit was not reported. The quality of life estimates were derived from adults. Hence, the authors assumed that improvements in childhood quality of life were equivalent to those in adulthood. They also assumed that all children would be fitted with a cochlear implant at four years and would have the same outcome.

**Validity of estimate of costs**
The price year was reported. There were no sensitivity or statistical analyses of costs, which makes it difficult to assess the validity of the cost estimates. In addition, since the cost estimates were derived from the authors' institution and one published study, this limited the generalisability of the cost results. There were no estimates of resources by category, and prices were not reported, thus further reducing generalisability. The average costs were only given for two hearing impairment categories, with the assumption that the children would fit into either of these. The method of calculating total costs was unclear. Some indirect costs were given, but the use of the post-school age years was difficult to elucidate.
Other issues
The authors made appropriate comparisons of their findings with those from other studies, but did not address the issue of generalisability to other settings. The authors did not seem to present their results selectively. The study considered profoundly hearing-impaired patients, and this was reflected in the authors’ conclusions. The authors noted that the study did not consider the costs of the relatively greater support required by parents of children with greater hearing impairment. It also did not assume any additional benefits in terms of enhanced earning by severely versus profoundly hearing-impaired persons.

Implications of the study
Paediatric cochlear implantation is a cost-effective health care intervention in profoundly hearing-impaired young children. The results suggest a cost-effectiveness ratio that is reasonable, although sensitive to discounting. The cost-effectiveness ratio is probably sensitive to other parameters too, for example effectiveness, QALY weights, and cost data, for which no evidence on study quality was given as no sensitivity analysis was performed. However, the research does highlight the usefulness of using indirect costs to take full account of efficiency at the societal level.

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Other publications of related interest