Cost utility of the multichannel cochlear implant in 258 profoundly deaf individuals

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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
Multichannel cochlear implant (MCCI) for profoundly deaf individuals.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
Profoundly deaf individuals.

Setting
Hospital. The economic study was carried out in Baltimore, MD, USA.

Dates to which data relate
The effectiveness data were obtained from studies published in 1992 and 1993. The costing was mainly performed on 17 patients in the study site whose data were collected between July 1993 and June 1994. The fiscal year adopted in the study was 1993.

Source of effectiveness data
Effectiveness data were derived from a review of previously published studies, a survey study and expert opinion.

Link between effectiveness and cost data
The costing was mainly performed on 17 patients who underwent implantation in the study site.

Study sample
No power calculations were reported. The implanted group consisted of 301 patients randomly selected from a record of patients, whereas the pre-implant group (awaiting surgical placement of a cochlear implant) consisted of 38 individuals. A questionnaire consisting of the Ontario Health Utilities Index was sent to both groups. The response rate in the implanted group was 76% versus 84% in the pre-implant group.

Study design
A retrospective cohort study. The average duration of the use of implanted device was 4.6 years.
Analysis of effectiveness
The main outcome measure used was the average health utility attributed to each health state (implanted and pre-implanted states). A questionnaire, consisting of the Ontario Health Utilities Index, addressing vision, hearing, speech, emotion, ambulation, dexterity, cognition, self-care, and pain was sent to both groups. The groups were shown to be comparable in terms of socio-economic and demographic features.

Effectiveness results
The incremental benefit in health utility due to the cochlear implant was 0.204 (p<0.0001).

Clinical conclusions
It appears that the implant user group had, on average, significantly better speech, hearing, and cognitive function as well as a more favourable emotional status than the group of similar individuals who were awaiting the placement of the device.

Modelling
A decision-analytic model was used to estimate the cost-utility of the alternative health technologies.

Outcomes assessed in the review
The literature review assessed device failure rate, minor complication rate, major complication rate, probability of audiologic suitability, probability of medical suitability, probability of favourable anatomy, probability of exit after a major complication, and probability of re-implantation after device failure.

Study designs and other criteria for inclusion in the review
Not stated.

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
Three published studies and a study of "current implant protocol" at the Johns Hopkins Hospital.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not reported.
Results of the review
The device failure rate was 3%; minor complication rate, 3%; major complication rate, 6%; probability of audiologic suitability, 70%; probability of medical suitability, 95%; probability of favourable anatomy, 98%; probability of exit after a major complication, 1%; and probability of re-implantation after device failure, 99%.

Methods used to derive estimates of effectiveness
The authors also made assumptions about effectiveness.

Estimates of effectiveness and key assumptions
It was assumed that patient life expectancy was 23 years.

Measure of benefits used in the economic analysis
The measure of benefits was quality adjusted life years (QALYs) gained using a decision-analytic model.

Direct costs
Costs were discounted. Quantities were not reported separately from the costs, although the cost items were reported separately. The costs measured were operational costs, costs of complications and follow up. The boundary adopted was the hospital. The expected cost of a major and a minor complication was extracted from a published paper. The prices used were from 1993.

Indirect Costs
Not considered.

Currency
US dollars ($).

Sensitivity analysis
A one way simple sensitivity analysis was performed on a wide range of cost and outcome parameters.

Estimated benefits used in the economic analysis
The cochlear implant resulted in an increase in health utility of 0.204. The corresponding QALYs were not reported. A life expectancy of 23 years was assumed. The discount rate was 5%.

Cost results
A 5% discount rate was used. The cost results were:

- total cost of preoperative evaluation was $1,915;
- cost of surgery was $13,114;
- initial device cost was $20,228;
- cost of rehabilitation was $1,230;
- cost of follow up was $7,157;
expected cost of a minor complication was $814;

expected cost of a major complication was $9,380.

The duration of costs was the expected lifetime of 23 years.

Synthesis of costs and benefits
The synthesis measure used was the cost per QALY gained, using a 5% discount rate for both costs and benefits. The cost per QALY gained at 5% discount rate in 1993 dollars was $15,928, for the intervention. The final result was most sensitive to four parameters: the health utility increase with intervention, the length of implant use, and the device and surgical costs. The health utility outcome was the most sensitive parameter, with a decrease in the utility gain from 0.204 to 0.10 (-50%) resulting in a cost per QALY gained of $32,751 (+100%). An increase of the gain to 0.25 (+25%) resulted in a cost per QALY gained of $12,972 (-18.75%).

Authors’ conclusions
Profound hearing loss has a significant effect on quality of life, and measurement of the changes that result from cochlear implant use indicates that this technology provides significant improvements and is quite cost-effective.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear.

Validity of estimate of measure of benefit
The internal validity of the benefit results may be weakened by the study design adopted, and the apparent lack of a systematic literature review and quality assessment of primary studies included in the review.

Validity of estimate of costs
The resource utilisation was not reported. Adequate details of methods of cost estimation were not given. The internal validity of the cost results may not be assured since the costing was not undertaken on the same patient sample as that used in the effectiveness analysis.

Other issues
Given the lack of randomisation, sensitivity analysis, and statistical analysis of the costs, the results need to be treated with some caution. The issue of generalisability to other settings or countries was not addressed.

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