Cost-effectiveness of pediatric bilateral cochlear implantation in Spain

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Incremental cost-effectiveness ratio of bilateral CI

- Unilateral cochlear implantation (UCI) is clearly cost-effective.
- The cost-effectiveness of bilateral CI (BCI) is not that clear.

When is an intervention cost-effective?

- Incremental cost-effectiveness ratio (ICER)
  \[ \text{ICER} = \frac{\Delta \text{cost}}{\Delta \text{effectiveness}} \]

- QALY = quality-adjusted life year
  - one year of life with perfect health,
  - or two years with a quality of life of 0.5,
  - or three years with a quality of life of 0.33, etc.

- Cost-effectiveness threshold (a.k.a. willingness to pay)
  - USA: $50,000 - 100,000 / QALY
  - UK: £20,000 - 30,000 / QALY
  - Spain: €30,000 - 35,000 / QALY
Our study for measuring the quality of life

- **Visual analog scale (VAS)**

![VAS Diagram]

- **Time trade-off (TTO)**

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<th>Informants</th>
<th>Method</th>
<th>Increase in quality of life</th>
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<tr>
<td>Summerfield et al. [2002]</td>
<td>adults</td>
<td>experts</td>
<td>TTO</td>
<td>0.031</td>
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<tr>
<td>Summerfield et al. [2006]</td>
<td>adults</td>
<td>bilaterally implanted patients</td>
<td>HUI-3</td>
<td>0.015 (initial)</td>
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<tr>
<td>Bichay and Miyamoto [2008]</td>
<td>adults and children</td>
<td>bilaterally implanted patients (or their parents)</td>
<td>HUI-3</td>
<td>0.11</td>
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<tr>
<td>Lovett [unpublished]</td>
<td>children</td>
<td>parents of bilaterally implanted children</td>
<td>VAS</td>
<td>0.33</td>
</tr>
<tr>
<td>Lovett et al. [2010]</td>
<td>children</td>
<td>parents of unilaterally and bilaterally implanted children</td>
<td>VAS</td>
<td>0.04</td>
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<tr>
<td>Summerfield et al. [2010]</td>
<td>children</td>
<td>experts, students and parents of children with other disabilities</td>
<td>HUI-3</td>
<td>0.003</td>
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<tr>
<td>Sparreboom et al. [2012]</td>
<td>children</td>
<td>bilaterally implanted children</td>
<td>HUI-3</td>
<td>0.04</td>
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<tr>
<td>Cleen et al., 2014</td>
<td>adults</td>
<td>doctors, implanted adults</td>
<td>HUI-3</td>
<td>0.03</td>
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<td>Härkönen et al. [2013]</td>
<td>adults</td>
<td>bilaterally implanted patients</td>
<td>ISD</td>
<td>0.03</td>
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<tr>
<td>Artaso, Olez [2015]</td>
<td>children</td>
<td>general populations (students)</td>
<td>VAS</td>
<td>0.25</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>TTO</td>
<td>0.10</td>
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</tbody>
</table>

Come see our poster at 4:30pm
Our Markov model
Our Markov model
Our Markov model
Our Markov model
Who pays for the costs of CI in Spain?

- Initial costs (assessment + device + surgery): the health system
- Failure of the internal components
  - first 10 years: manufacturer’s warranty
  - after the 10th year: health care system
- Failure of the external processor
  - first 2 years: manufacturer’s warranty
  - 3rd to 7th year: user or his/her family (usually repaired)
  - after the 7th year: if fails, replaced by the health system
- Microphone: if fails after the 4th year, replaced by the health system
- Coil: if fails after one year of use, replaced by the health system
- Cables and batteries: paid by the user or his/her family.

Results: ICERs

- Simultaneous bilateral vs. unilateral: € 12,133 / QALY
- Sequential bilateral vs. unilateral: € 13,232 / QALY
- Simultaneous, if the health system covered the repairs and supplies € 17,262 / QALY
- Sequential, if the health system covered the repairs and supplies € 18,362 / QALY

- In all cases, clearly below the threshold (€30,000-35,000/QALY).
- The effectiveness decreases with the age of implantation and the time between implantations.
Probabilistic sensitivity analysis
Probabilistic sensitivity analysis

![Cost-Effectiveness Acceptability Curve]

98% probability that BCI is cost-effective

Future work

- Make all the details available on a web page:
  - the raw data collected during the quality of life survey,
  - the analysis of those data,
  - the Markov model, and
  - a stable version of the software, with a user manual,
  so that everyone can reproduce the results of our study,
  because research needs to be reproducible to be credible.

- Analyze the cost-effectiveness of BCI for adults (and SSD).

- Adapt the model to other countries.
If you wish to know more details about this study or adapt it to your country, please write to:
cochlear-implant@cisiad.uned.es.

Thank you very much!