Development of the Cochlear Implant Use Questionnaire to assess habits and barriers to use

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Issues in Cochlear Implants

Low uptake for CI technology

• Only 0.97-7.7% of American adults who meet strict FDA criteria for a cochlear implant actually receive one  
  (Gifford et al., 2010; Hoffman et al., 2015; iData Research Inc., 2010; Kochkin, 2005; Sorkin 2013; Wilson & Dorman 2008)
Issues in Cochlear Implants

High Variability in Speech Recognition Outcomes

• Range: 0-100%, Average: 50-60%
  Buchman et al., 2020; Buss et al., 2008; Gifford, Dorman, Sheffield, Teece, & Olund, 2014; Gifford, Shallop, & Peterson, 2008; Holden et al., 2013; Litovsky, Parkinson, Arcaroli, & Sammeth, 2006

• Many factors contributing to outcomes

• Interventions to improve outcomes
  o Can be costly (i.e., new programming strategy)
  o Many only apply to subset of users (i.e., EAS, bimodal)
  o Many cannot be altered after implantation (i.e., electrode type, surgical technique)

N = 937 post-lingually deafened adults
Daily CI Use via Data Logging

• Average number of hours per day that the CI is used
• CI software objectively tracks the average number of hours of CI use per day
• Relatively new feature to CIs (2013)
• Highly variable
  o Average = 10 hours/day
• Current clinical recommendation: all waking hours
Primary Finding

• Average daily CI use = 10 hours
• Range = 0 – 23 hours

Holder et al., 2019
Results: Poster 2128!

Mean % Point Improvement

- CNC: 9
- AzBio: 7
- AzBio +10: 21

Holder & Gifford, Under Review
Goals for Questionnaire

• Identifying reasons people use or do not use their CI and barriers to using it more is critical to understanding and addressing variability in wear time

• 1) Design a questionnaire aimed at identifying daily CI use habits and barriers to daily CI use

• 2) Administer this questionnaire to adult CI users with varying degrees of daily CI use
Information-Motivation-Behavioral Skills (IMB) Model of Adherence

Adherence Information

Adherence Behavioral Skills

Consistent Processor Use Adherence

Outcomes
- Speech recognition scores
- Subjective quality of life

Adherence Motivation

Lindsay Mayberry, PhD
Cochlear Implant Use Questionnaire (CIUQ)

Open ended questions
- Subjective daily CI use
- Recommendation provided by surgeon/audiologist
- Daily routine

25 quantifiable questions
- 5-point Likert scale
  - “I don’t wear my cochlear implant processor because I’m afraid of what people might think or say about it.”
  - “Wearing my cochlear implant processor gives me a headache.”
<table>
<thead>
<tr>
<th><strong>Participants</strong></th>
<th>N = 100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td>Male = 55, Female = 45</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td>Mean = 61.6, SD = 15.9, Range = 18-87</td>
</tr>
<tr>
<td><strong>CI Manufacturer</strong></td>
<td>Advanced Bionics = 29, Cochlear = 39, Med-El = 12</td>
</tr>
<tr>
<td><strong>Hearing Device Configuration</strong></td>
<td>Bilateral CI = 27, Bimodal = 58, Unilateral CI = 15</td>
</tr>
<tr>
<td><strong>Living Situation</strong></td>
<td>Alone = 15, With Someone = 85</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td>Retired = 58, Full-time = 31, Part-time = 11</td>
</tr>
<tr>
<td><strong>Average data logging from software (hours/day)</strong></td>
<td>Mean = 10.4, SD = 3.7, Range = 0.5-15.2</td>
</tr>
<tr>
<td><strong>Average participant reported CI use (hours/day)</strong></td>
<td>Mean = 13.0, SD = 3.3, Range = 2.5-24.0</td>
</tr>
</tbody>
</table>
Cochlear Implant Use Questionnaire (CIUQ)

• What was your surgeon or audiologist’s recommendation for how often you should wear your cochlear implant processor?

  43% = Don’t remember or no recommendation was made
  14% = Response inconsistent with current recommendations
  43% = All waking hours or all day
Cochlear Implant Use Questionnaire (CIUQ)

• Do you remove your processor for certain activities?

67% = Yes

sleep/nap, showering, exercise, working outside (heat/sweat), to enjoy silence, and noisy environments (mowing lawn, woodworking)
Cochlear Implant Use Questionnaire (CIUQ)

- How many hours per day do you wear your cochlear implant processor?

![Graph showing data logging and participant report hours per day.](image-url)
# Cochlear Implant Use Questionnaire (CIUQ)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When my cochlear implant processor battery dies, I have a backup battery with me.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. It is important that I hear my best at all times.</td>
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<tr>
<td>3. When I take my cochlear implant processor(s) off, I enjoy the silence.</td>
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<td></td>
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<tr>
<td>4. I take my cochlear implant processor off when I am home alone.</td>
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</tr>
<tr>
<td>5. I get so exhausted from listening that I want to take my cochlear implant processor off.</td>
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<tr>
<td>6. When sounds are annoying, I take my cochlear implant processor off.</td>
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</tr>
<tr>
<td>7. If I am sick or do not feel well, I do not like to wear my cochlear implant processor.</td>
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</tr>
</tbody>
</table>

Total possible score = 0 - 100  
Average total score = 23.3  
Range = 3 - 54
Cochlear Implant Use Questionnaire (CIUQ)

• I take off my cochlear implant processor to avoid getting it wet such as while exercising or working outside during the summer

• If I forget to wear my cochlear implant processor, my friends or family members will ask me why I’m not wearing it

• When I take my cochlear implant processor(s) off, I enjoy the silence

• If I am sick or do not feel well, I do not like to wear my cochlear implant processor(s)

• I take my cochlear implant processor off when I am home alone
Construct Validity

$r_s = -0.561, p < 0.0001$
Clinical Application Example

- Time on Air: Daily average
  - Off air: 17.5 hrs
  - Speech: 0.3 hr
  - On air: 6.5 hrs (3 power-ons)

- Scatter plot:
  - CNC Words (% correct) vs. Daily CI Use (hours/day)
  - Correlation coefficient: $r_s = 0.61$
  - Significance: $p < 0.0001$
  - Sample size: $n = 290$
Clinical Application Example

17. I take breaks from wearing my cochlear implant processor because my ear feels uncomfortable.
18. My cochlear implant processor is sensitive to my ear.

Date of IRB Approval: [Insert Date]

25. Wearing my cochlear implant processor gives me a headache.
Clinical Application Example

- Time on Air:
  - Off air: 11.1 hrs
  - On air: 12.9 hrs
  - Speech: 0.3 hr
  - Daily average:

- Graph:
  - CNC Words (% correct) vs. Daily CI Use (hours/day)
  - Correlation coefficient: $r_s = 0.61$
  - Significance: $p < 0.0001$
  - Sample size: $n = 290$
Conclusion

• Strong relationship between daily CI use & speech recognition

• At least 10 hours of CI use per day to maximize speech recognition results
  o > 10 likely yields additional gains

• Daily CI use can be increased to improve speech recognition outcomes in a short time (four weeks)
  o Even for patients with up to 10 hours of daily CI use

• CI Use Questionnaire can be used by clinicians to understand barriers to consistent CI use and support patients in overcoming them
Thank you for tuning in!
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