Exposing Relationships between Cognitive Status and Hearing Aid Factors

Introduction
Research has suggested a link between cognitive status and hearing aid outcomes1-5. Improvements in speech recognition ability as a result of amplification are well-documented6; however, benefits from hearing aids may differ significantly across individuals. As such, the relationship between cognitive status and hearing aid outcomes may be complex and multifaceted. In this work, we investigated associations between measures of cognitive status and hearing aid satisfaction. Methods
Participants
- Retrospective analysis of data collected from 61 hearing-impaired individuals who participated in hearing aid trials
- 24 males and 37 females, ranging in age from 55 to 84 years
- Mean age of male participants was 71.9 years and the mean age of female participants was 68.6 years

Qualification Testing
- All participants completed a qualification examination prior to participating in hearing aid research
- Qualification testing included, but was not limited to, audiometric testing, completion of the MoCA, and self-report of gender and age

Pure Tone Audiometry
- Four-tone audiometry was administered as part of the American Speech-Language-Hearing Association (ASHA) Guidelines for Manual Pure Tone Threshold Audiology (2005)7

LISTENING IN NOISE VERSUS SIGNAL (LISTENS)
- The total variance in MoCA scores explained by all variables combined into one model is approximately 51%

Language
- Improvements in language skills, such as auditory comprehension and vocabulary, are well-known effects of hearing aid amplification

Retrospective Analysis
- A series of multiple regression models were fit to examine the effect of all variables
- The variables included in the models were selected based on clinical significance and statistical significance

Summary and Conclusions
- Correlation analysis revealed significant correlations between MoCA scores and the following variables:
  - Age (r=0.45, p<0.001)
  - Male gender (r=-0.50, p<0.001)
  - HINT scores (multinomial: r=-0.46, p<0.001; adaptive: r=-0.46, p<0.001)
  - Age at onset (r=-0.46, p<0.001)
- Simple linear regression models suggest that each measured variable accounts for a small proportion of the variability in MoCA scores when considered on an individual basis
- A series of multiple regression models were fit to examine the effect of all variables
- Approximately 36% of the variance in MoCA scores can be explained by age, gender, and HINT score (Model A)
- Approximately 32% of the variance in MoCA scores can be explained by all variables (Model B)

Conclusions
- The apparent relationship between MoCA score and age, gender, and speech recognition in noise, point toward future opportunities in the prediction of a patient’s ability to realize clinical benefits from hearing aids. Further study is required to identify the factors that account for the variability in MoCA scores when considered on an individual basis.

Table 3. Descriptive statistics for MoCA scores and demographic information.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>61</td>
<td>70.3</td>
<td>8.0</td>
<td>55-84</td>
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<tr>
<td>Gender (Female)</td>
<td>37</td>
<td>15.9</td>
<td>0.9</td>
<td>0-20</td>
</tr>
<tr>
<td>Age Group</td>
<td>3</td>
<td>71-76 yrs</td>
<td>3</td>
<td>64-70 yrs</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>55-63 yrs</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Comparison of simple regression models and multiple regression models predicting MoCA scores for all variables (SII, HINT, MoCA, satisfaction ratings, gender, and age). Significant factors are noted by asterisk.

<table>
<thead>
<tr>
<th>Predictor B</th>
<th>SE</th>
<th>B SE</th>
<th>B SE</th>
<th>B SE</th>
<th>B SE</th>
<th>B SE</th>
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</thead>
<tbody>
<tr>
<td>SII</td>
<td>0.25***</td>
<td>0.04</td>
<td>0.19***</td>
<td>0.04</td>
<td>0.14***</td>
<td>0.04</td>
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<tr>
<td>HINT</td>
<td>-0.12***</td>
<td>0.04</td>
<td>-0.11***</td>
<td>0.04</td>
<td>-0.08***</td>
<td>0.04</td>
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<tr>
<td>PT A</td>
<td>0.45***</td>
<td>0.02</td>
<td>0.42***</td>
<td>0.02</td>
<td>0.37***</td>
<td>0.02</td>
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<tr>
<td>Age</td>
<td>0.65***</td>
<td>0.08</td>
<td>0.59***</td>
<td>0.08</td>
<td>0.50***</td>
<td>0.08</td>
</tr>
<tr>
<td>Gender (F)</td>
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<td>0.01</td>
<td>-0.02***</td>
<td>0.01</td>
<td>-0.01***</td>
<td>0.01</td>
</tr>
</tbody>
</table>

References

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Figure 1. Individual MoCA scores as a function of SII scores for the right ear at four Fit and Fit specifications. Lower regression lines are plotted.

Figure 2. Multiple regression models predicting MoCA scores for all variables (SII, HINT, MoCA, satisfaction ratings, gender, and age). Significant factors are noted by asterisk.