Choosing hearing aid technology for older adults: Are premium features better?

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Levels of Hearing Aid Technology

- Basic
- Mid-Level
- Premium
Some features differ for premium and basic hearing aids
The problem:

• Independent research has not demonstrated that use of premium-level technology results in better everyday user outcomes than use of basic-level technology.
Purpose

• This research evaluated exemplars of basic and premium hearing aid technology from two major hearing aid manufacturers with the goal of evaluating outcomes in the laboratory and in the real-world.
Outcome domains for lab tests and questionnaires (as used in daily life)

- Speech understanding
- Listening effort
- Localization
- Sound acceptability
Research Questions

In the laboratory and in daily life, are outcomes:

1. Better with hearing aids compared to without?

2. Better with examples of premium hearing aids compared to basic?
Participants

• 45 participants (30M, 15F)
• Age: 61 to 81 (M=70.3, SD=5.5)
• Symmetric mild to moderate sensorineural hearing loss
• English as first language
Hearing aid fittings

• Bilateral, with appropriate coupling
• Fitted using best-practice protocols, starting with NAL targets
• Features set to manufacturers’ recommendations.
• 3 manually selectable programs:
  – “everyday”- default automatic
  – “look and listen” - fixed front-facing directional
  – “speech finder” - for 360° listening
Statistical comparisons for each outcome measure

1. Unaided vs. aided (all HAs together).
2. Basic vs. premium (both brands together).
RESULTS
Speech understanding

Listening effort

Localization

Sound acceptability
How we measured speech understanding

- In three simulated environments with soft, average, & loud noise
- Participants repeated a keyword embedded in a carrier phrase.
- Responses were a 4 item forced choice format
- HA set to default automatic program
Is speech understanding improved with hearing aids?

- **Soft**
  - Unaided
  - Basic A
  - Basic B
  - Premium A
  - Premium B
  - *p < .001*

- **Average**
  - Unaided
  - Basic A
  - Basic B
  - Premium A
  - Premium B
  - *p < .001*

- **Loud**
  - Unaided
  - Basic A
  - Basic B
  - Premium A
  - Premium B
  - *p < .005*

- **Daily Life**
  - Unaided
  - Basic A
  - Basic B
  - Premium A
  - Premium B
  - *p < .001*
Is premium > basic?
Outcome: Speech Understanding

- Verified that amplification improves performance.
- No evidence to suggest that premium features (more channels, more programs, multiband directional microphone) further improve speech understanding compared to basic features.
Speech understanding

Listening effort

Localization

Sound acceptability
How we measured listening effort

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No effort</td>
</tr>
<tr>
<td>2</td>
<td>Very little effort</td>
</tr>
<tr>
<td>3</td>
<td>Little effort</td>
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<tr>
<td>4</td>
<td>Moderate effort</td>
</tr>
<tr>
<td>5</td>
<td>Considerable effort</td>
</tr>
<tr>
<td>6</td>
<td>Much effort</td>
</tr>
<tr>
<td>7</td>
<td>Extreme effort</td>
</tr>
</tbody>
</table>
Was aided listening easier than unaided?

Hard

Listening Effort

Hard

Easy

Listening Effort

Hard

Easy

Listening Effort

Hard
Was premium easier than basic?
Outcome: Listening Effort

• Supports previous research demonstrating easier listening with hearing aids.
• No evidence to suggest that premium features result in less listening effort than basic features.
Speech understanding

Listening effort

Localization

Sound acceptability
Testing localization in the lab
Localization in the lab: Do hearing aids change performance?

Quiet

Noise
Localization in the lab: Do premium features improve performance?

Quiet

Noise
Localization in daily life: is performance better with premium?

Reported benefit

Better

Worse

SSQ localization subscales

Basic A

BasicB

PremiumA

PremiumB

NS
Outcome: Localization

• Aided localization performance in the lab is similar to unaided performance.

• Premium-feature hearing aids outperformed the basic-feature hearing aids in the lab when high frequency stimuli were used and the test environment was quiet.

• This small difference did not translate to perceived improvement in daily listening.
Speech understanding

Listening effort

Localization

Sound acceptability
How we measured acceptability

• Live presentation of noise-makers.
• Acceptability based on the listener’s total impression of the sound.
• Judged on a scale from 0 to 10.
Are amplified sounds more/less acceptable in the lab (SAT test)?

**Transient (<1 sec)**
- More (p < .05)

**Episodic (1-5 sec)**
- Less (p < .1)

**Continuous (>5 sec)**
- Less (p < .05)
Are amplified sounds more/less acceptable with premium compared to basic?

Of 9 comparisons, 0 Statistically Significant
Are amplified sounds more/less satisfactory in daily life?

**Satisfaction With Loudness**

<table>
<thead>
<tr>
<th>Loudness Category</th>
<th>Unaided</th>
<th>Basic A</th>
<th>Basic B</th>
<th>Premium A</th>
<th>Premium B</th>
</tr>
</thead>
<tbody>
<tr>
<td>soft</td>
<td>4</td>
<td>4</td>
<td>3.5</td>
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<td>3.5</td>
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<td>3</td>
<td>3.5</td>
<td>3.5</td>
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<tr>
<td>loud</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**More**
- More ($p < .1$)
- More ($p < .05$)

**Less**

Legend:
- Green: Unaided
- Red: Basic A
- Pink: Basic B
- Blue: Premium A
- Light Blue: Premium B

Significance levels noted with stars for $p < .05$.
Are amplified sounds more/less satisfactory with premium?
Are sounds in daily life more acceptable with premium HAs?

**Bar Chart**

- **Basic A**
- **Basic B**
- **Premium A**
- **Premium B**

The chart shows a comparison of Pleasantness/Comfort levels across different hearing aids (Basic A, Basic B, Premium A, Premium B) with the label **APHAB(AV)+DOSO**. The x-axis represents the level of Pleasantness/Comfort, ranging from 0 to 10, and the y-axis indicates whether the sounds are perceived as **More** or **Less** acceptable. The chart indicates a non-significant (NS) comparison between the groups.
Outcome: Acceptability

- No evidence that premium features resulted in greater acceptability, satisfaction with loudness, pleasantness or comfort than basic features.
Summary

• Modern hearing aids are amazing devices.
  – For these participants, hearing aids
    • improved speech understanding,
    • reduced listening effort,
    • maintained or improved localization performance,
    • improved acceptability of everyday non-speech sounds in daily listening.

• But premium-feature hearing aids mostly did not result in further improvements compared to basic–feature devices.
Summary

• These results are extremely compelling.
  – We implemented a broad scope of outcomes, paid careful attention to optimizing all hearing aid fittings, and designed lab tests that favored premium capabilities when possible.
  – Yet there was only 1 difference where performance with premium was statistically better than basic.
    • This small difference, found in the lab, did not translate to perceived benefit in the real-world.
These findings apply for...

• People like those included in our study.
  – Older adults
  – Mild to moderate, uncomplicated, adult-onset, sensorineural hearing loss
  – All participants were recruited from the Memphis metropolitan area

• No evidence to suggest that the sample was different from the population
These findings apply for...

• Devices like those included in our study.
  – This is a comparison of select technologies at a given moment time.
    • 2 brands of BTE aids from two manufacturers, released into the market in 2011.
  – Currently, cost of premium > basic, but we have presented evidence that these devices did not result in better performance for typical older hearing aid candidates.
  – We do not claim that this outcome will hold for all brands of all manufacturers at all points in time; however, payers should remain skeptical about device benefits without independent proof of real-world effectiveness.
Considerations

• These findings do not indicate that advances in hearing aid technology are not of significant value.

• There is evidence of improved patient experiences with hearing aid technology over time. (e.g., MarkeTrak IX; Abrams & Kihm, 2015)

Considerations

• Trained audiologists are equipped with the skills and knowledge necessary to provide competent professional best hearing health care practices.

• Yet, today’s hearing aid fitting practices are shaped by:
  • A lack of current, independent evidence about the effectiveness of hearing health devices
  • Concerns about the financial practicality of providing evidenced-based rehabilitative services.
    – Reimbursement tied up with cost of devices
    – Only those who can pay out-of-pocket are allowed access to care

• Change is needed.
Recommendations

• The professional community needs better evidence and will require support to facilitate change.

• Best-practice rehabilitation services, including hearing aid selection and fitting practices, should be unbundled from the cost of the device, and should be reimbursable.

• There should be more demand from payers for independent proof of the extent to which specific hearing aids help patients.
  – Need a lab, not funded by manufacturers, that will establish the effectiveness of these medical devices.
Acknowledgement

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