LEFT TO THEIR OWN DEVICES?

*What the evidence tells us about self-fitting hearing aids*

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WHAT ARE SELF-FITTING HEARING AIDS?

Hearing aids that are set up for the user, by the user

Physical fit
- Ear tip size
- Tube length

Hearing test
- User-directed
- In situ

Fitting formula
- Automatic
- First fit

Fine-tuning
- User-directed
- Real world
COMMERCIAL AVAILABILITY

SoundWorld Solutions
- 16-channel WDRC, noise suppression, feedback cancellation
- Directional microphones
- Bluetooth connection to self-fitting app
- Rechargeable batteries, retractable tubing, 3 ear tip sizes

iHear Medical
- 4-channel WDRC, noise suppression, feedback cancellation
- USB programmer with cables
- Variety of ear tip sizes
- Hearing test with ambient noise sensing, calibrated earphones
POTENTIAL BENEFITS OF SELF-FITTING

Accessibility
For rural and remotely located people in developed countries; for parts of the developed world that lack an audiological infrastructure

Affordability
Less expensive than conventional hearing aids, since there are no professional service fees

User control
Ability to make permanent adjustments to the hearing aid settings in real time and in real-world listening environments
PRESENTATION ROADMAP

Technical Specifications

Interface and Usability

Clinical Support

Fitting Outcomes

Infrastructure and Service Delivery
PHYSICAL DESIGN CONSIDERATIONS

Physical fit modifications under user control

Automatic diagnostic test of LF leakage to ensure correct ear tip size and placement

Reliable and valid *in situ* audiometry algorithm

Correction factors for transducer, coupling, ambient noise, residual LF leakage

Integration of quality checks to ensure valid audiometric thresholds

Automatic application of fitting rationale

Margolis et al. (2007), Keidser et al. (2011), Convery et al. (2015)
Task: Assemble and insert a pair of RIC-style hearing aids

Participants with lower health literacy levels were significantly less likely to succeed.

Health literacy was not a significant predictor of the outcome...

...despite significantly lower levels of health literacy in this sample.
**Overall Task** | **Insertion % Correct**
--- | ---
Assemble and insert a pair of RIC-style HAs | 46
Insert pair of RIC-style HAs and perform *in situ* audiometry | 64
Full self-fitting setup with prototype self-fitting HAs | 58
Full self-fitting setup with commercial self-fitting HAs | 80

*Convery et al. (2011, 2015, 2016, Unpublished Data)*
Step 3 – Insert the hearing aids

1. Place the hearing aid behind your ear, hanging the tube and earpiece over the front of your ear.

2. Insert the ear tip all the way into your ear canal.

3. The ear tip should fit snugly and comfortably in your ear.

4. Do these steps for both ears.

Note: The insertion video (and all other self-fitting instructional videos) can be found at http://diy.nal.gov.au

“Click the black rectangle to watch a video about inserting your hearing aids.”
USER INTERFACE

- More processing power
- Visual interface
- Multifunctional (not just for HAs)
- Existing ownership
- Conversant with only one or two functions
- “Hand-me-downs” from younger family members
- Low penetration among prime HA demographic
Task: Set up a pair of self-fitting hearing aids

<table>
<thead>
<tr>
<th>PHYSICAL HANDLING</th>
<th>USING THE APP</th>
</tr>
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<tbody>
<tr>
<td>Identify L &amp; R HAs</td>
<td>Pair HAs to phone</td>
</tr>
<tr>
<td>Choose ear tips</td>
<td>Assign ears in app</td>
</tr>
<tr>
<td>Adjust tubes</td>
<td>Test hearing</td>
</tr>
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<td>Insert HAs</td>
<td>Practice fine-tuning</td>
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<table>
<thead>
<tr>
<th>Step</th>
<th>% Correct</th>
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<tbody>
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<td>Identify L &amp; R HAs</td>
<td>97</td>
</tr>
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<td>87</td>
</tr>
<tr>
<td>Insert HAs</td>
<td>80</td>
</tr>
<tr>
<td>Pair HAs to phone</td>
<td>58</td>
</tr>
<tr>
<td>Assign ears in app</td>
<td>42</td>
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<td>Test hearing</td>
<td>63</td>
</tr>
<tr>
<td>Practice fine-tuning</td>
<td>80</td>
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</table>
CLINICAL SUPPORT

Layperson
Lacks necessary expertise

Trained clinical assistant

Audiologist
Perhaps overqualified?
<table>
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<th>Step</th>
<th>With clinical assistant help (% correct)</th>
</tr>
</thead>
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<td>91</td>
</tr>
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Convery et al. (2016)
OVERALL PERFORMANCE

68% Successful

Completed the self-fitting task independently, using the instructions only

OR

Correctly identified specific difficulties and sought help with them from the clinical assistant

32% Unsuccessful

Did not complete the self-fitting task

OR

Source(s) of error were identified opportunistically by the clinical assistant, not by the participant

N = 60
PREDICTORS OF SUCCESS

A person who is successful at setting up a self-fitting hearing aid is...

32 times more likely to own a smartphone or tablet
20 times more likely to have previous experience with conventional hearing aids

These two variables correctly classify 75% of cases

A successful self-fitter also has...

A less external health LoC
Better self-management skills
Higher HA self-efficacy
Better problem-solving skills

All six variables correctly classify 80% of cases
Self-fitting HAs provided significantly more gain at and below 3000 Hz

- Fitting rationale differences
- Fine tuning differences: only the self-fitting HAs allowed adjustment of the frequency response shape
- Partial contributor: overestimation of 500 Hz threshold by in situ audiometry algorithm (10 dB)
SPEECH DISCRIMINATION

No significant difference in speech reception threshold

<table>
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<th>Condition</th>
<th>SRT$_{50}$ (dB SNR)</th>
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<tbody>
<tr>
<td>Self-fitting HA</td>
<td>-0.14</td>
</tr>
<tr>
<td>Conventional HA</td>
<td>-0.55</td>
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</table>

$N = 22$
Conventional HAs were rated as significantly better at improving communicative confidence and reducing requests for repetition.

Conventional HAs were rated as significantly more physically appealing.

Conventional HAs were rated as significantly more satisfactory overall.
Self-fitting HAs were rated significantly more beneficial in background noise.

Conventional HAs were rated significantly more beneficial in the presence of aversive or uncomfortably loud sounds.

Self-fitting HAs were rated as significantly more beneficial overall.
SELF-FITTING IN CLINICAL PRACTICE?

**Why offer?**
- Additional option to appeal to a wider/more diverse array of clients
- Increase geographic reach
- Free up time to carry a larger caseload, see more complex clients, meet psychosocial needs

**Why choose?**
- Receive a proper assessment of candidacy – and alternative options
- Option of receiving rehabilitative support from an audiologist
- Less costly than conventional hearing aids

**“How do I get my husband to look at me when he’s speaking?”**

**“What do I say when my friends see my hearing aids?”**
ACKNOWLEDGEMENTS

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