Ecological momentary assessment and its potential as future clinical tool

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- Rehabilitation outcomes for adults with hearing impairment
- Intervention options for adults with hearing and balance issues
- Implementation of family-centred care in audiology
- New approaches in mHealth and teleaudiology.
What is Ecological Momentary Assessment (EMA)?

Using EMA in research

EMA as a clinical tool
Measuring hearing impairment

- Audiometry shows hearing acuity
- Low correlation with self-reported hearing difficulties, esp for mild hearing impairment

- Self-report gives better insight into activity limitations and participation restrictions

Self-report measures

- Traditional self-report measures require input from the participant based on his/her memory and experience of select listening situations, often generalized across listening situations.

Compared to using no hearing aid at all, do your hearing aids help you understand the people you speak with most frequently?
Self-report measures

- Ecological Momentary Assessment (EMA) captures data about experiences in real time, in participants’ natural environments.

Happiness study

Over one million responses from more than 20,000 participants.

What is EMA?

Surveys of current experiences in real time and at multiple times per day.

- Used across many health disciplines to investigate chronic conditions e.g., pain, substance addiction, eating disorders, and mental health disability.
- Also called experiential sampling.
- Can yield a large number of reports per participant and allow for investigation of variability between and within individuals.
- Use of smartphones increases reliability.
- Valid and relevant for audiology research.

In 91% of listening events participants rated their percentage of speech understanding as either 75% or 100%.

In 67% of listening situations, participants reported that listening effectively required effort.
Using EMA to measure hearing aid benefit

The most common intervention for adults with mild hearing impairment is the provision of hearing aids.

Some audiologists adopt a ‘wait and retest’ approach rather than provide hearing aids.

Research question:

Can hearing aids provide benefit for adults with a mild hearing impairment in daily life, as measured by EMA?
**Participant characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Age (years)</th>
<th>Sex</th>
<th>Length of hearing difficulties (years)</th>
<th>Confidence in managing HAs</th>
<th>Attitude to HAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>71</td>
<td>Female</td>
<td>2</td>
<td>Quite a bit</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>73</td>
<td>Male</td>
<td>10</td>
<td>Quite a bit</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>Female</td>
<td>9</td>
<td>Quite a bit</td>
<td>-3</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>Male</td>
<td>17</td>
<td>Quite a bit</td>
<td>-1</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
<td>Male</td>
<td>8</td>
<td>Extremely</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>81</td>
<td>Female</td>
<td>15</td>
<td>Somewhat</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>71</td>
<td>Female</td>
<td>7</td>
<td>Quite a bit</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>57</td>
<td>Male</td>
<td>20</td>
<td>Extremely</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>72</td>
<td>Male</td>
<td>6</td>
<td>Quite a bit</td>
<td>0</td>
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<td>Male</td>
<td>4</td>
<td>Extremely</td>
<td>-2</td>
</tr>
</tbody>
</table>

† Target: 3 EMA surveys/day, 16 questions about listening activity, characteristics of the listening event and hearing performance.
**EMA survey - listening event**

Listening activity, and characteristics of the listening situation and acoustic environment, e.g.,

<table>
<thead>
<tr>
<th>What were you listening to?</th>
<th>Conversation, 3 people or fewer</th>
<th>Conversation, 4 people or more</th>
<th>Speech listening, live</th>
<th>Speech listening, media</th>
<th>Conversation on phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were you familiar with the speaker(s)?</td>
<td>Unfamiliar</td>
<td>Somewhat unfamiliar</td>
<td>Somewhat familiar</td>
<td>Familiar</td>
<td></td>
</tr>
<tr>
<td>On average, how noisy was it during the listening event?</td>
<td>Quiet</td>
<td>Somewhat noisy</td>
<td>Noisy</td>
<td>Very noisy</td>
<td></td>
</tr>
</tbody>
</table>
**EMA Survey – hearing performance**

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average, how much <strong>speech</strong> did you understand during the listening event?</td>
<td>0% 10% ........ 90% 100%</td>
</tr>
<tr>
<td>On average, how much <strong>effort</strong> did you have to put in to listen effectively?</td>
<td>No effort Some effort Moderate effort Quite a bit of effort A lot of effort</td>
</tr>
<tr>
<td>Do you feel that any difficulty with your hearing negatively affected or <strong>hampered communication</strong> during this listening event?</td>
<td>Not at all A little Moderately Quite a bit Very much</td>
</tr>
<tr>
<td>Do you feel your hearing negatively affected your <strong>enjoyment</strong> of this listening event?</td>
<td>Not at all A little Moderately Quite a bit Very much</td>
</tr>
</tbody>
</table>
Results

A total of 860 listening event surveys collected from the 10 participants (mean= 67.4, range = 43 – 112 per participant)

- Conversation, 3 or fewer: 4% + 1% = 5%
- Speech listening - media e.g. TV/radio: 6%
- Conversation 4 or more: 15%
- Telephone conversation: 22%
- Speech listening - live e.g. seminar: 52%
- Non-speech listening e.g. music: 74%

► Participants were predominantly in non-complex listening situations.
Effect size calculation of benefit

Benefit effect size = scores baseline (no HA) vs intervention (HA)

Four hearing performance dimensions: speech understanding, listening effort, communication impact and listening enjoyment.

Benchmarks for effect sizes from:
As a group, participants reported small benefit from hearing aid for all four dimensions.
Individual hearing aid effect size

- Better speech understanding
- Reduced listening effort
- Communication less hampered by hearing difficulties
- Increased listening enjoyment

Effect sizes:
- Large
- Medium
- Small
Conclusions

• Mild hearing impairment may have little bearing on speech understanding in common (non-complex) real-world listening events, but greater impact on other aspects that affect daily communication.

• Real-world data can be used to highlight individualised hearing aid benefit, a need for further counselling, or hearing aid modifications.

Hearing aid outcome goals for adults should include more aspects than only improved speech understanding.
Smartphone-based EMA as clinical tool

- Smartphone-based EMA is a prime example of a potential mHealth tool with relevant clinical benefits.
- Smartphone and tablet ownership is increasing in all age groups.

EMA can support the entire patient journey

- EMA can be used when goals or outcomes change
- EMA can alert audiologists to provide assistance
- EMA can inform audiologists which adjustments are required
- EMA can give insight into candidacy and specific hearing difficulties
- EMA can guide individualized goal setting
EMA can:

• Collect real-world information, about situations relevant to the individual.
• Gain information about dimensions beyond speech understanding which can affect communication and well-being.
• Provide insights other measures can’t.
• Be easily individualized.
• Support the individual in self-management.
• Be a valuable mHealth clinical tool in future.
Thank you

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