Knowledge is power: using eAudiology to improve hearing-related knowledge for patients, partners and professionals

Melanie Ferguson, PhD
NIHR Nottingham Biomedical Research Centre
Nottingham, UK
Overview

• Introduction: hearing-related knowledge is poor
• Participatory approach to eHealth education (C2Hear)
• Evaluation of C2Hear for patients
• Research into practice
• Including others: partners and professionals
• Development and evaluation of individualised learning
Self-management of long-term conditions enhances healthcare

- Those who take an active role in their care are more likely to adopt better health behaviours and have better outcomes
  
  (Mosen et al, 2005)

- Provision of education to improve knowledge
- Strategies to support adherence to treatment
- Tailoring of practical support
- Social support e.g. partners, peers, professionals

  (Taylor et al 2014)

- Audiology: knowledge exchange and patient education
  → self-management and patient-centred care
- NICE guidelines on hearing loss recommend that good quality information is provided to patients and their family

  (Grenness et al, 2016; Barker et al, 2016; NICE 2018)
Question

If you are an audiologist

• How confident are you that the information and advice you offer your first-time hearing aid patients is

  • understood
  • absorbed
  • and then acted upon

once they leave the comfort of your clinic room?
Delivery and retention of information in new hearing aids users is poor

“You get a lot of information …by the time you get home, you’ve forgotten most of it.”
51% found difficulties using aid at first

25% of information at fitting forgotten 6 weeks later: closed set

Retention of information in first-time hearing aid users after 6 weeks, free recall
Overall = 49.6%: practical = 62.9%, psychosocial = 34.3%

(AoHL Hear Me Out, 2011)
(Reese & Hnath-Chisolm, 2005)
(El-Molla et al, BAA, 2012)
Knowledge of all things hearing is poor

- Patients, public, practitioners
  - Experienced hearing aid users
    - hearing aids and how to use them - poor to excellent
    - 60-80% did not know how to use the telephone

Hearing aid non-use

Costs: financial - individual and healthcare systems
  person with hearing loss = communication difficulties
  → reduced social interaction → poorer QoL

- Health context
  - better knowledge increases patient satisfaction and treatment compliance

- Hearing aid users have a desire for additional information
  - both before and after the fitting appointments

(Desjardin & Doherty, 2009)
(Goggins & Day, 2003)
(Murray et al, 2005)
(Laplante Levesque et al, 2013; Kelly et al, 2013)
Question to audiologists:
I am confident that the information given is remembered and acted upon by my hearing aid patients

- Only one-third reported they were confident

(Hajat, 2016)
Remote delivery of supplementary information and advice to patients

- Home-communication program – video tapes
  
- Education program
  - written, telephone follow-up
  - internet delivery, email feedback
  
- I-ACE (Individualised Active Communication Enhancement)
  
- One-way delivery of information is not the same as educating the patient to increase their knowledge base
Learning requires more than just giving information

Constructivist learning theory

Promotion of learning occurs when:
- learners construct an internal representation by taking an active role
- interactivity with learning materials is high

(Zhang et al, 2006)
Re-usable learning objects (RLOs)

Commonly used in eLearning environments

Interactive multimedia clips

Highly visual illustration of concepts support learning goal

Self-assessment – a test of mastery of content

Activity and engagement with the content

- Participatory approach → high quality materials aligned to the user’s needs
- Improve motivation and compliance with health treatments
HEAR-IT study

Q: Do video tutorials (or RLOs) *supplement* advice and information provided by audiologists and result in enhanced benefit and use for hearing aid users?

1. To *develop* a series of reusable learning objects (RLOs)
   - range of auditory rehabilitation subjects
   - accessible to hearing aid users and their families

2. To *evaluate* the benefits and cost-effectiveness of the RLOs

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Randomised controlled trial

RLO+  or  RLO-
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Research for Patient Benefit

*inspired by patients and practice*
Participatory approach to developing eHealth education
Participatory approach: to identify content

Delphi review → Workshops → RLO content

Consensus
n=33 Hearing Healthcare professionals

n=33 hearing aid users
n=11 audiologists

(Ferguson et al, Int J Audiol, 2018)
Participatory approach: to develop RLOs

(Ferguson et al, Int J Audiol, 2018)
Based on educational principles

Each reusable learning object (RLO) has:

• Learning outcomes
• Subtitles
• Reinforcement and consequences
• Variety of images
  • Photos, animations, videos, patient testimonials
• Interactive quiz
• Problems? go back to audiology

(Ferguson et al, Int J Audiol, 2018)
Acclimatisation: demonstration of the concept

Learning outcome: be aware of how you adapt to listening with your hearing aids
Based on educational principles

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(Ferguson et al, Int J Audiol, 2018)
Hearing aid insertion

Reinforcements and consequences: “recognise the shape of your earmould with the shape of your ear”
Based on educational principles

Each reusable learning object (RLO) has:

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  • Photos, animations, videos, patient testimonials
• Interactive quiz
• Problems? go back to audiology

(Ferguson et al, IJA, 2018)
Testimonials: communication partners

“hearing loss is not visible in anyway”
Based on educational principles

Each reusable learning object (RLO) has:

• Learning outcomes
• Subtitles
• Reinforcement and consequences
• Variety of images
  • Photos, animations, videos, patient testimonials
• Interactive quiz
• Problems? go back to audiology

(Ferguson et al, IJA, 2018)
Interactive quiz: Q&A

Select the statement: that is the correct action if you experience pain or discomfort from your earmould

(a) Continue to wear the hearing aid despite the pain.

(b) Contact Audiology- there may be a problem with the fitting of the earmould.

(c) Give up wearing the hearing aid.
The correct answer is b

The earmould may feel strange to begin with, however there should be no pain or discomfort.

The audiologist may need to re-shape the earmould or re-instruct you.
The final product and its delivery

- Introduction
- Getting to know
- Insertion
- Expectations
- Acclimatisation
- Comm. tactics
- Phone
- Troubleshooting

51% 15% 33%

PC use 85% 36%
Internet use 66% 17%

(Henshaw et al, J Med Int Res, 2012)
Evaluation of interactive multimedia RLOs
Evaluation of effectiveness (RCT) n=203

Take-up and adherence

Self-management

HA knowledge & skills

HA use

Valued by users

Health economics

(Ferguson et al, Ear Hear, 2016)
RLO re-use suggests self-management

<table>
<thead>
<tr>
<th>RLO title</th>
<th>% watched 2+</th>
<th>% watched 3+</th>
<th>Useful (0-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acclimatisation</td>
<td>55</td>
<td>21</td>
<td>9.2</td>
</tr>
<tr>
<td>Getting to know HA</td>
<td>55</td>
<td>27</td>
<td>9.1</td>
</tr>
<tr>
<td>Insertion of HA</td>
<td>52</td>
<td>24</td>
<td>9.0</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>51</td>
<td>25</td>
<td>9.0</td>
</tr>
<tr>
<td>Expectations</td>
<td>48</td>
<td>19</td>
<td>8.9</td>
</tr>
<tr>
<td>Phones and ALDs</td>
<td>44</td>
<td>19</td>
<td>8.8</td>
</tr>
<tr>
<td>Communication</td>
<td>39</td>
<td>19</td>
<td>8.5</td>
</tr>
</tbody>
</table>

*(Ferguson et al, Ear Hear, 2016)*
RLO+: better knowledge of hearing aids and communication

20 item questionnaire; free recall 6 weeks post-fitting

Highly significant effect of group
- total, practical, psychosocial (p<.001)
- generally large effect sizes

Error bars = mean +/- 95% CI

(E.S. Cohen’s d
≥ 0.8 large
≥ 0.5 moderate
≥ 0.2 small)

(Ferguson et al, Ear Hear, 2016)
RLO+: better practical hearing aid handling skills

Practical Hearing Aid Skill Tasks: 18 items

Highly significant effect overall (p<.001)
- earmould clean and phone use (p<.001)
- moderate effect sizes

E.S. Cohen’s $d$
\[ \geq 0.8 \text{ large} \]
\[ \geq 0.5 \text{ moderate} \]
\[ \geq 0.2 \text{ small} \]

(Ferguson et al, Ear Hear, 2016)
RLO+: hearing aid use greater in those who do not wear them all the time

Glasgow Hearing Aid Benefit Profile: 4 situations

Use < 70%
- Significant effect (p<.05)
- 15% difference
- $d = .88$ large effect size

No effect on outcomes for benefit, satisfaction, anxiety, depression

(Ferguson et al, Ear Hear, 2016)
Positive feedback on RLOs

- Gave me confidence to use HAs and communicate 83% 2%
- If I had a problem I would refer back to RLOs 93% 5%
- Quiz was valuable to show me what I’d learned 86% 2%
- Prefer RLOs to written information 83% 7%

(Ferguson et al, Ear Hear, 2016)
RLOs are effective

<table>
<thead>
<tr>
<th>Take-up and adherence</th>
<th>Self-management</th>
<th>HA knowledge &amp; skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Take-up = 78%</strong>&lt;br&gt;94.3% watched all RLOs</td>
<td><strong>2+ times = 49.9%</strong>&lt;br&gt;Re-use suggested self-management</td>
<td><strong>Better knowledge on HAs and communication &amp; HA handling skills</strong></td>
</tr>
</tbody>
</table>

**HA use**

Greater use (GHABP) in suboptimal users

**Valued by users**

Rated RLOs as highly useful (9/10)<br>Improved confidence<br>Preferable to written info

**Health economics**

RLOs were a very effective and cheap healthcare intervention

*(Ferguson et al, Ear Hear, 2016)*
Early delivery improves self-efficacy

Measure of Audiological Rehabilitation for Self-efficacy for Hearing Aids (MARS-HA): 20 items

- Early delivery of C2Hear ‘primes’ patients for their hearing aid fitting

(Gomez & Ferguson, in prep)
**Underlying processes**

**Contextual factors**
- Anything external to the intervention that informs why the intervention works

  - Greater hearing aid self-efficacy predicted:
    - Greater use
    - Reduced emotional consequences of hearing loss (e.g. anxiety)
    - Greater hearing aid handling skills and knowledge

**Causal mechanisms**
- Also known as mechanisms of impact, refers to how the intervention elicits its effects

  - Improved hearing aid handling skills and knowledge led to:
    - Greater use, benefit and satisfaction
    - Reduced emotional consequences of hearing loss (e.g. anxiety)
    - Increased patient activation

(Maidment et al, Int J Audiol, submitted)

Research into practice
Getting C2Hear out there

- 4x increase in second year, ~6000/month
- Views from >50 countries: 38% UK  38% N America
- Used in UK audiology departments, on ~30 websites
- Included in national guideline documents
- Research Impact awards

Just google ‘C2Hear Online’ and select ‘YouTube’ option
What the end-users say

“if it wasn’t for the DVD I would have stopped wearing my HAs”

“some were in 2 minds if they wanted HAs..... were reassured and referred themselves”

“some have undertaken repairs at home reducing need to attend the drop-in clinic”

“It’s a fab thing you have done”
What is mHealth?

- Delivers healthcare by mobile technologies
- A subgroup of telehealth, ehealth and telemedicine
Mobile technology use is increasing in older adults

### Smartphone ownership in 55+ year olds

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2014</th>
<th>2016</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All adults</td>
<td>66</td>
<td>72</td>
<td>9</td>
</tr>
<tr>
<td>55-64</td>
<td>49</td>
<td>59</td>
<td>20</td>
</tr>
<tr>
<td>65-74</td>
<td>26</td>
<td>39</td>
<td>50</td>
</tr>
<tr>
<td>75+</td>
<td>7</td>
<td>15</td>
<td>115</td>
</tr>
</tbody>
</table>

(Deloitte, 2017)
Internet-smartphone mode of delivery (mHealth): benefits

- Overcome barriers
time, mobility, geography
  → Greater accessibility

- Easy access and convenience
  → Empowerment

- Personalised tailored information to meet individual’s needs
  → Better knowledge and understanding

- Interactive, enabling self-monitoring and self-evaluation
  → Greater engagement and self-management

- Social network opportunities
  → Increase social support

- Limited healthcare resources
  → Low cost, high volume, new service delivery models

- Training healthcare workers
  → Increase awareness of hearing loss

and more.....
Including others: partners, professionals
mRLOs for communication partners

- Support and involvement from others improved outcomes  
  \[\text{(Scarinci et al, 2008)}\]

- Aligned coping strategies between people with hearing loss and their family and friends → positive effect and improved outcomes  
  \[\text{(Barker et al, Int J Audiol, 2017)}\]

- Focus groups suggested that CPs would value information relevant to them  
  \[\text{(Ferguson et al, Ear Hear, 2016)}\]

- Repurposed Communication Tactics RLO for ‘others’
  - Designed specifically for mobile-technologies (e.g. smartphones, tablets)
  - Added more activities
Additional activities I

Controlling the environment – restaurant

Choose the best location to hear conversation as well as possible

There are some disadvantages to sitting here:

<table>
<thead>
<tr>
<th>Plenty of light</th>
<th>Noise from the restaurant entrance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small table; the distance between people is less</td>
<td>Music from the piano</td>
</tr>
<tr>
<td>Sitting opposite each other</td>
<td>Music from the speaker</td>
</tr>
<tr>
<td></td>
<td>Wooden floor</td>
</tr>
</tbody>
</table>

There are many advantages to sitting here that would make conversation easier:

- Small table; the distance between people is less
- Sitting in close proximity to each other
- Carpeted floor
- Booth
- Curtains on the window
- No competing sound source
Additional activities II

How do I work with others to help me take part in conversations?

Hearing problems and solutions activity

Here are some situations you might recognise with suggested solutions.

Activity: Drag which solution you think would be best to each problem.

- Helps communication
- Doesn't help communication

Options: Face the person, Attract attention, Speak clearly, Be patient, Answering for others, Covering your face, Shouting, Talking from a different room
Joint-working between partners

Think aloud and video analysis

(Henshaw et al, BSA, 2017)
Greatest impact for joint-working

- Increased CP’s hearing-related knowledge, and highlighted difficulties faced by the PHL
  
  “I expected the hearing aids to bring his hearing back to normal... I understand better now” (CP)
  
  “It’s rather nice for them to fully appreciate [the challenges]” (PHL)
  
- Prompted novel discussions about challenging everyday communication situations
  
  “I never thought about that...out in traffic... Did you hear me?” (CP)
  
  “When I’m at the golf club it’s terrible, when you get 12 people around the table” (PHL)
  
- CPs would change their behaviour to help improve communication based on their learning
  
  “That’s what we shall look for [a quiet restaurant table]” (CP)
  
  “We are both on the same wavelength, we can look for it now” (PHL)

(Henshaw et al, BSA, 2017)
Residential carehome staff: knowledge and practical hearing aid skills improve

$n = 25$ care home staff  
$n = 3$ homes

**Knowledge of hearing aids and communication**

Significant pre-post improvement $p < .001$; $d = 3.6$

“This should be made mandatory at induction with annual refresher sessions”

**Practical hearing aid skills**

Significant pre-post improvement $p < .001$; $d = 3.3$

“Awareness of hearing aids has definitely gone up with all of us”

* (Rocks & Ferguson, BAA, 2013)
Question to audiologists:
I am confident that the information given is remembered and acted upon by my hearing aid patients

- Vast majority were more confident

(Hajat, 2016)
mRLOs tailored for hearing aid users (m2Hear)
Phase 1: Development of m2Hear

Theoretical underpinning COM-B model

- Domains: e.g. physical skills, reinforcement, capabilities

Think Aloud Analysis
- User involvement

Data tags
- e.g. physical skills, reinforcement, capabilities

Individualisation

COM-B model

- Capability
- Motivation
- Opportunity

Behaviour

Behaviour→ hearing aid use

(Michie et al., 2011)
‘Active ingredients’ of m2Hear

- Identified which aspects of the Theoretical Domains Framework (TDF) are present in each RLO → mapped onto the COM-B model

*How to insert your hearing aids*

(Maidment et al., in prep)
Welcome to m2Hear

Please select your hearing aid type

Open fit

Custom earmould

Using your hearing aids

Getting used to your hearing aids

Looking after your hearing aids

Communicating with others

Using phones and other devices
Individualised information to meet user’s needs

Mel - You have selected information on **Getting used to your hearing aids.**

Back

What can I expect when wearing hearing aids for the first time?

How do I get used to wearing my hearing aids?

How can I get used to wearing my hearing aids?

You may wish to become familiar and comfortable with the sounds in your own home at first.
Individualised information to meet user’s needs

How do I clean my hearing aid ear tip and tubing?

Drag the pictures to show the correct order for cleaning your open fit ear tip and tubing. Select each picture to see a description.

- **Step One**
  - That's correct! The tubing and hearing aid must be separated. The tubing should be cleaned weekly or when there is a visible obstruction to maintain the sound from the hearing aid. Make sure to keep the hearing aid well away from water!

- **Step Two**

- **Step Three**

Drag and drop
Improved outcomes for m2Hear

<table>
<thead>
<tr>
<th>Outcome</th>
<th>c2Hear RLO+ (n=79)</th>
<th>m2Hear (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing aid data logging (max hours/day)</td>
<td>8.0 (4.6)</td>
<td>9.8 (4.5)</td>
</tr>
<tr>
<td>System Usability Scale (≥68 above avg)</td>
<td>-</td>
<td>79.9 (5.6)</td>
</tr>
</tbody>
</table>

Average uMARS score
(0=poor, 5=excellent)

<table>
<thead>
<tr>
<th>Average uMARS score</th>
<th>C2Hear CP RLO</th>
<th>m2Hear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall App Quality</td>
<td>3.6</td>
<td>4.2</td>
</tr>
<tr>
<td>Engagement</td>
<td>3.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Functionality</td>
<td>3.8</td>
<td>4.4</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>3.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Information</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Subjective App Quality</td>
<td>3.3</td>
<td>4.1</td>
</tr>
<tr>
<td>Star Rating</td>
<td>3.7</td>
<td>4.0</td>
</tr>
<tr>
<td>Perceived Impact (Behaviour Change)</td>
<td>3.6</td>
<td>4.3</td>
</tr>
</tbody>
</table>

uMARS = user version Mobile Application Rating Scale
m2Hear viewed positively by user's

I was glad to be able to use m2Hear to help me remember things.

It was great that I could check things quickly, especially if I had forgotten something the audiologist told me.

It was easy to follow and well-structured. The information was clear and concise.
Summary of eHealth developments

November 2015
Freely available online

2016/17
mRLOs for communication partners

2017/18
mRLOs tailored for hearing aid users

(Ferguson et al, ASHA Perspectives SIG 7. submitted)
Take home messages

- eAudiology via remote technologies provides patient benefit by improving:
  - Knowledge
  - Handling skills
  - Self-management
  - Hearing aid use
  - Self-efficacy
  - Valued by users

- Knowledge is power – and a mechanism of impact - leading to:
  - Better hearing aid outcomes, reduced psychosocial effects (e.g. anxiety), and greater patient activation

- The future is the 3 I’s – individualisation, interactivity and inclusivity

- Involving partners in ‘joint-working’ with C2Hear prompts novel discussions about challenging communication leading to behaviour change in partners

  “technology works best when it brings people together”

(Matt Mullenweg)
Thanks to ..... 

Clinical and academic colleagues

Patient panels

Mild-moderate hearing loss team

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References


Hajat, T. (2016). *Exploring the views of audiologists on the effectiveness of C2Hear for better information retention and knowledge on hearing aids for first time hearing aid users.* (BSc Audiology), De Montfort University.


