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# Evidence-based interventions for adult aural rehabilitation: that was then, this is now

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Nottingham, UK

Canadian Academy of Audiology, Niagara Falls, 19th October 2018

# That was then…

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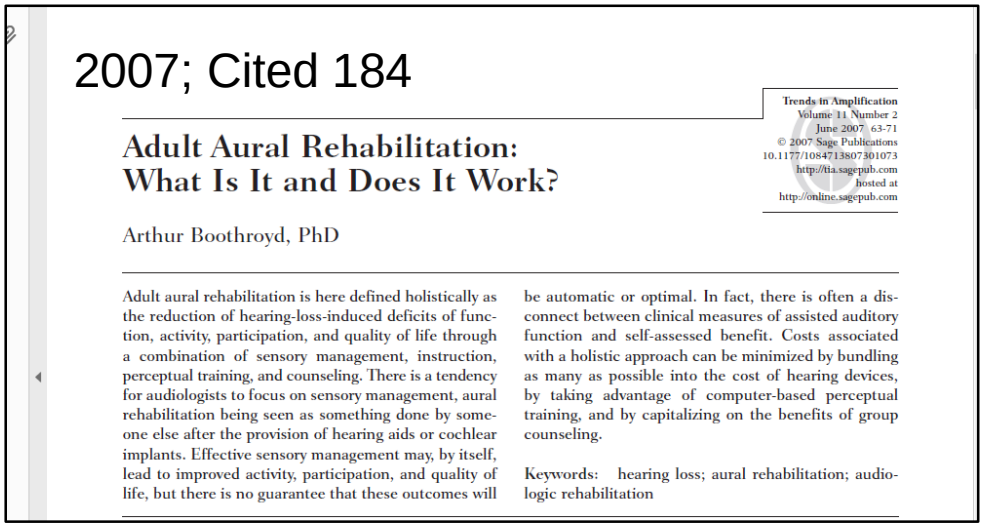

2007; Cited 184

Trends in Amplification
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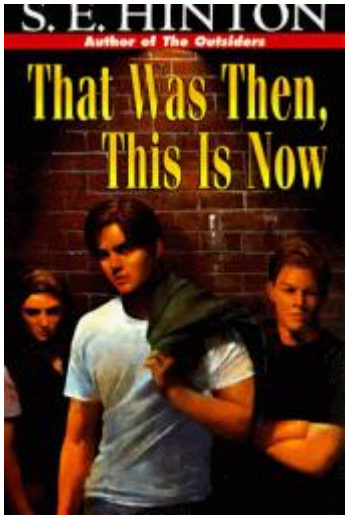
## Adult Aural Rehabilitation: What Is It and Does It Work?

Arthur Boothroyd, PhD

Adult aural rehabilitation is here defined holistically as the reduction of hearing-loss-induced deficits of function, activity, participation, and quality of life through a combination of sensory management, instruction, perceptual training, and counseling. There is a tendency for audiologists to focus on sensory management, aural rehabilitation being seen as something done by someone else after the provision of hearing aids or cochlear implants. Effective sensory management may, by itself, lead to improved activity, participation, and quality of life, but there is no guarantee that these outcomes will be automatic or optimal. In fact, there is often a disconnect between clinical measures of assisted auditory function and self-assessed benefit. Costs associated with a holistic approach can be minimized by bundling as many as possible into the cost of hearing devices, by taking advantage of computer-based perceptual training, and by capitalizing on the benefits of group counseling.

Keywords: hearing loss; aural rehabilitation; audiologic rehabilitation


- Turn the clock forward a decade on….
- Evidence base for AR
  - High-quality research
  - Frameworks and principles (e.g. patient-centred care)
  - Underpinning theories (e.g. behaviour change)
  - Developments in technology, including e- and m-health

*(Ferguson, Henshaw, Maidment, Heffernan, Sem Hear, In press)*

# Interventions for hearing loss (Boothroyd, 2007)

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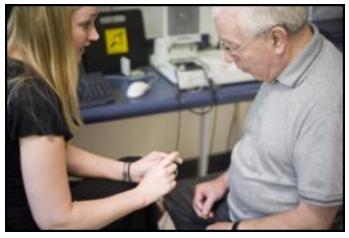
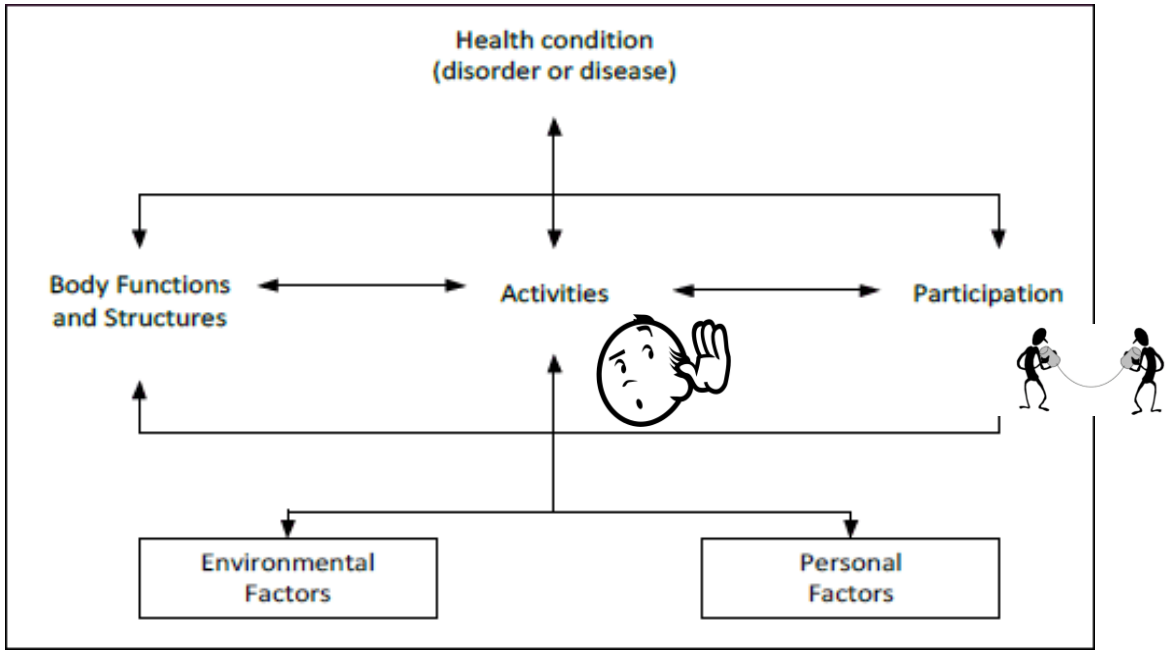
- **Sensory management** to optimise auditory function
- **Instruction** in the use of technologies and control of the listening environment
- **Perceptual training** to improve speech perception and communication
- **Counselling** to enhance participation

# ICF Framework


Adult aural rehabilitation “the reduction of hearing loss-induced deficits of function, activity, participation and quality of life through….” *(Boothroyd, 2007)*

*(WHO International Classification of Functioning, Disability and Health, 2001)*

# Evidence to inform clinical practice

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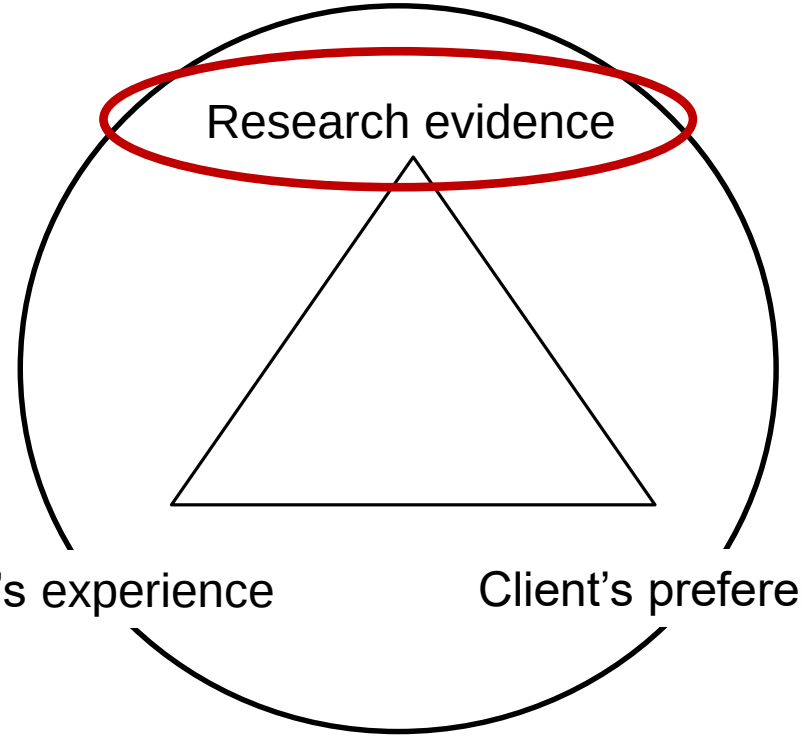
"the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients" *(Sackett, 1996)*


Evidence-based practice (EBP) framework

*(Wong and Hickson, EBP in Audiology, 2012)*

# Hierarchy of evidence

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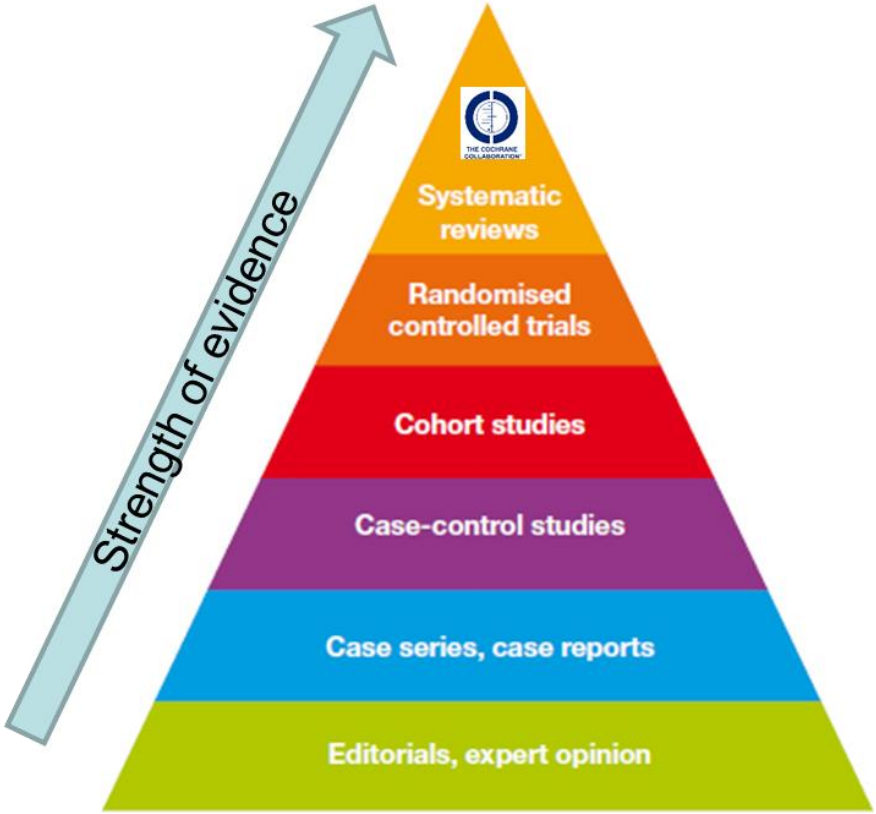
## Evidence-based clinical guidelines



# National clinical guidelines

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- NICE guidelines
  - Hearing loss in adults: assessment and management (2018)

NICE National Institute for Health and Care Excellence

- BSA Practice Guidance
  - Common principles of rehabilitation for adults in audiology services (2016)

British Society of Audiology
KNOWLEDGE | LEARNING | PRACTICE | IMPACT

- Audiology Australia
  - Professional practice standards – Part B Clinical standards (2016)

audiology australia

- AAA
  - Guidelines for the audiologic management of adult hearing impairment (2006)

AMERICAN ACADEMY OF AUDIOLOGY

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# Sensory management

# Sensory management



That was then


- Plenty of evidence that hearing aids enhance function and activity

- But…. limited evidence for participation and QoL
  "often assumed rather than confirmed"

*(Boothroyd, 2007)*

# What is the evidence that hearing aids are effective?

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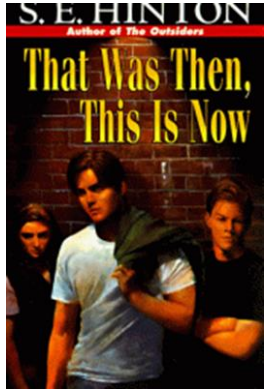
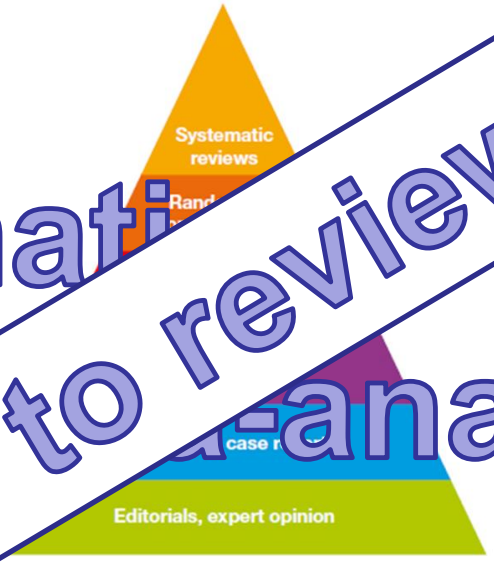



Systematic reviews with meta-analysis

Time to review?

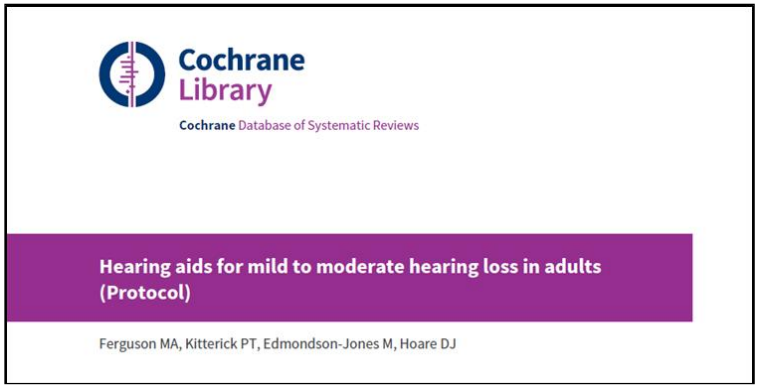



Ilsolm et al, J Am Acad Audiol 2007
Mild-profound hearing loss

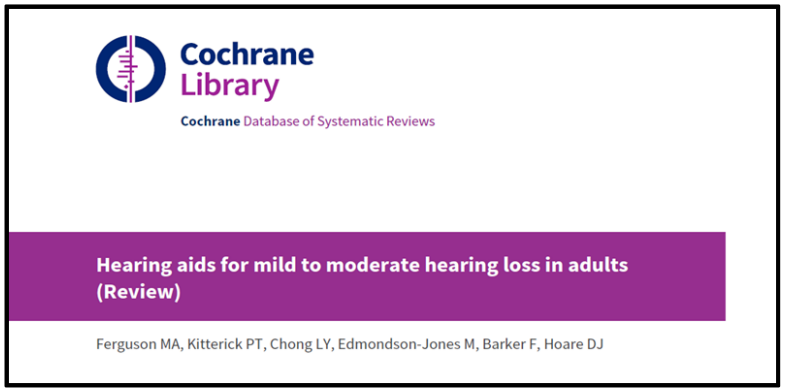
Ferguson et al, Cochrane Collaboration 2017
Mild to moderate hearing loss

# Cochrane review on HAs

- Gold standard for systematic reviews, highest level of research evidence
- Internationally recognised as the highest standard in assessing healthcare resources
- Explicit methods are used to assess quality (risk of bias, e.g. selective reporting)
- Peer-reviewed review protocol is published to maximise transparency
  - ➢ **to provide reliable findings to inform clinical decision-making**
- RCTs n=5, 3 included in meta-analyses




*(Ferguson et al, 2015)*




*(Ferguson et al, 2017)*

# The evidence: hearing aids are effective

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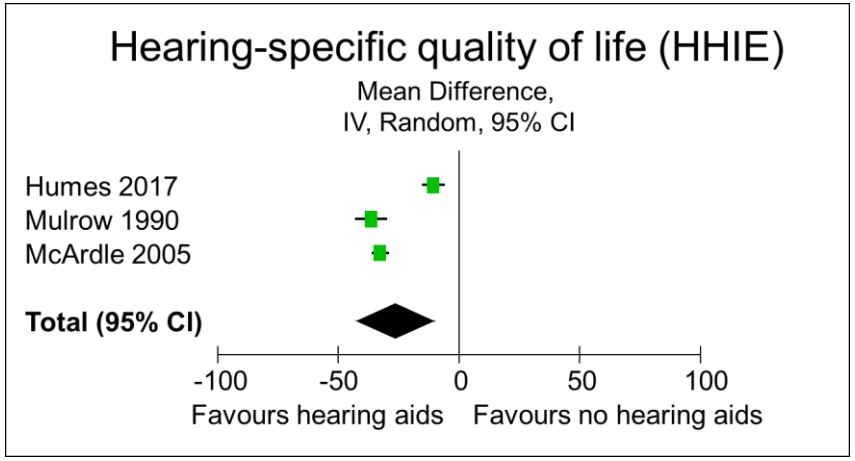
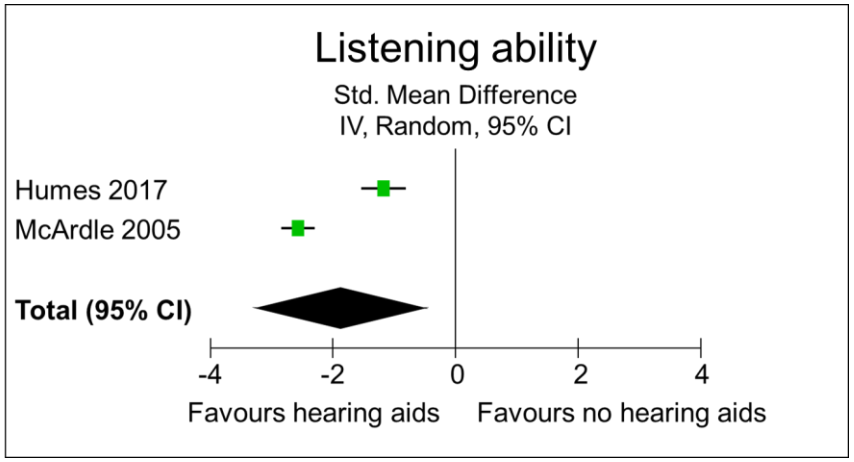
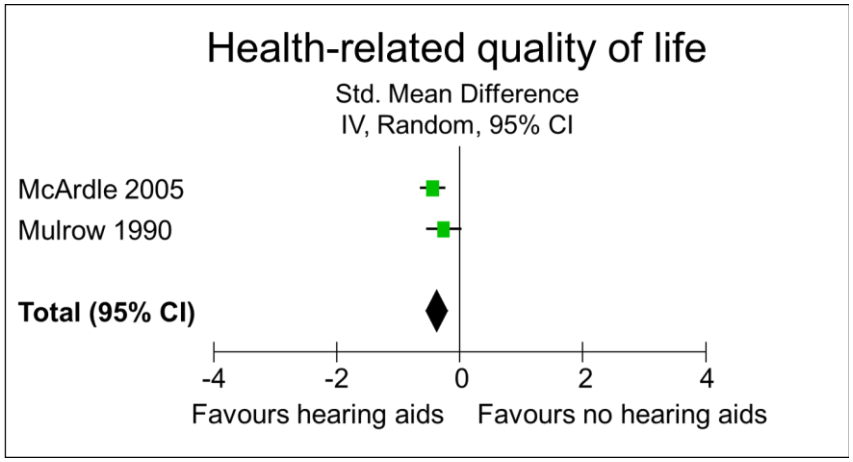



Large beneficial effect, moderate quality




Large beneficial effect, moderate quality




Small beneficial effect, moderate quality

# Implications for practice

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- "If the goals and needs of an individual with hearing loss are to improve their:

  listening abilities, participation with others in everyday life and health-related QoL,

  ***then hearing aids are an appropriate intervention"***

- "The evidence is compatible with the widespread provision of hearing aids as the first-line clinical management in those seeking help for hearing difficulties."



*(Ferguson et al, Cochrane, 2017)*

# Impact: NICE Guidelines on hearing loss

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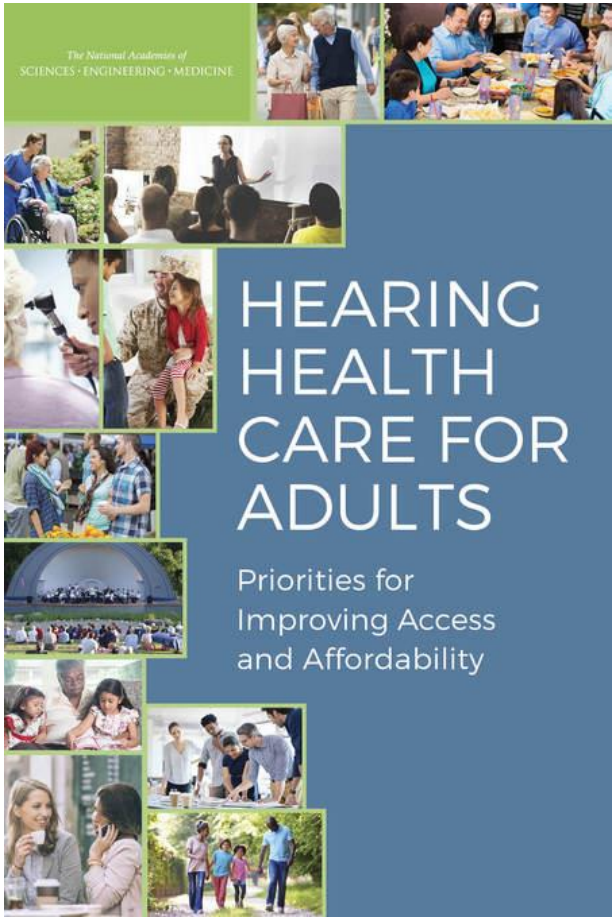
- Published in May 2018
- Cochrane review informed the clinical evidence for the question "What is the effectiveness of hearing aids?"
- Alongside a cost-effectiveness analysis
  - Hearing aids vs no hearing aid (ICER: £4102 / QALY gained)
- Recommendation
  - "*Offer* hearing aids to adults whose hearing loss affects their ability to communicate and hear.."
  - No mention of levels of hearing loss




*(National Academies of Sciences, Engineering, and Medicine, 2016)*

# Accessibility, affordability and use

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- Majority (2/3) who would benefit from hearing aids do not have them

*(Davis et al, HTA, 2007)*

- Hearing aid non-use variable: 3-24%

*(Ferguson et al, Cochrane, 2017)*

- "Can new technologies replace hearing aids?" ranked as the 5th research priority by patients and audiologists


*(Henshaw et al. Lancet, 2015)*

- Implement a new FDA device category for over-the-counter (OTC) wearable hearing devices separate from hearing aids

*(National Academies of Sciences, Engineering, and Medicine, 2016)*

# Alternative listening devices

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1. Alternative devices to conventional hearing aids

| | |
|---|---|
| **Smartphone-connected hearing aids** |  |
| **Personal sound amplifi… pr…** | |
| **Sm… wire…** |  |
| **Smartphone ar… wired earphon…** | |

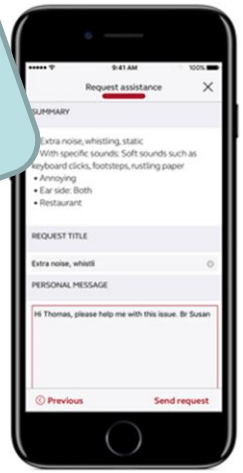
BOSE self-fitting hearing aid

Can new technologies improve access and use?

→ New service delivery models

Self-fitting


User-adjustment




Remote delivery

# OTC service delivery model

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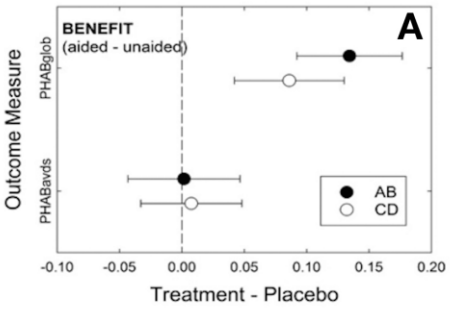
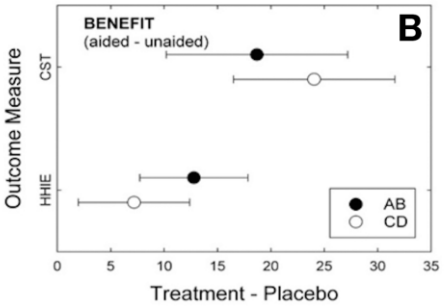
**PHAB**
HA performance

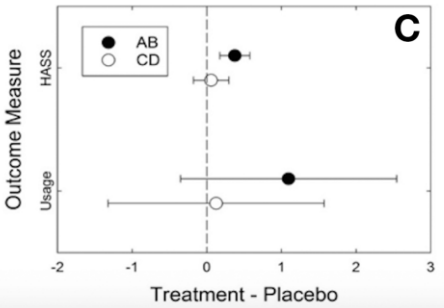
**CST**
Speech

**HHIE**
Hearing 'handicap' (participation)

**HASS**
Satisfaction




AB = Audiology best practice
CD = Consumer decides (OTC)
P = Placebo, acoustically transparent


- Double-blind, placebo-controlled RCT (n=154)
- Positive outcomes were observed for both AB and CD groups
- No difference between groups for
  - HA performance
  - Speech
  - Hearing 'handicap'

➢ **"Efficacious OTC models may increase accessibility and affordability of hearing aids for millions of older adults"**

*(Humes et al, AJA, 2017)*

# Systematic review of alternative listening devices to conventional hearing aids

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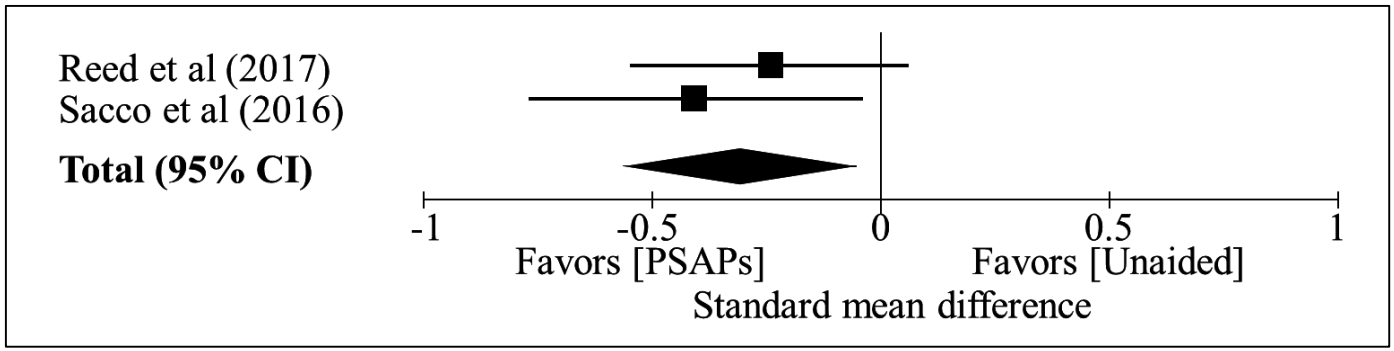
- **Speech intelligibility** better for **PSAPs** compared to unaided




11 included studies

- Evidence less robust for other outcomes:
  - hearing-specific QoL
  - listening ability
- All evidence was judged to be high or uncertain risk of bias

➢ **Need for further high-quality evidence for alternative devices**

*(Maidment et al. IJA, in press)*

# Usability of new listening devices in the 'real world': health behaviour theory

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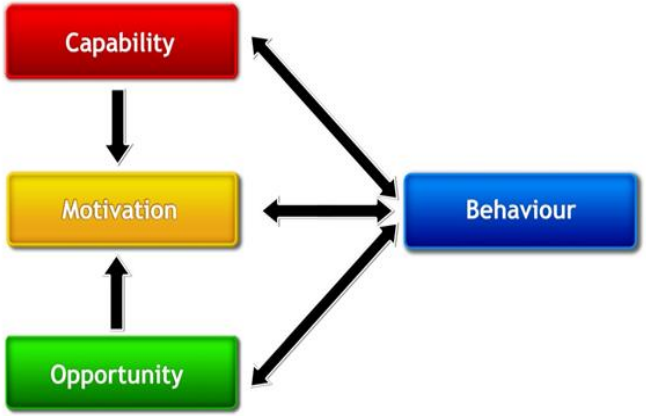
Factors that affect a particular health behaviour
→ Use of alternative listening devices




**COM-B** health behaviour change model

| | |
|---|---|
| Smartphone-connected hearing aids |  |
| Personal sound amplification products (PSAPs) |  |
| Smartphone app & wireless 'hearable' |  |
| Smartphone app & wired earphones |  |

*(Maidment & Ferguson, 2017; Michie et al, 2011; 2014; Coulson et al IJA, 2016)*

# What the patients said

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- The devices should be **simple and intuitive** to use **(C)**

> "You want something you take out of the box and it's ready to go."

- **User-control** to make fine-tune adjustments had an **impact on participation (O)**

> "[the app] gave me a higher possibility of being able to hear what's being said and join in."

- The devices were viewed as potentially **less stigmatising (M)**

> "If I just look as if I've got ear buds in, people will just treat me normally."

*(Maidment and Ferguson, Innovations, 2017: Maidment et al JAAA, submitted)*

# Instruction

(Education, knowledge and skill)

# Instruction

- Instruction is a key component for effective use of devices and their use in the environment

- Some very limited evidence but some key points made….
  - instruction is not counselling
  - difference between ‘telling’ and ‘learning’

That was then


“One way delivery of information is not the same as educating the patient to increase their knowledge base”

*(Boothroyd, 2007)*

# Learning requires more than just giving information

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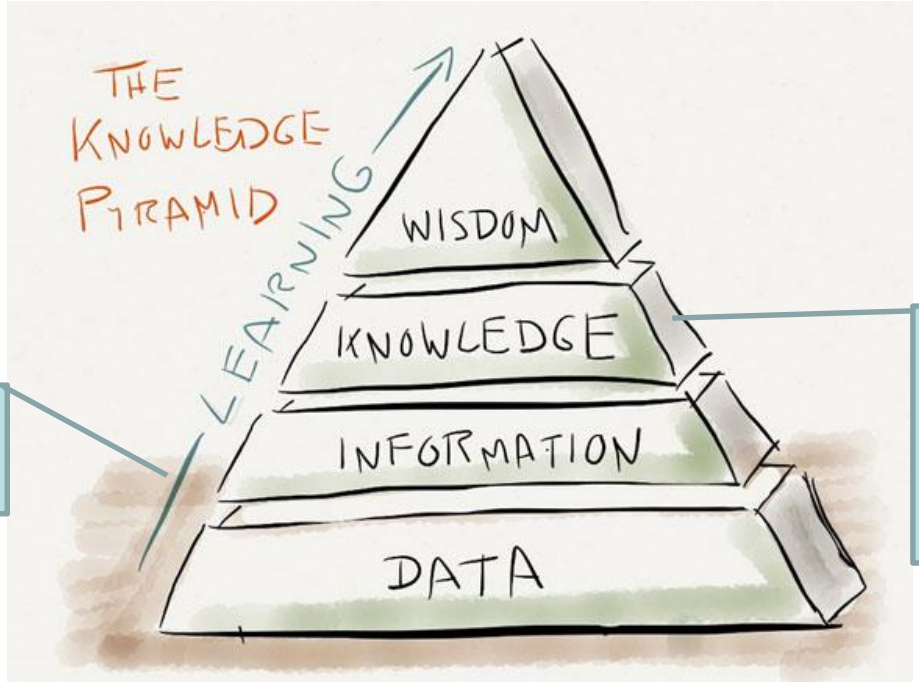


Information is factual

Knowledge forms meaning and understanding from information

*(Rowley, 2007)*

**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)*

# Remote and online delivery of information and advice

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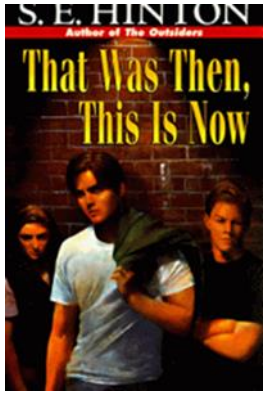



- Home-delivered communication programme using DVDs

  *(Kramer et al, 2005)*

- Education program
  - written, with telephone follow-up
  - internet delivery with email

  *(Lundberg et al, 2011; Thoren et al, 2011, 2014)*

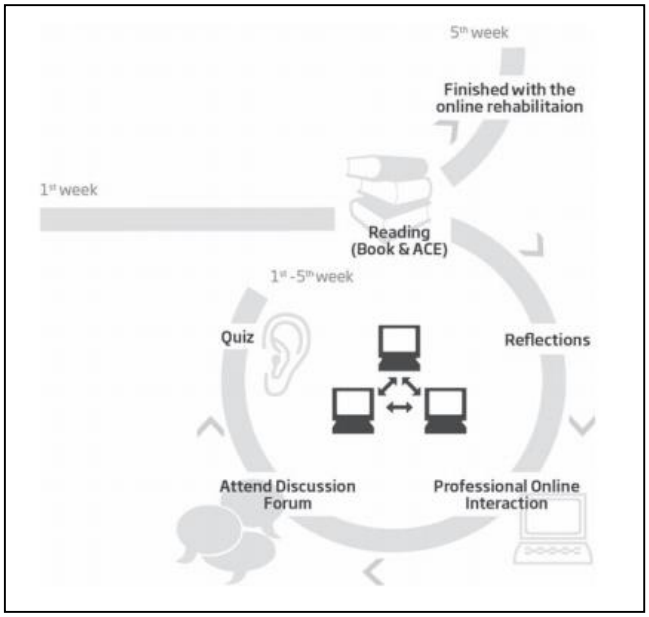
- I-ACE (active communication enhancement programme)
  - e-version

  *(Hickson et al, 2007)*

- C2Hear multimedia interactive programme
  - Based on the concept of re-usable learning objects

  *(Ferguson et al, 2016)*

# Online rehabilitation programme




Eriksholm Guide to Better Hearing

Nottingham: following usability/feasibility studies → RCT in UK NHS hearing aid users

5 week programme for HA users

- RCT (n=76)
  - Intervention: online rehab programme
  - Control: Reading materials on history of HAs
- 3m follow-up: Sig improvement in intervention gp
  - HHIE (11 points, $p < .001$)
  - IOI-HA, impact on others, (0.6 points $p < .01$)
  - HADS (2 points, $p < .01$)

➢ **Online delivery of rehabilitation can be effective for hearing aid users**

*(Thoren et al, IJA, 2014)*

# Multimedia educational programme

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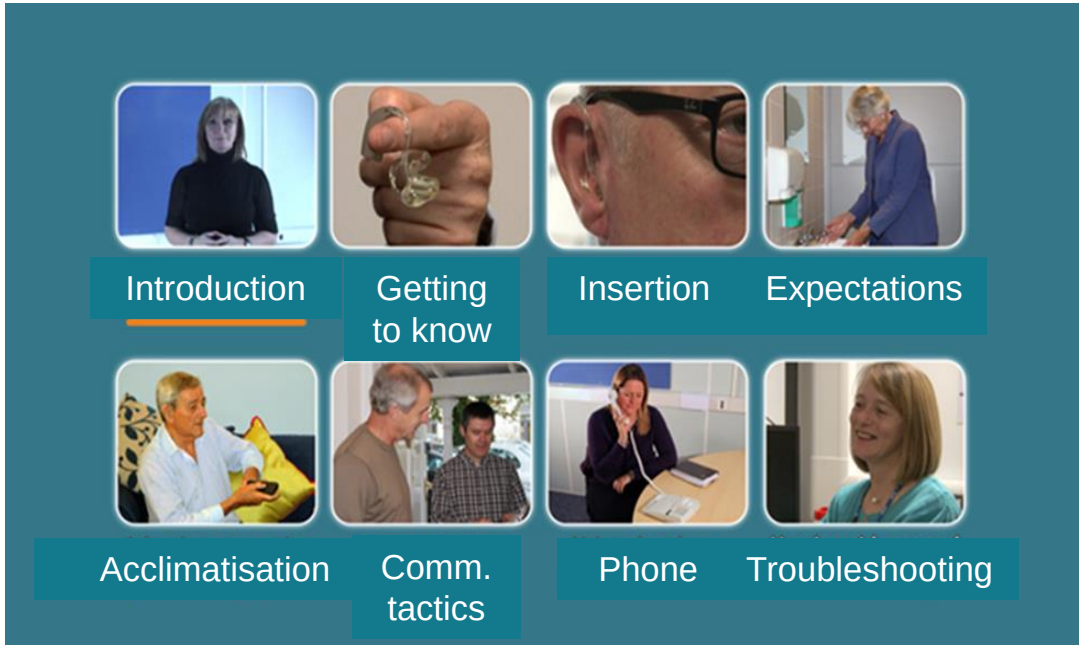
Aim: Develop a series of interactive multimedia reusable learning objects, RLOs

- Based on learning theory
- Range of auditory rehabilitation subjects
- Video clips, animations, photos, testimonials
- Subtitled
- Interactive quiz
- Home-delivered

51% 15% 33%

- Developed with HA users**




C2Hear

*(Ferguson et al, Ear Hear, 2016; Ferguson et al, IJA, 2018)*

# Involvement of patients and public is at the heart of our research

titute for Research


# C2Hear multimedia programme is effective

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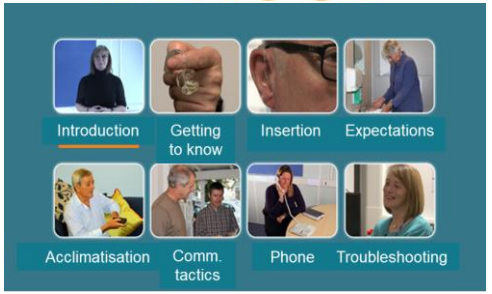
C2Hear




knowledge

handling skills

hearing aid use


self-management


valued by users

First-time HA users

- RCT (n=203)
  - Intervention: C2Hear
  - Control: waitlist group
- 6 wk follow-up: Sig improvement in intervention gp
  - Knowledge, HACK ($p<.001$, $d=.95$ )
  - Handling skills, PHAST ($p<.001$, $d=.57$)
  - Hearing aid use, GHABP ($p<.05$, $d=.88$)

”if it wasn’t for the DVD I would have given up wearing my hearing aids”

➢ **Increasing knowledge improves hearing aid users’ outcomes**

*(Ferguson et al, Ear Hear, 2016)*

# Summary of ehealth and mhealth developments

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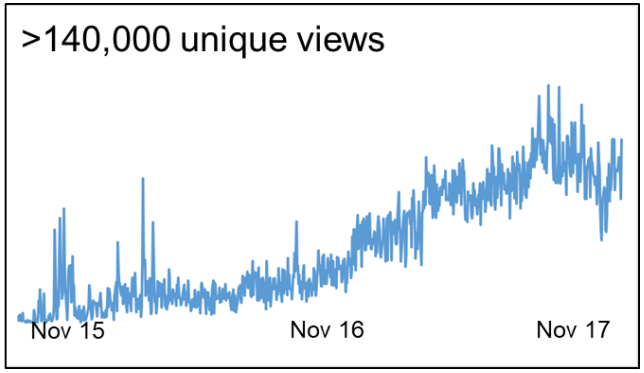
## Get C2Hear out there




| | |
|---|---|
| United Kingdom | 39% |
| United States | 32% |
| Canada | 6% |
| India | 4% |
| Australia | 3% |

US version now developed

Chinese version under discussion

JOHNS HOPKINS MEDICINE THE JOHNS HOPKINS HOSPITAL

**November 2015**


Freely available online

YouTube

**2016/17**


mRLOs for communication partners

**2017/18**


mRLOs tailored for hearing aid users

Just google ‘C2Hear Online YouTube’

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# Auditory perceptual training

# Auditory perceptual training



- Does not target function but by improving function leads to → "enhancement of perceptual skill"

- LACE (Sweetow et al, 2006)

  – Improvements in speech, cognition

  – But… questions about generalisability of learned skills to everyday communication in real life

"carry over to participation and QoL is often assumed rather than measured"


*(Boothroyd, 2007)*

# Auditory training: how does it work?

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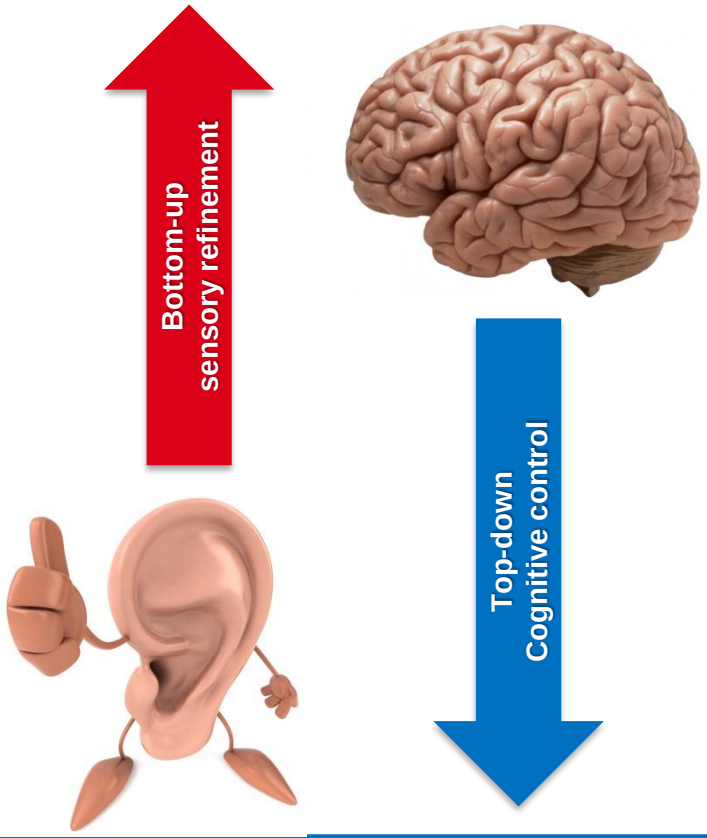
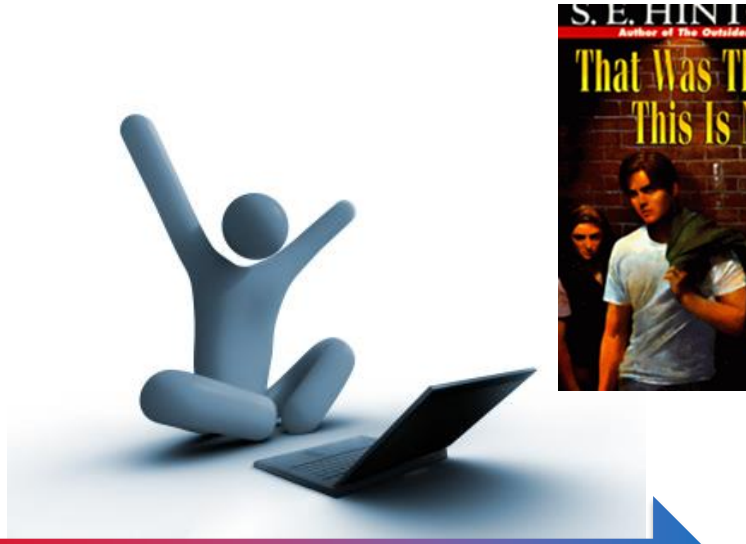
Teaching the brain to listen through active engagement with sounds

## Bottom-up vs. top-down




## Near vs. far transfer






Near transfer → Far transfer

| Trained task different talker | Untrained task | Untrained task different modality |
|---|---|---|

**Real-world benefit**

# Auditory training: does it work?

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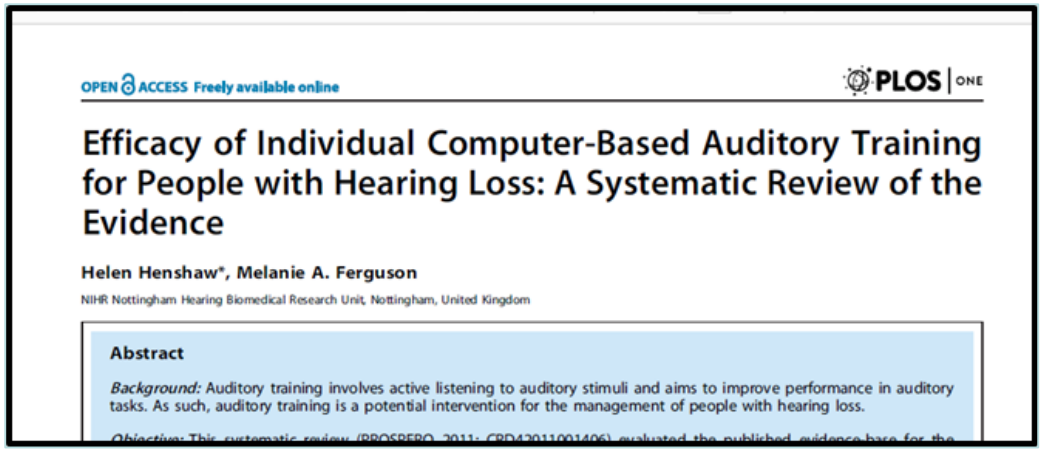

OPEN ACCESS Freely available online

PLOS ONE

## Efficacy of Individual Computer-Based Auditory Training for People with Hearing Loss: A Systematic Review of the Evidence

Helen Henshaw*, Melanie A. Ferguson

NIHR Nottingham Hearing Biomedical Research Unit, Nottingham, United Kingdom

**Abstract**

*Background:* Auditory training involves active listening to auditory stimuli and aims to improve performance in auditory tasks. As such, auditory training is a potential intervention for the management of people with hearing loss.

*Objective:* This systematic review (PROSPERO 2011: CRD42011001406) evaluated the published evidence base for the

On-task learning

Transfer of learning

Currently being updated

MACQUARIE University

*(Henshaw & Ferguson, PLOS ONE, 2013)*

# Large RCT shows no benefit for auditory training using LACE

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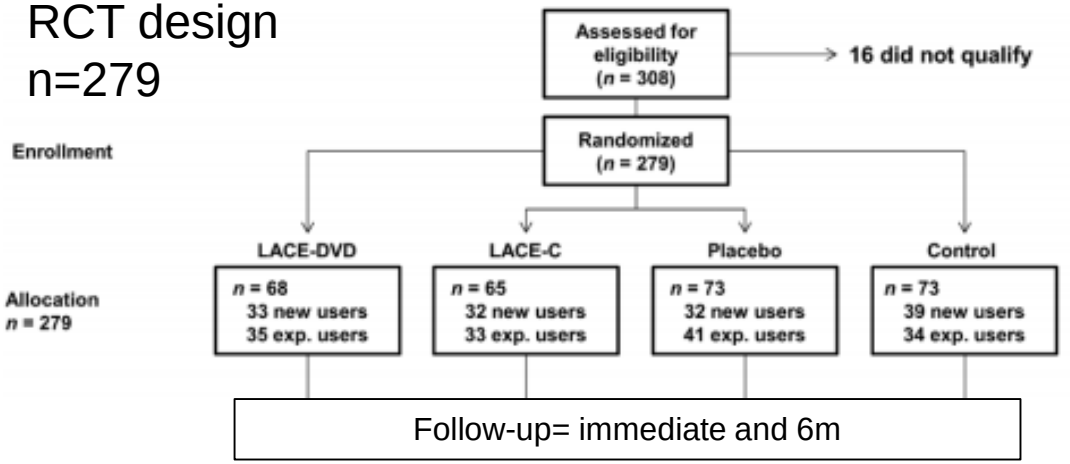
LACE Listening And Communication Enhancement

RCT design
n=279




Outcome measures: Speech in noise, rapid speech, competing speaker, word memory, linguistic context, activity limitations and participation restrictions

- Immediate and 6-month follow-up: No statistically significant effects

➢ **However…..potential benefits of auditory training may be evident in other, more complex outcome measures than were used in this study**

*(Saunders et al, Ear Hear, 2016)*

# Auditory training: does it work?

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| Auditory I | Auditory II | Working Memory |
|---|---|---|
| RCT | Repeated measures | RCT |
| **Phoneme in quiet** | **Phoneme in noise** | **Cogmed WM** |
| Non-HA users | Existing HA users | Existing HA users |
| n=44 | n=30 | n=57 |

Choice of:

- outcome measures
- training materials

➢ need to tap into the intended mechanism of benefit

*(Ferguson & Henshaw, Frontiers in Psychology, 2015; Sem Hearing, 2015)*

# Auditory I: improvements seen in complex measures

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| RCT | Simple | Complex |
|---|---|---|
| **Communication** | Watching TV ✗ | Conversation with people in a group ✓ |
| **Cognition** | Single attention ✗<br>Simple-span WM (digit span) ✗ | Divided attention ✓<br>Complex-span WM (visual letter monitoring) ✓ |
| **Speech perception** | Energetic masking (speech in noise) ✗ | *Informational masking (competing speech)* ✓ |

**Executive processes**

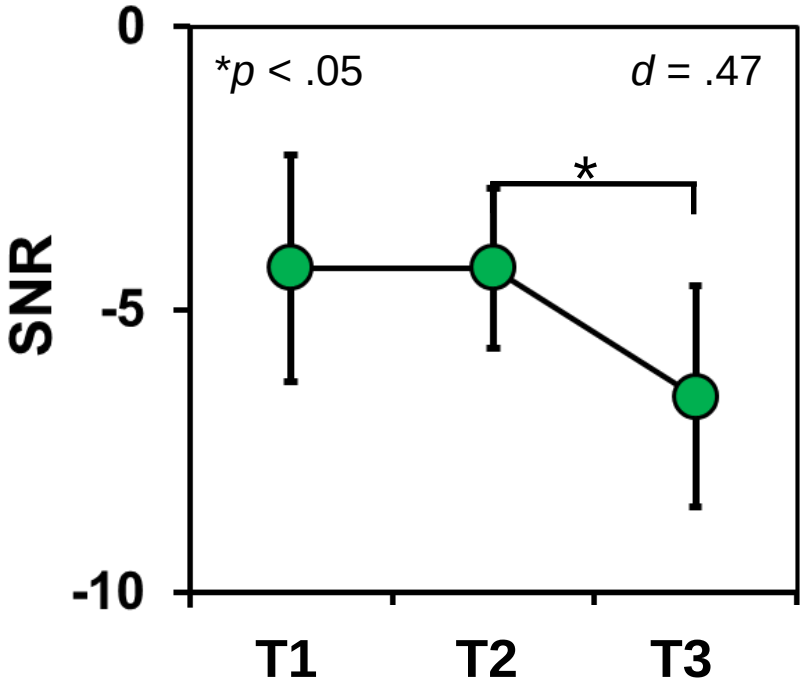
*(Ferguson et al, Ear & Hearing, 2014; Ferguson & Henshaw, Front Psychol, 2015)*

# Auditory II: transfer of learning to competing speech

National Institute for Health Research

Training stimuli = phonemes in noise

## Competing speech




n=30


*(Henshaw & Ferguson, ISAAR proceedings, 2014)*

# Working memory training: can training cognition directly improve outcomes?

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- Digit span (trained task, different talker)
- Visual letter monitoring task (untrained WM task)
- Dual-task listening and memory
- Self-reported hearing (GHABP/HHIE)
- High/low predictability sentences
- Competing speech (MCRM)

**Double blind RCT**
n= 57 hearing aid users

*(Henshaw & Ferguson, Trials, 2013)*

# Working memory training: can training cognition directly improve outcomes?

NHS National Institute for Health Research

COGMED

Near transfer

Far t

Training cognition in isolation does not improve auditory outcomes

- Digit span (trained task, diff
- Vis (untrained WM task)
- task listening and memory
- Self-reported hearing (GHABP/HHIE)
- High/low predictability sentences
- Competing speech (MCRM)

**Double blind RCT**
n= 57 hearing aid users

*(Henshaw & Ferguson, Trials, 2013)*

# Auditory-cognitive training: new approach

NHS National Institute for Health Research

- Two cognitively-demanding speech training programs
- designed to maximise transfer of learning to real-world benefits

**Maximise near transfer**

Practice listening to competing speech in situations that people find difficult

**Improved real-world listening**

- ✓ Speech perception
- ✓ Cognition
- ✓ Participation
- ✓ Quality of life

**Maximise far transfer**

Train on a cognitively challenging task using phonemes (n-back) for effortful listening

# Auditory-cognitive training: new approach

National Institute for Health Research

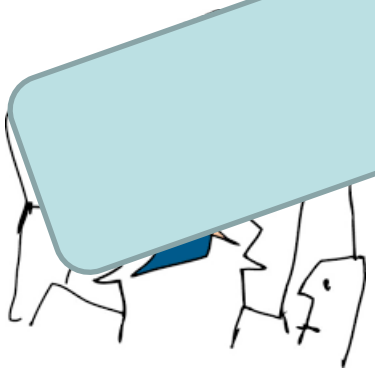
- Two cognitively-demanding speech training programs
- designed to maximise transfer of learning to real-w ts

**Maximise near transfer**

**Maximise far transfer**

Watch this space…

- ✓ Speech perception
- ✓ Cognition
- ✓ Participation
- ✓ Quality of life



Practice listening to competing speech in situations that people find difficult

Train on a cognitively challenging task using phonemes (n-back) for effortful listening

# Counselling

# Counselling



- Some evidence of effectiveness
  - e.g. group counselling (Hawkins et al, 2005)

- Dependent on:
  - characteristics PHL
  - rapport the audiologists have with the patients

That was then


*(Boothroyd, 2007)*

# Patient-centred care

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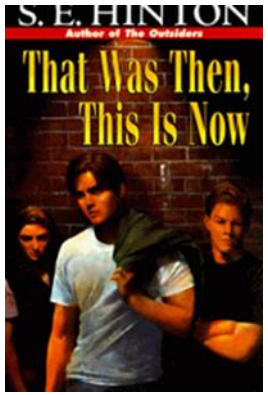
Aim: Shared understanding needs, desires, interests


**Audiologist**

**Patient**

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# Health behaviour theories

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- Transtheoretical Model

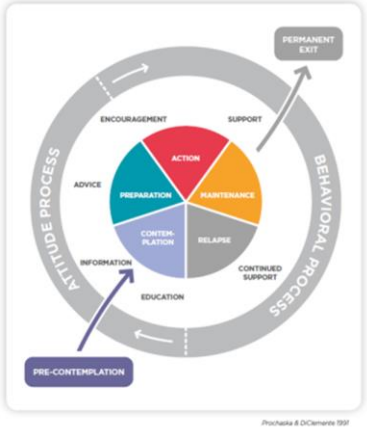
  *(Laplante-Lévesque et al, 2013)*

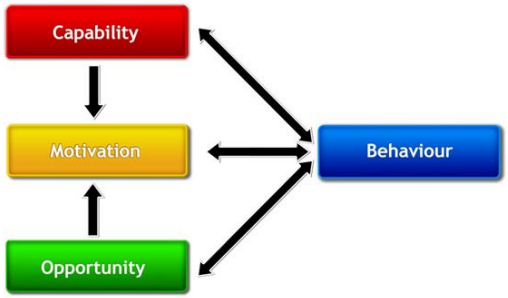
- Self-regulatory model

  *(Heffernan et al, IJA, 2016)*


- COM-B model

  *(Barker et al, IJA, 2016)*




*Ferguson, Coulson,Henshaw, Heffernan, 2016*

# Motivational engagement

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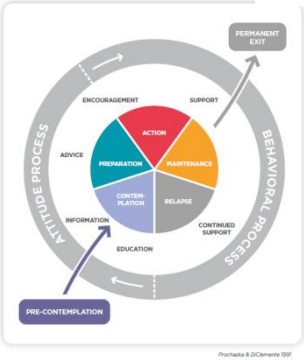
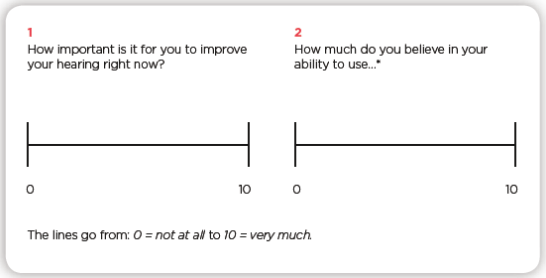
THE HEARING CO-OPERATION

## MOTIVATION TOOLS





Designed to support, engage and coach hearing aid users to improve outcomes

30 minute ethnographic video

1. Can the motivational tools be implemented in an NHS audiology service?
2. What are the benefits of motivational engagement?

# 1. Can the tools be implemented in NHS audiology services?

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- In depth Information in short period of time

  "We haven't got the time?!" – Not true!

- Tools could replace other elements of history taking, and provided a more patient-centred approach

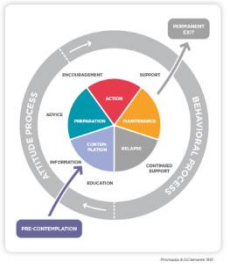
- Tap into patient needs more than standard history

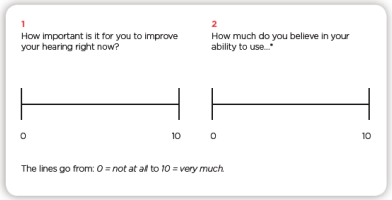
- Provided a framework to help the patient reveal relevant information

**Audiologists were enthusiastic about the tools**

# 2. Benefits of motivational engagement

National Institute for Health Research







Used at
- hearing assessment
- HA fitting appointments

- Quasi-RCT (n=68)
  - Intervention: motivation tools
  - Control: standard care
- 4 wk hearing aid fitting: Sig improvement in intervention group
  - Self-efficacy ($p < .001$)
  - HADS, anxiety ($p < .01$)
  - Greater engagement with audiologist ($p < .05$**)**
- 10 wk follow-up: no significant differences

➢ **Some positive short-term benefits**

➢ **Would qualitative results provide better understanding of benefits?**

*(Ferguson et al, IJA, 2016)*

# Why Improve My Hearing? Telecare Tool

NHS National Institute for Health Research

## Pre-assessment


Identify a situation

Choose a photo that shows a situation where you've had difficulty hearing.

Choose or upload an image

Describe your situation

Mark the number that best describes how important it is for you to improve your hearing.

1

1 10

- Why did you place the marker where you did?
- What will happen if you continue as you are today?
- What would happen if you get a hearing aid and improve your hearing right now?

# Qualitative study on the views of patients and audiologists

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Aim: To explore the views of patients and audiologists toward the Tool when used in the audiological rehabilitation process.

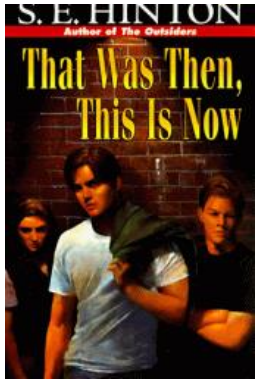
- Individual, semi-structured interviews
  - Adults with hearing loss (n=10)
  - Audiologists (n=5)
- Inductive thematic analysis (Braun & Clarke, 2006)
- Three themes:

| | | |
|---|---|---|
| Helps patients to prepare for clinic appt in advance | Enhances discussion between patient and audiologist | Has potential to influence outcomes after appointment |

*(Maidment, Heffernan, et al, 2018)*

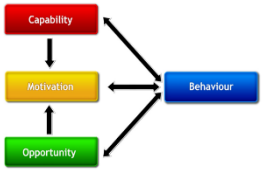

- Need for a core outcome set

# …..this is now




- In the last decade
  - Substantial developments in the evidence-base for aural rehabilitation
  - Does AR work? Yes, but more to do…

- Driven by
  - Increase in high-quality research evidence, qualitative methods
  - Increasing use of frameworks and theory to underpin and explain research (e.g. patient-centred care, health behaviour)
  - New and emerging technologies delivered by e- and m-health
  - Use of patients and public in co-production of research


# …..this is now

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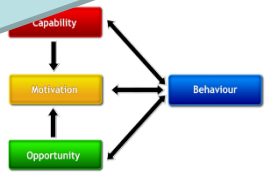
→ Improving lives of adults with hearing loss

What will the next decade bring?




# Thanks to ….

NHS National Institute for Health Research

**Mild to moderate hearing loss team**

David Maidment
Helen Henshaw
Eithne Heffernan

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UK | CHINA | MALAYSIA

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