

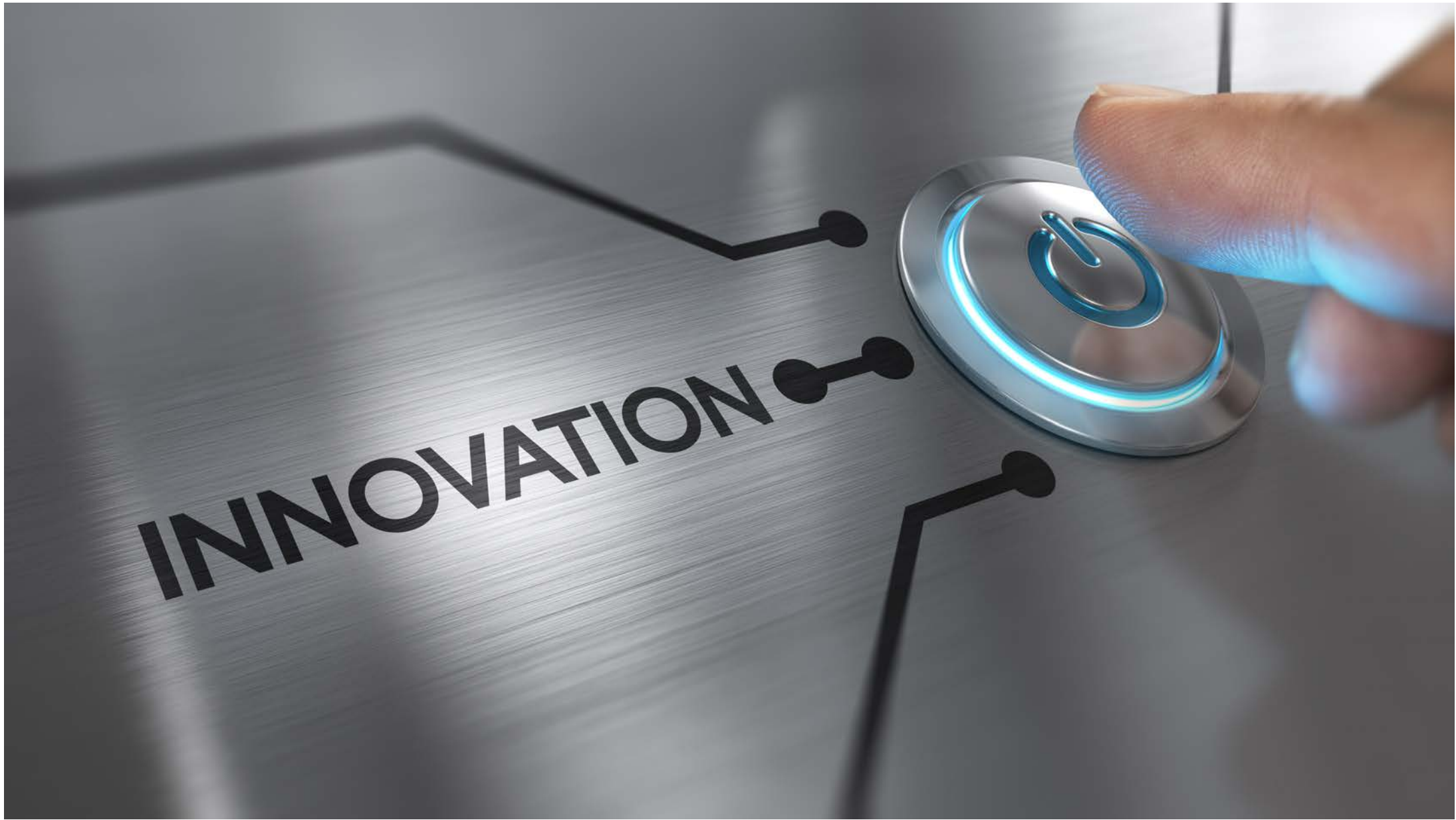
TRENDS SHAPING THE FUTURE OF AUDIOLOGY AND HEARING TECHNOLOGY

Brent Edwards¹

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Sydney, Australia

¹ Adjunct Professor, Macquarie University





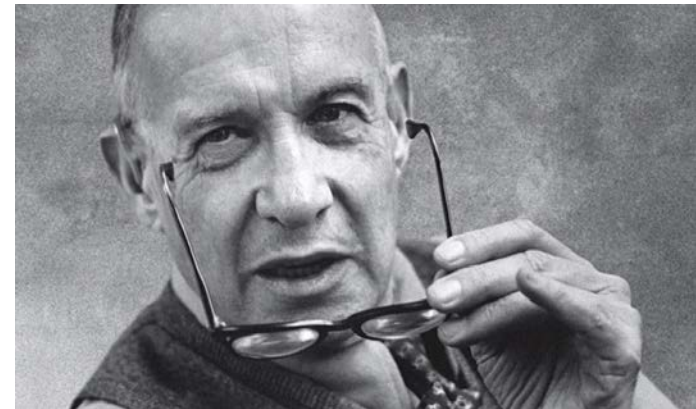
“Innovation distinguishes between
leaders and followers.”


Steve Jobs



“Innovate or die.”

Peter Drucker





New + Value = Innovation
Products

Services

Processes



Population with Auditory Dysfunction

PTA < 25 dB HL

PTA > 25 dB HL

Population with Auditory Dysfunction

PTA < 25 dB HL	PTA > 25 dB HL

Population with Auditory Dysfunction

PTA < 25 dB HL	PTA > 25 dB HL Self-perceived difficulty
	PTA > 25 dB HL Self-perceived no difficulty

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PTA < 25 dB HL	PTA > 25 dB HL Self-perceived difficulty Accepts Hearing Aids/ Audiologist	PTA > 25 dB HL Self-perceived difficulty Rejects Hearing Aids/ Audiologist
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HEARABLE

HEARING AID
& AUDIOL

OTC
& SELF-FIT

PTA < 25 dB HL

Self-perceived
difficulty

PTA > 25 dB HL

Self-perceived
difficulty

Accepts
Hearing Aids/
Audiologist

PTA > 25 dB HL

Self-perceived
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Rejects
Hearing Aids/
Audiologist

PTA < 25 dB HL

Self-perceived
no difficulty

PTA > 25 dB HL

Self-perceived
no difficulty

CONSUMER PRODUCTS

HEARABLE

HEARING AID
& AUDIOL

OTC
& SELF-FIT

PTA < 25 dB HL
26M
Self-perceived
difficulty

PTA > 25 dB HL
Self-perceived
difficulty
10M
Accepts
Hearing Aids/
Audiologist

PTA > 25 dB HL
Self-perceived
difficulty
10M
Rejects
Hearing Aids/
Audiologist

PTA < 25 dB HL
?M
Self-perceived
no difficulty

PTA > 25 dB HL
25M
Self-perceived
no difficulty

CONSUMER PRODUCTS

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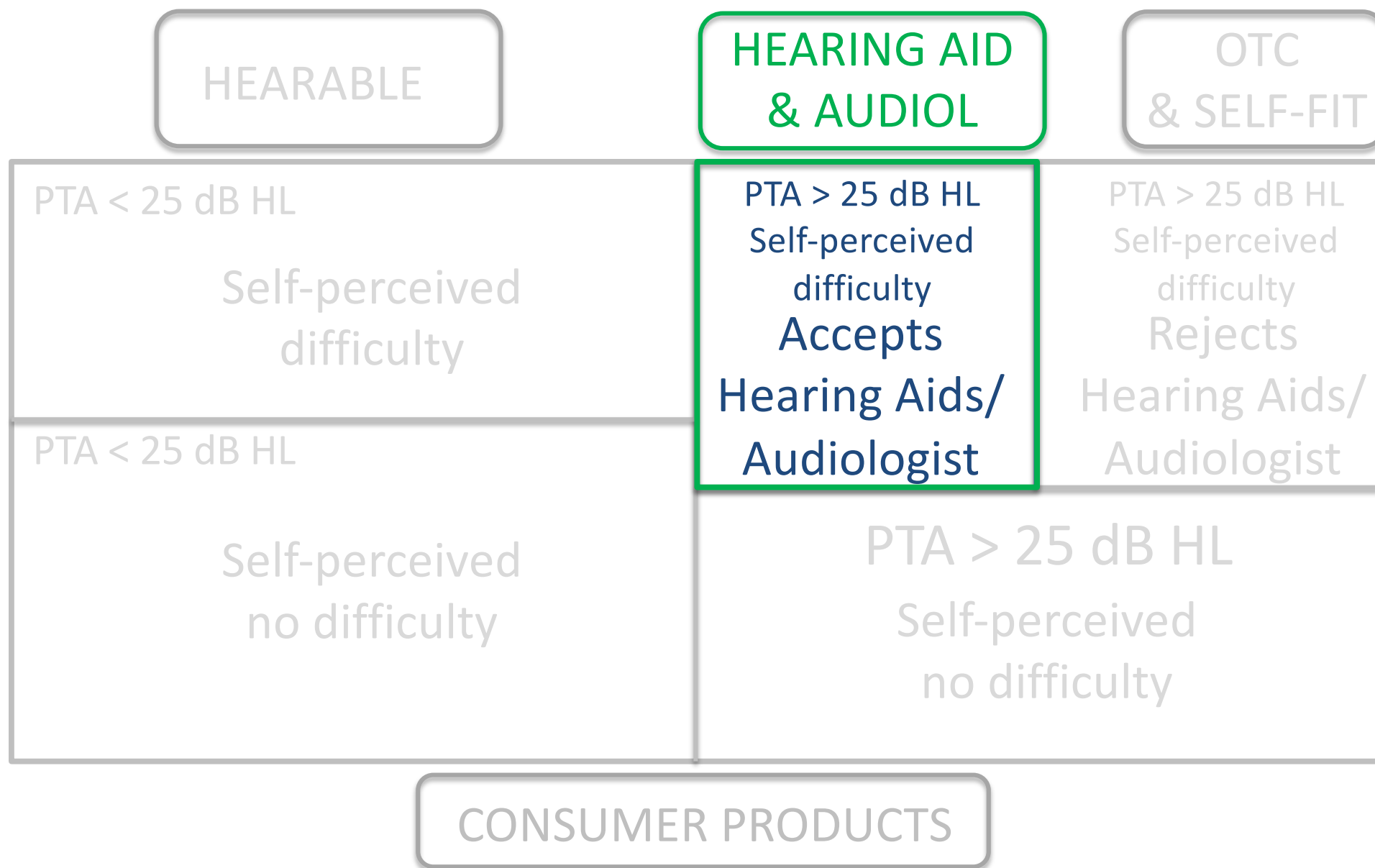
PTA < 25 dB HL

Self-perceived
no difficulty

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no difficulty

CONSUMER PRODUCTS



Hearing Loss / Accepts HCP

Unmet Needs

- This population wants:
 - Improved speech understanding
 - Improved sound quality
 - Less listening effort
 - Improved usability of treatment solution
 - Improved care from their audiologist

Hearing Loss / Accepts HCP

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Hearing Loss / Accepts HCP

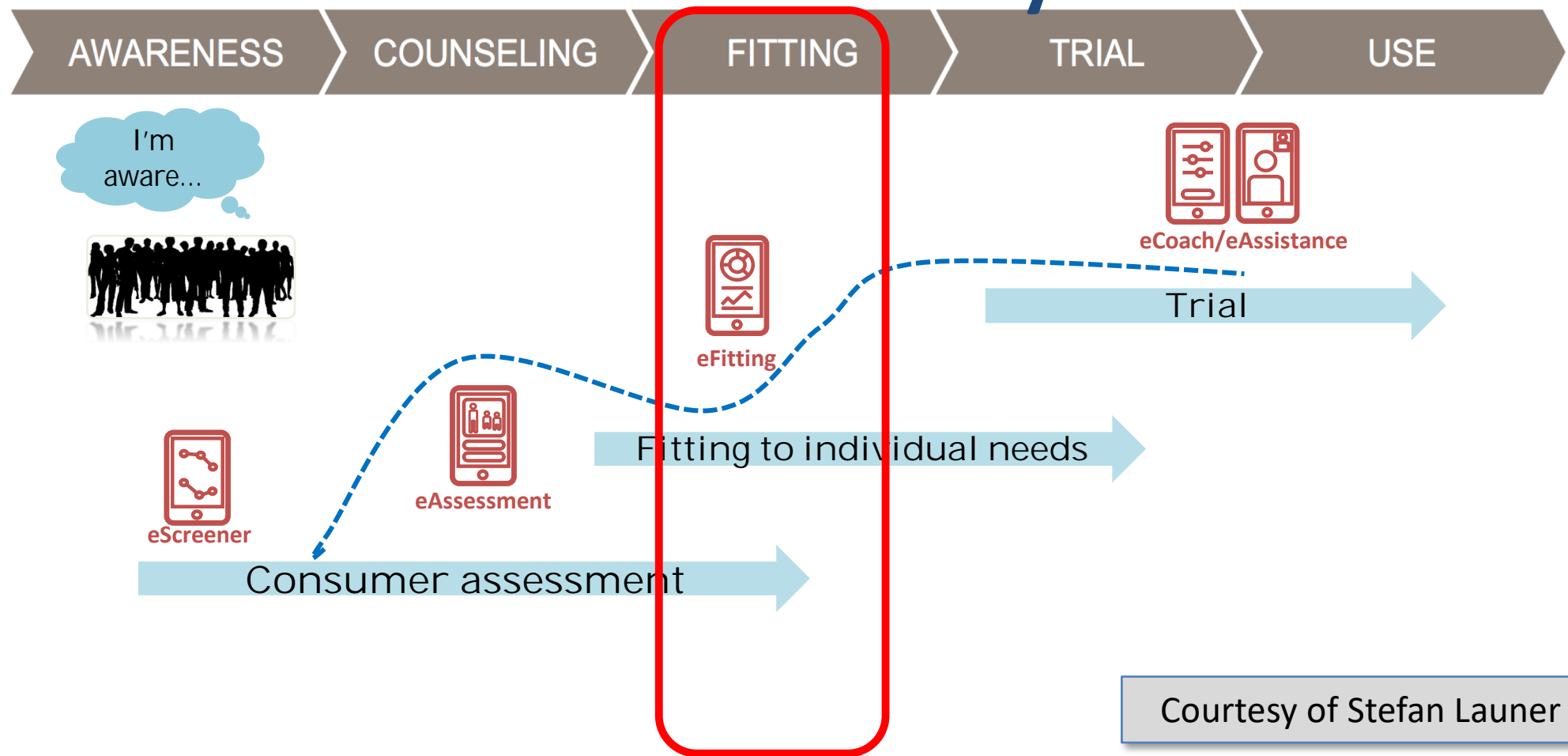
Unmet Needs

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 - Less listening effort
 - Improved usability of treatment solution
 - **Improved care from their audiologist**

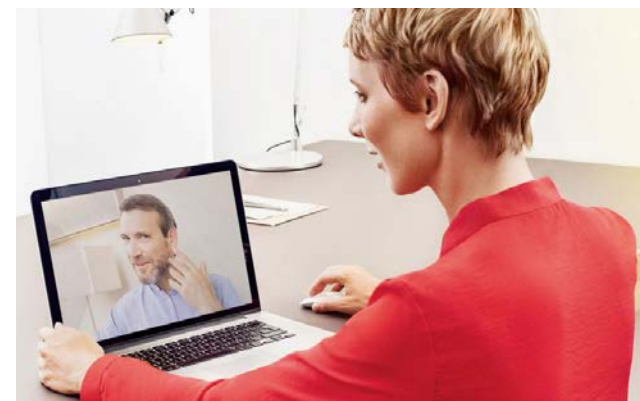
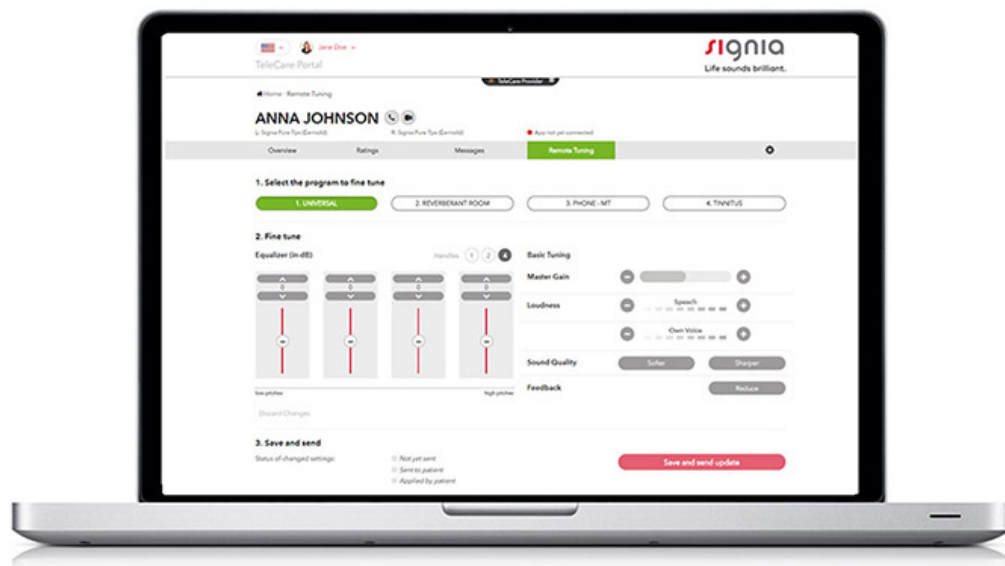
Teleaudiology (Connected Hearing Health), is one of several coming waves that will transform audiology and hearing healthcare



Connected Health Throughout the Patient Journey



Connected Health



Carrier 1:50 PM Oticon Hearing Diary

Please rate the following:

Overall sound quality of the device



Sound quality of voices



Back

Next



Study of Remote Programming App

- 2 groups: teleaudiology and control
 - 15 subjects used remote programming app to replace the 2-week followup office visit
 - 15 subjects didn't use app and did the 2-week followup visit

Problems Fixed Remotely

Tinniness	Fine-tuning (reduce high-frequency gain)
Feedback	Fine-tuning (reduce high-frequency gain; increase strength of feedback manager)
Overall volume too soft or loud	Fine-tuning (adjust overall gain) Replace wax guard to address receiver blockage
Background noise	Fine-tuning (adjust gain/frequency response; add Restaurant program)
Wind noise	Fine-tuning (add Outdoor program; enable wind guard)
Request for telecoil	Fine-tuning (add Telecoil program)
Alert beeps too loud	Fine-tuning (reduce level of alert beeps)

Convery et al., 2019

Problems Not Fixed Remotely

Cannot maintain Bluetooth connection between hearing aids and smartphone	Advice given
Domes causing itchy ear canals	Advice given
Cannot stream audio to iPhone	Advice given
Domes uncomfortable	Dome size changed
Cannot retain hearing aids in ear canal	Sport locks added

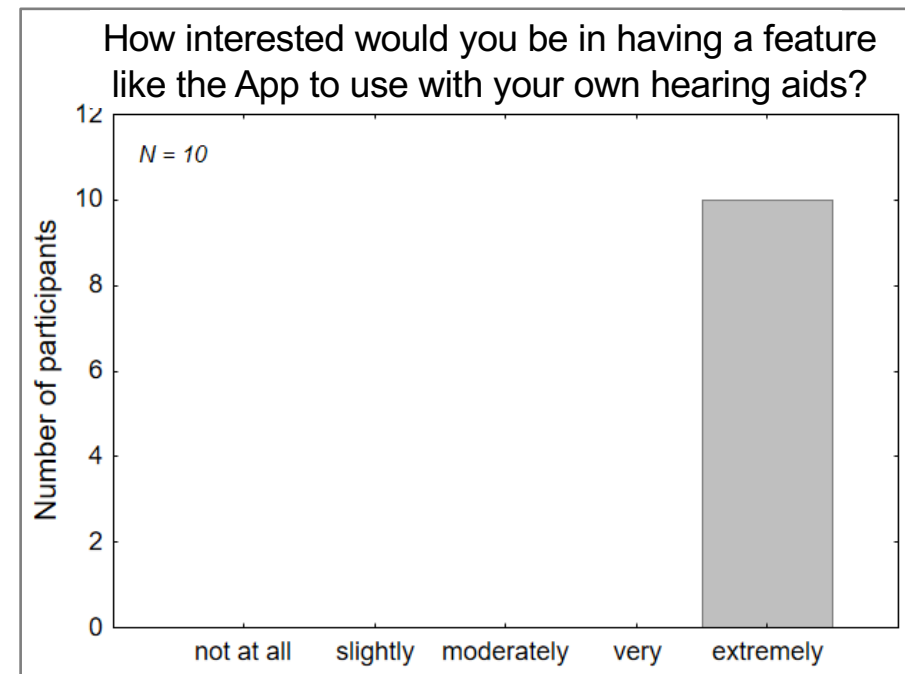
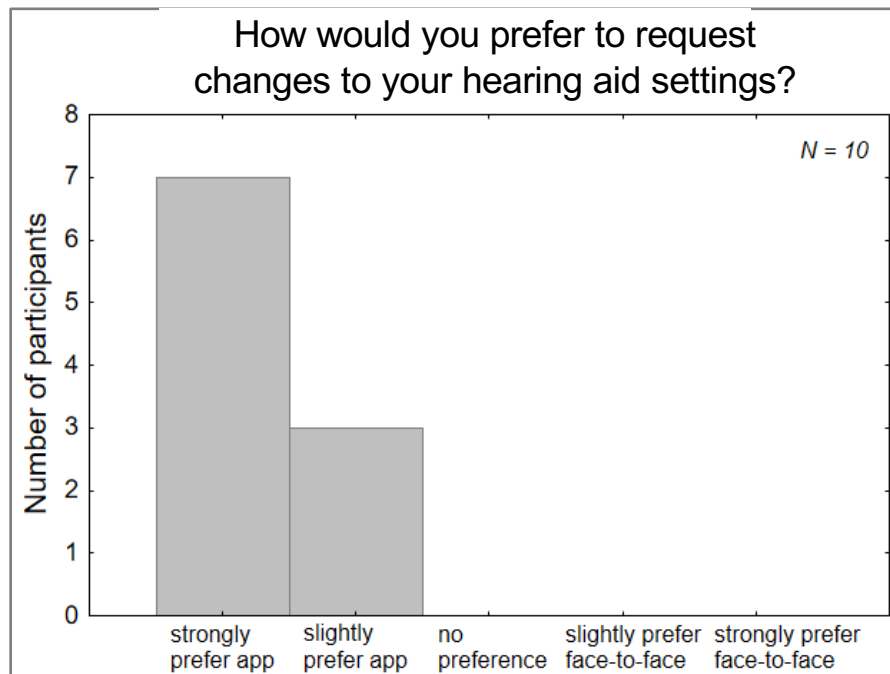
Convery et al., 2019

Results

- Remote assistance produced the same outcomes as office visits
 - Hearing aid benefit
 - Hearing aid satisfaction
 - Speech in noise
 - Hours of daily use

Results

High level of satisfaction with the remote service



Convery et al., 2019

Teleaudiology Design Thinking

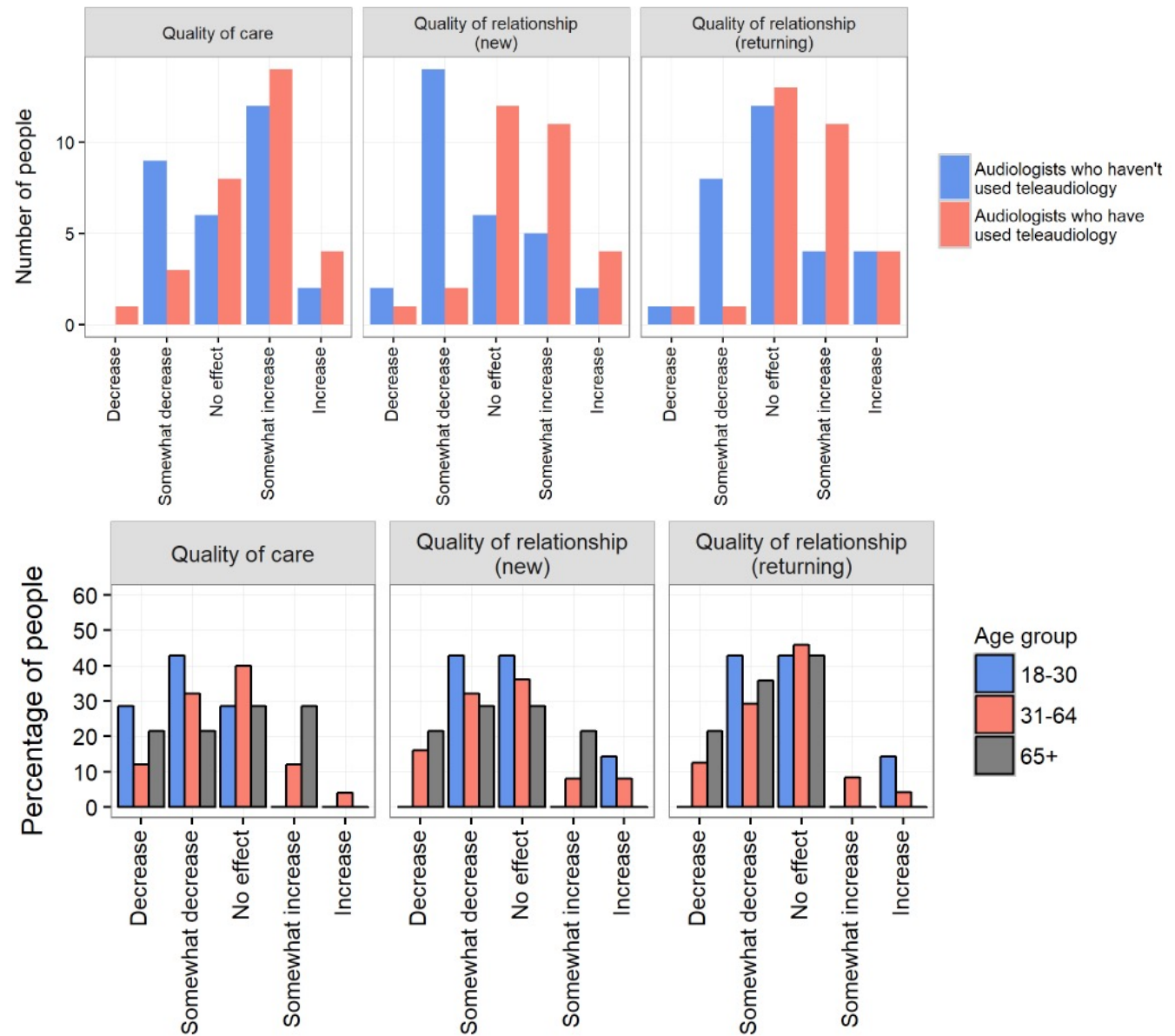
- Understand the experiences, attitudes and needs of teleaudiology
- Interviews and surveys include:
 - 70 people with hearing loss
 - 95 audiologists

Polling Question

- The impact of teleaudiology on the audiologist-client relationship and quality of care will:
 1. Improve the relationship and quality of care.
 2. Worsen the relationship and quality of care.
 3. Have no impact on either.

Effect on audiologist-client relationship

- Audiologists with teleaudiology experience more positive
- Clients negative on effect on relationship



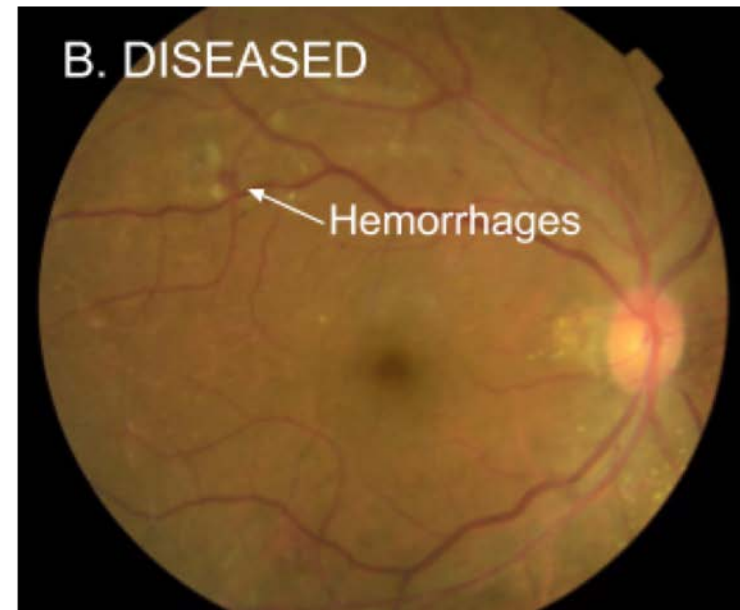
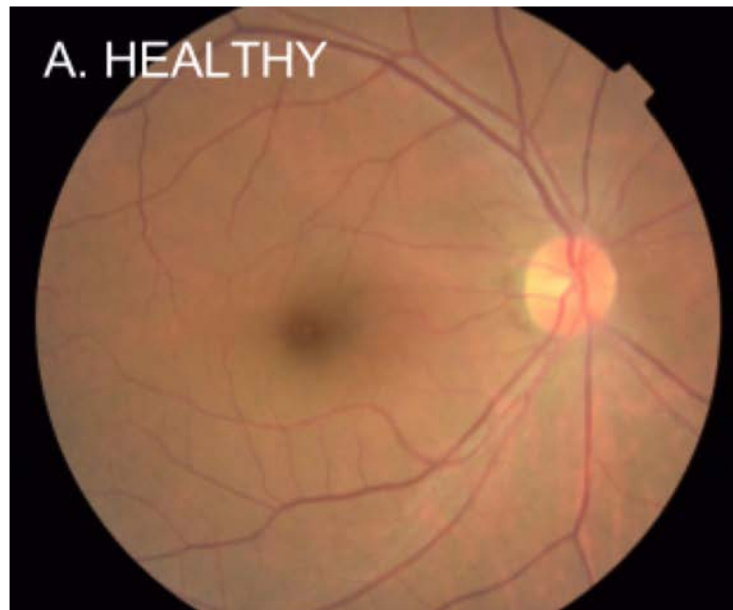
Machine Learning/Deep Neural Networks/AI

Changing the landscape of **EVERY FIELD**



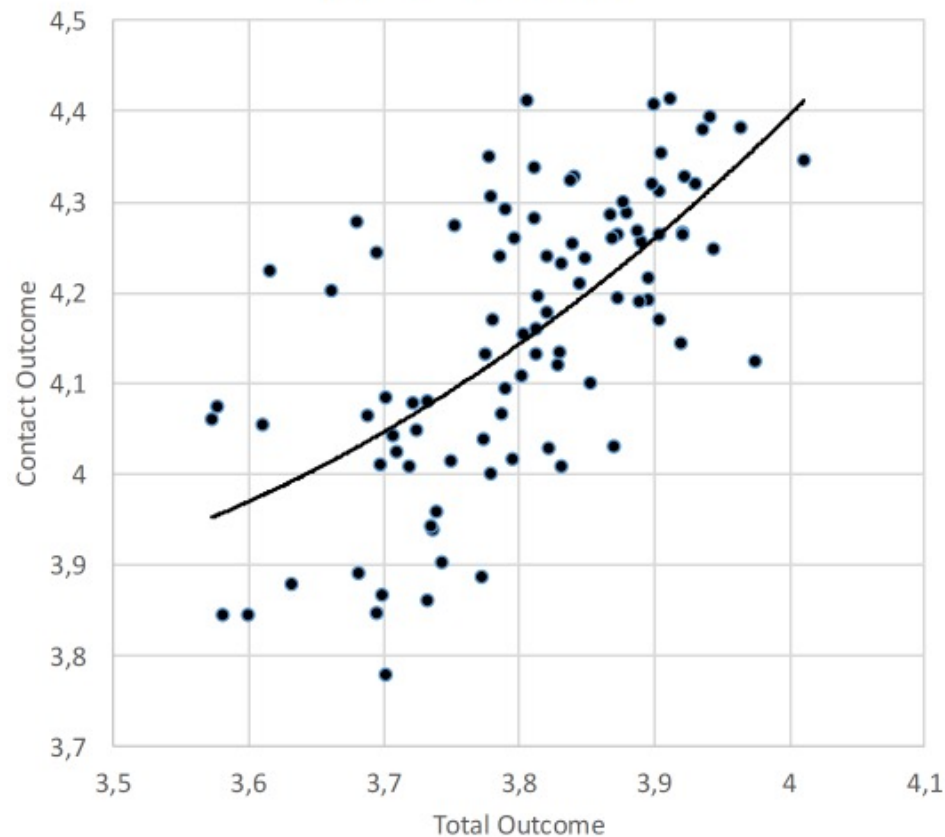
Machine Learning for Clinical Use

- Take patient data and prescribe a targeted treatment for the client



Better clinician care results in better client outcomes

Clinic : Total Outcome (IOI-HA) vs Contact Outcome
103<N<2515 Pearson: 0.65



Nordquist, 2017

Increased Personalization: Precision Hearing Healthcare

Unique hearing losses

New clinical diagnostics

New client intake assessments

CLINICAL
PROCEDURES

Big data

Processing capacity

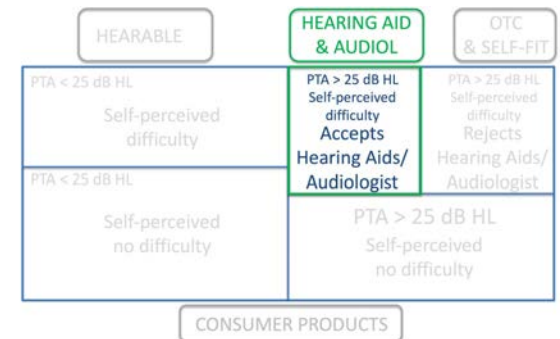
Connectivity technologies

INFORMATION
TECHNOLOGY

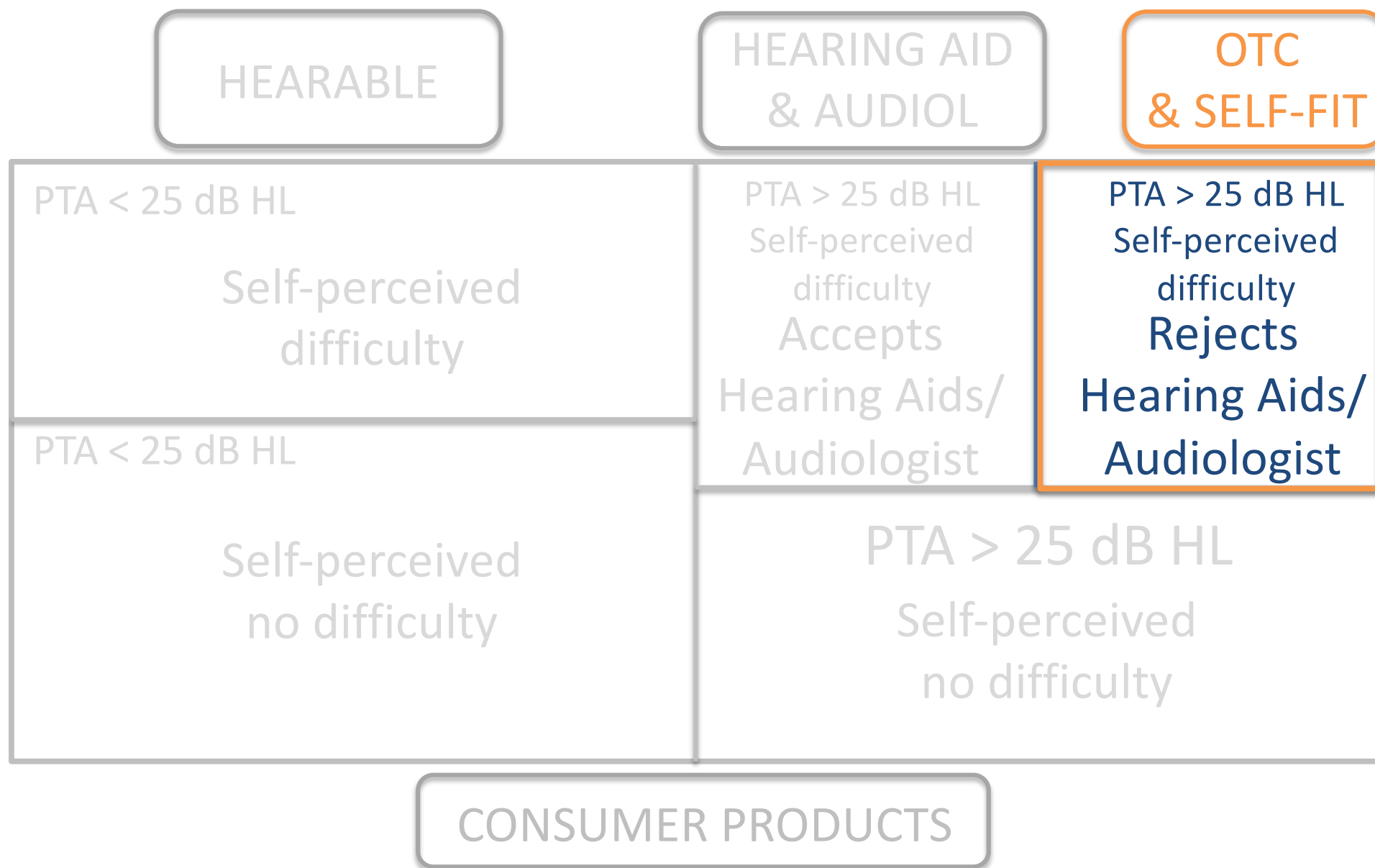
Predictive outcomes
Targeted solutions
Client engagement
and participation

Hearing Loss / Accepts HCP

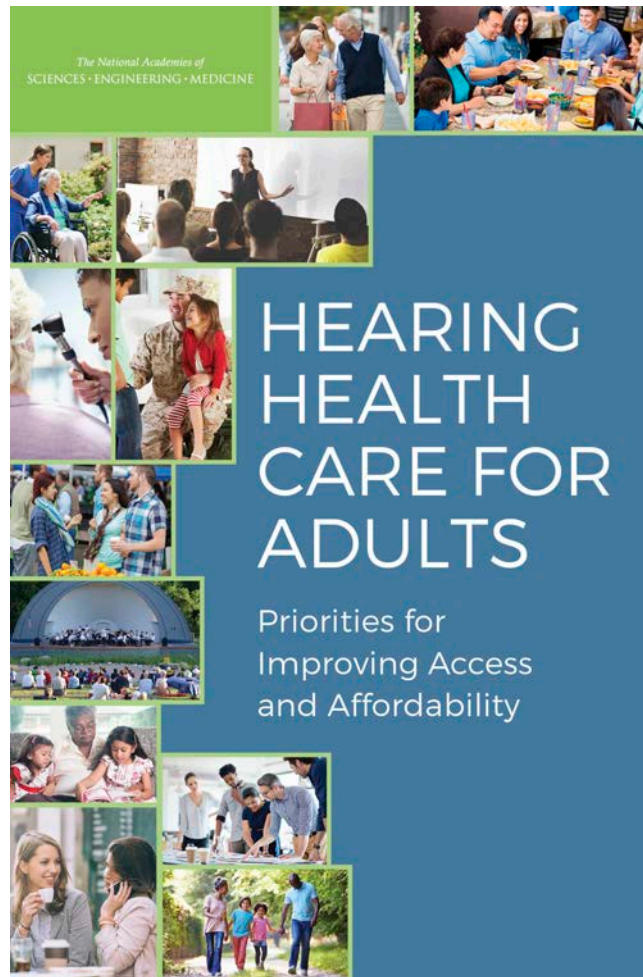
Summary



- Will continue to see HCPs for their hearing needs
- Connected Health technology will improve the audiologist-client connection
- Machine learning will off-load some tasks and enable more personalised treatment



Affordability & Accessibility



Hearing Loss / Rejects HCP

Unmet Needs

- Need improved speech understanding while also needing a solution to their:
 - Stigma
 - Laziness
 - Confidence in the solution
 - Lack of support structure
 - Desire to do everything themselves

Over-the-Counter Hearing Aids

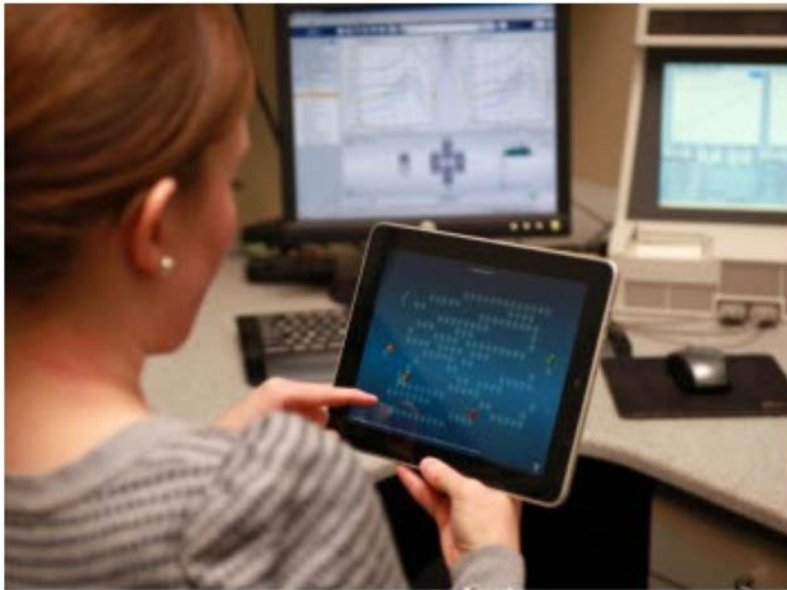


- Low-cost (<US\$500), direct-to-consumer (DTC) devices at retail stores
 - DTC already exists on internet
- Will likely be massive confusion years
 - How to market
 - Self-administered hearing test
 - Self-adjusted fittings

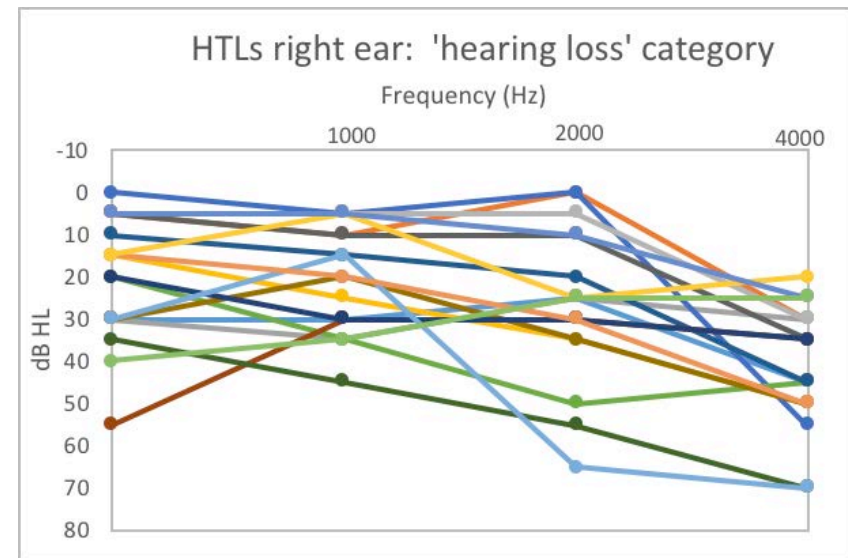
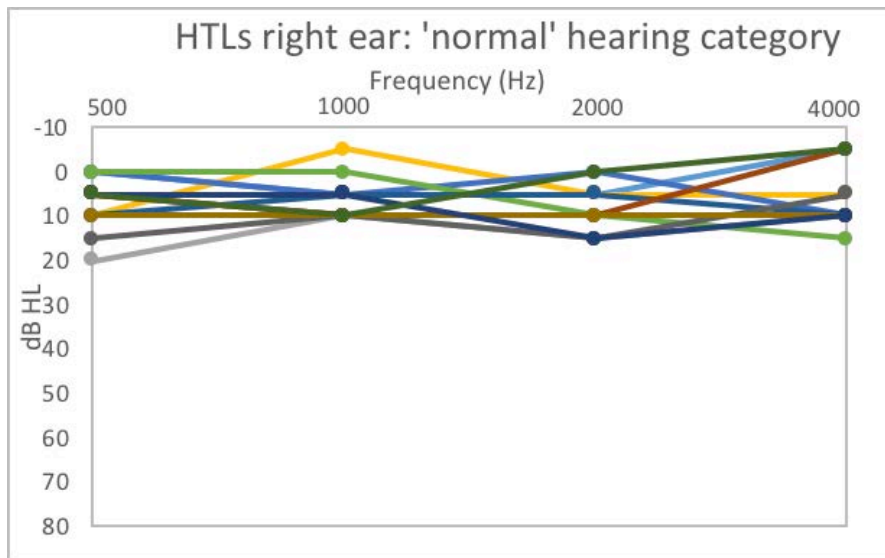


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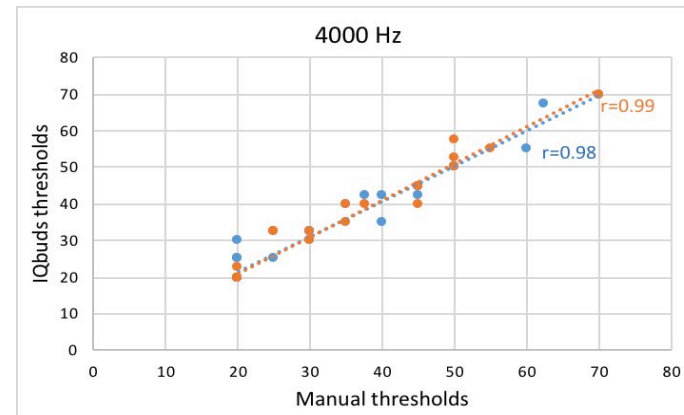
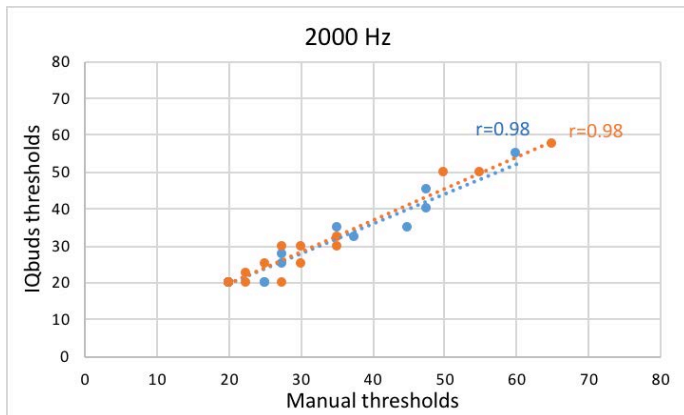
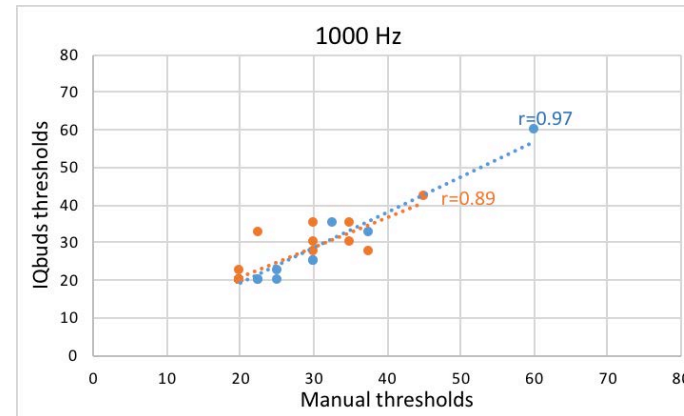
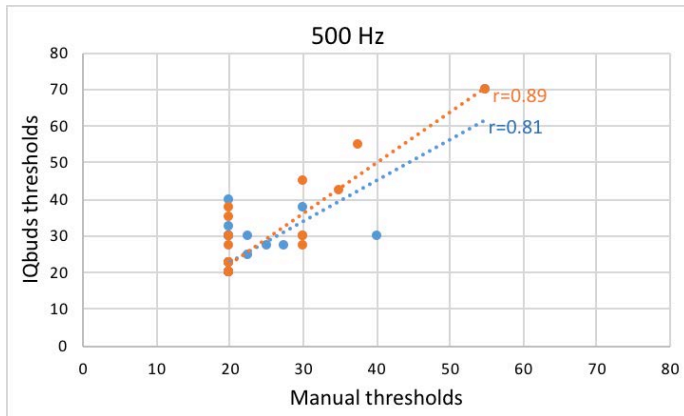
Self Fine-Tuning Apps

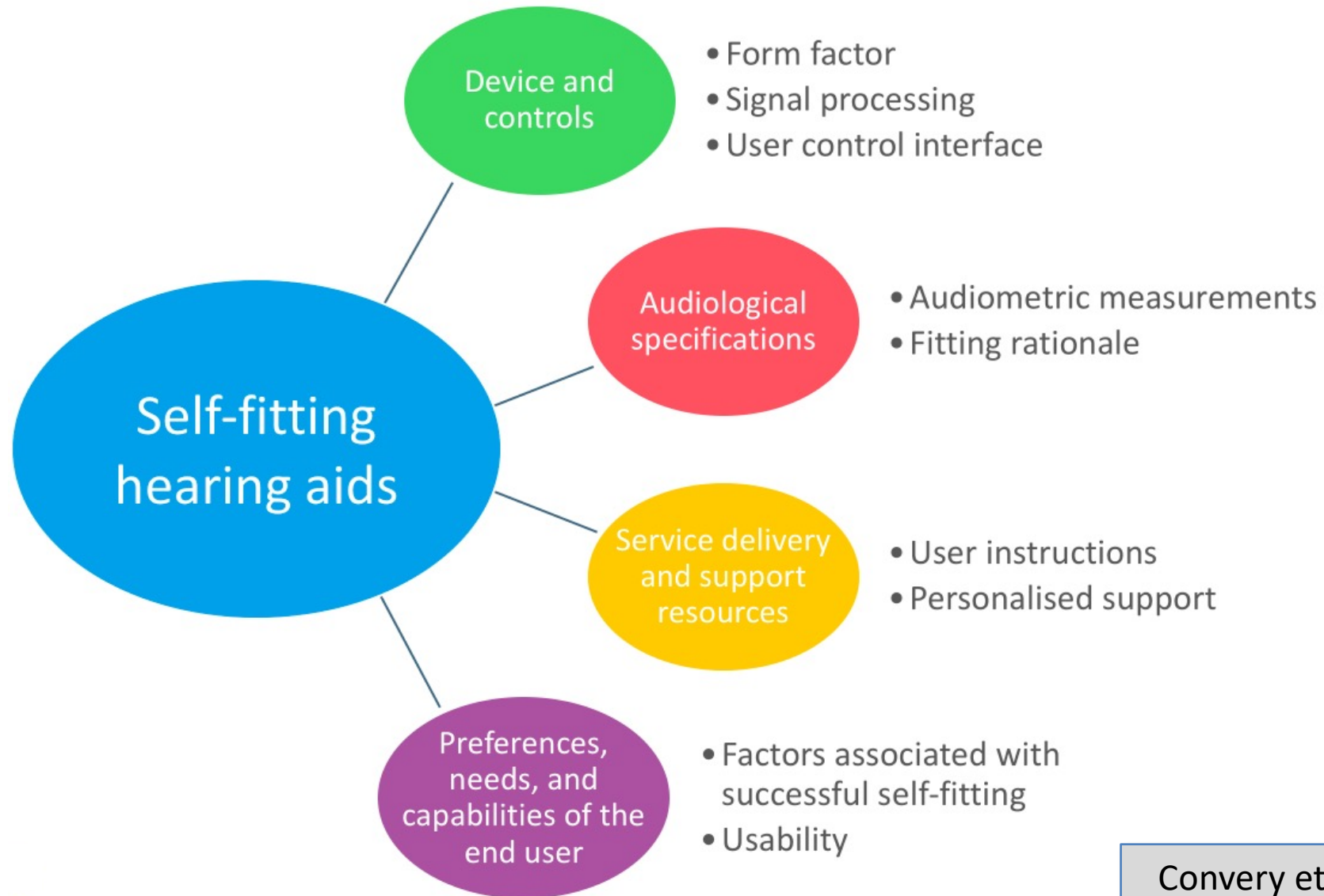


Self-test of Hearing Loss



Self-test of Hearing Loss





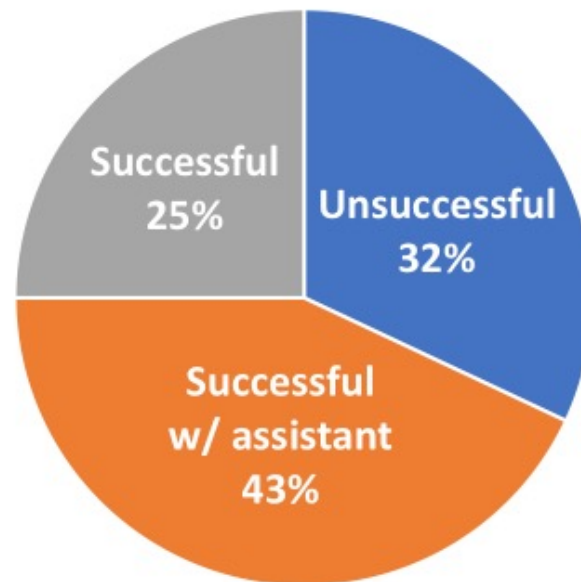
Convery et al., 2017

Self-Fitting Hearing Aids

- Assessment of self-fitting ability, 60 adults



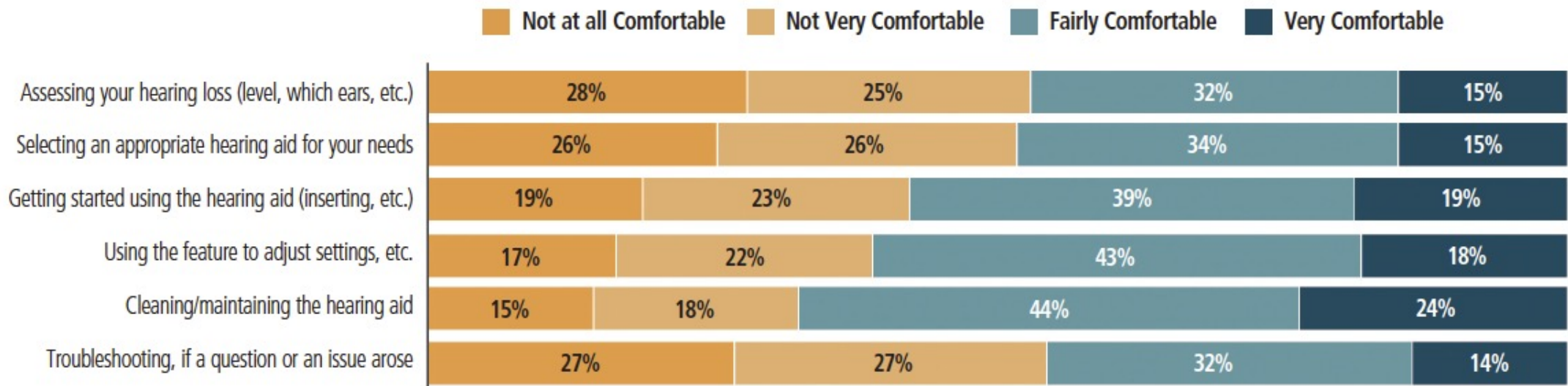
Success with Self-fitting Hearing Aid



Convery et al., 2017

MarkeTrak 10

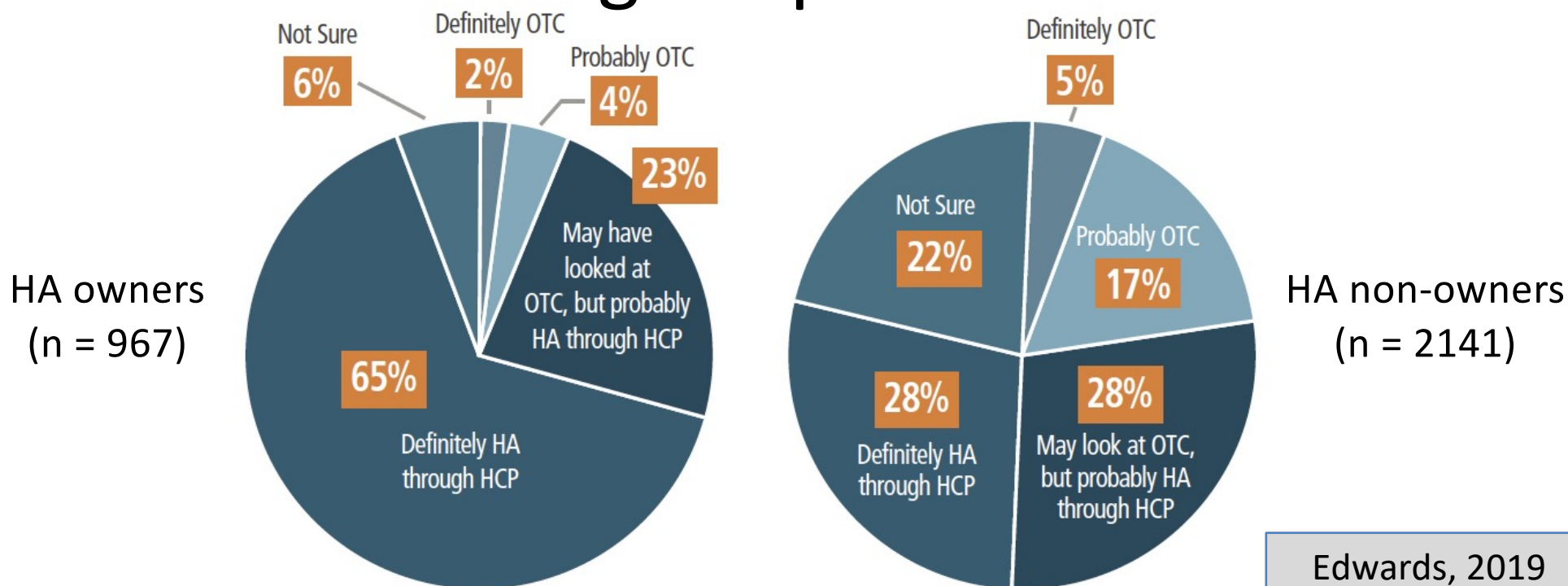
Approximate half of those with HL (n=3113) uncomfortable doing tasks associated with OTC



Edwards, 2019

MarkeTrak 10

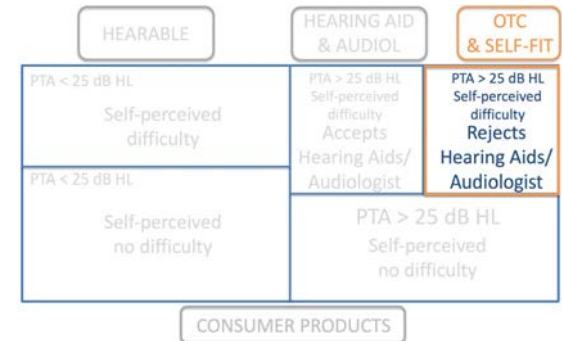
Most with HL prefer seeing an HCP for a hearing aid purchase



Edwards, 2019

Hearing Loss / Rejects HCP

Summary



- Challenge for OTC HAs will be overcoming:
 - Barriers to successful fit and use
 - Stigma
 - Laziness
 - Confidence in the solution
 - Lack of support structure
- Opportunity for HCP for a follow-up solution

HEARABLE

HEARING AID
& AUDIOL

OTC
& SELF-FIT

PTA < 25 dB HL

Self-perceived
difficulty

PTA > 25 dB HL

Self-perceived
difficulty

Accepts

Hearing Aids/
Audiologist

PTA > 25 dB HL

Self-perceived
difficulty

Rejects

Hearing Aids/
Audiologist

PTA < 25 dB HL

Self-perceived
no difficulty

PTA > 25 dB HL

Self-perceived
no difficulty

CONSUMER PRODUCTS

No HL / Difficulty in Noise

Unmet Need

- This population needs:
 - Improved understanding speech in noise
 - Extreme usability in solution
 - Cosmetically appealing solution

Who Are These People?

- Which factors are indicators of a poor ability to understand speech in noise?



STUDY DESIGN

Behavioural	Electro-physiology	Hearing Experiences
<ul style="list-style-type: none">• 122 participants• Online survey• Audiometry• Auditory processing• Cognitive skills	<ul style="list-style-type: none">• 68 participants• Five tests [CAEP's, IRN, speech ABR, click ABR, EFR]• Designed to support behavioural measures	<ul style="list-style-type: none">• 50 participants• Interviews & online survey• Exploring listening difficulties, impacts and strategies

Yeend *et al.*, 2017

Composite Speech-in-Noise Score

1. You are talking with one other person and there is a TV on in the same room. Without turning the TV down, can you follow what the person you're talking to says?

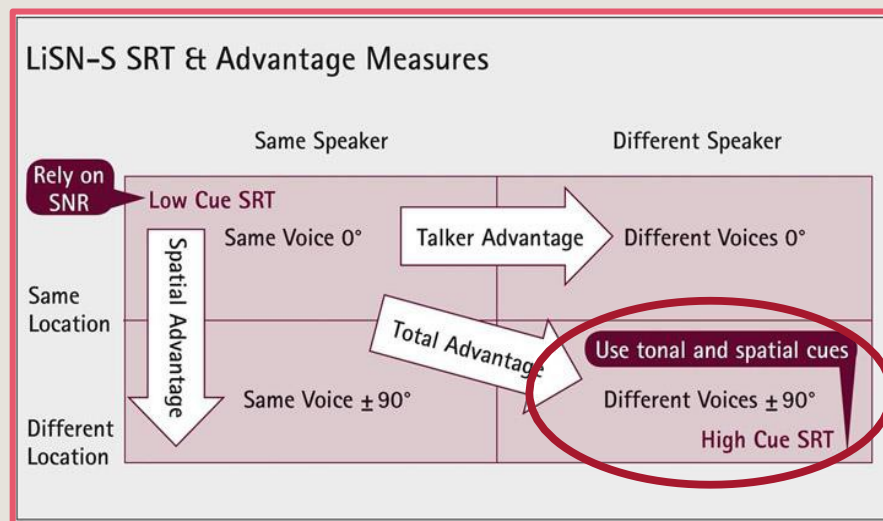
2. You are listening to someone talking to you, while at the same time trying to follow the news on TV. Can you follow what both people are saying?

3. You are in conversation with one person in a room where there are many other people talking. Can you follow what the person you are talking to is saying?

4. You are in a group of about five people in a busy restaurant. You can see everyone else in the group. Can you follow the conversation?

Each item includes a scale from 0 to 15 and a 'Not applicable' checkbox.

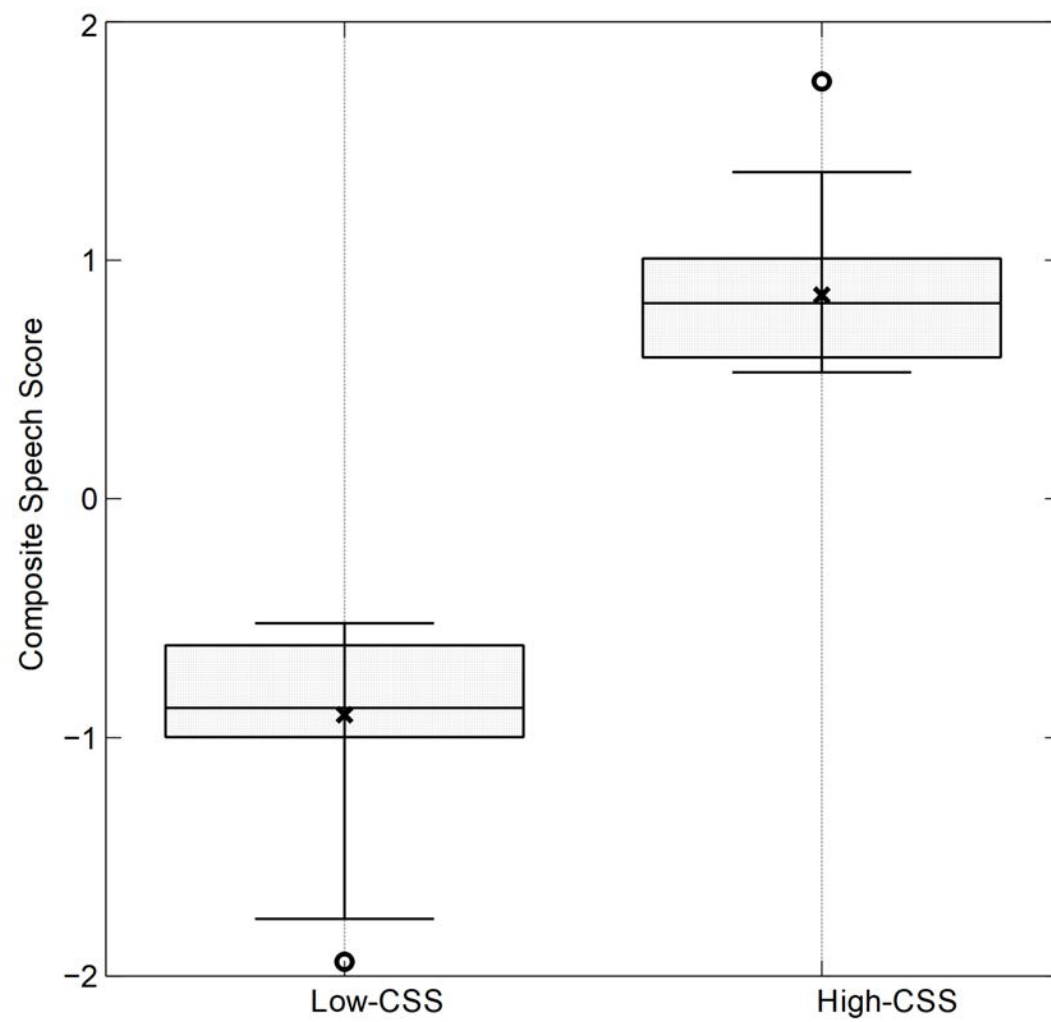
SSQ12 speech items



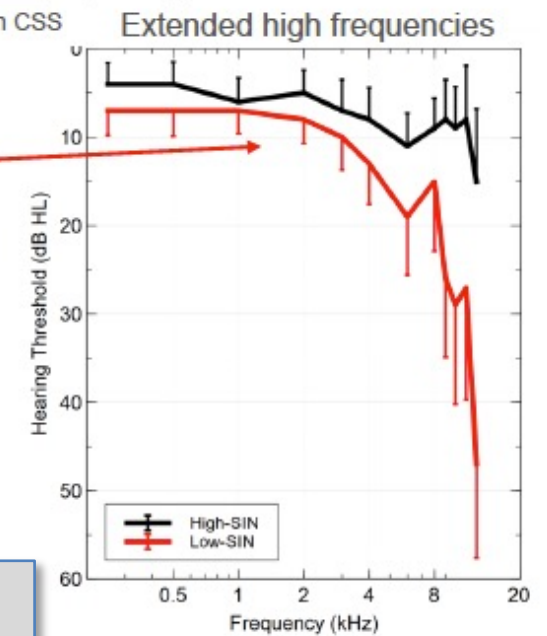
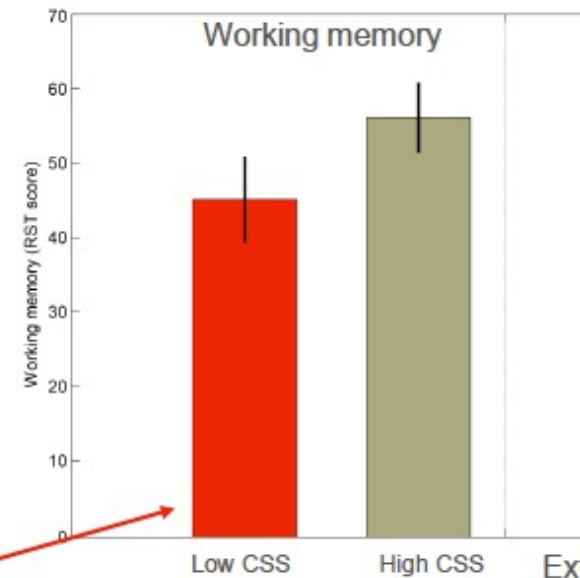
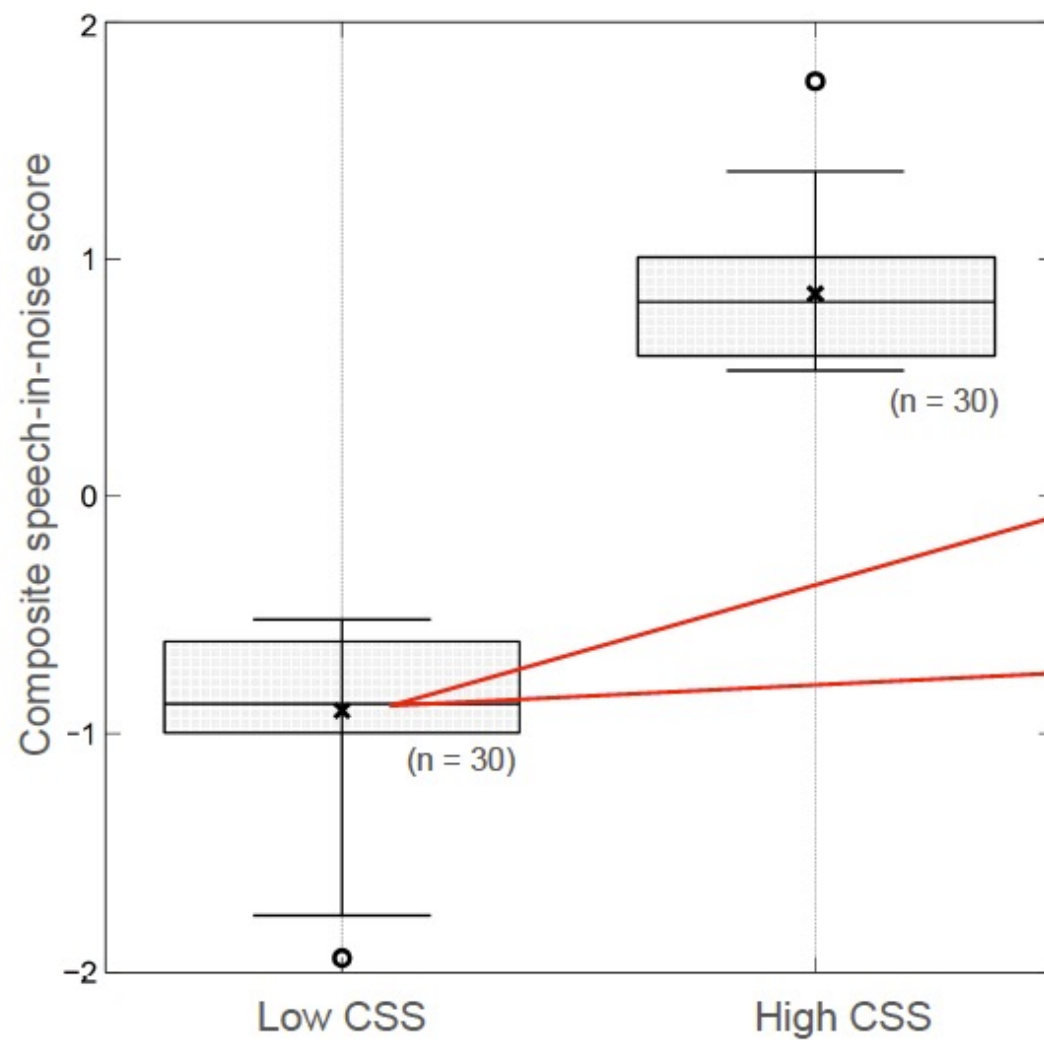
LiSN-S



NAL-DCT

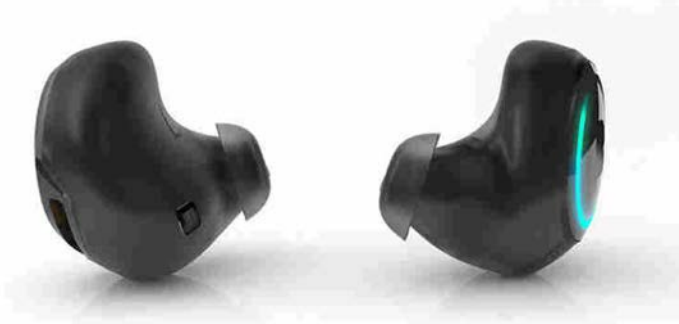
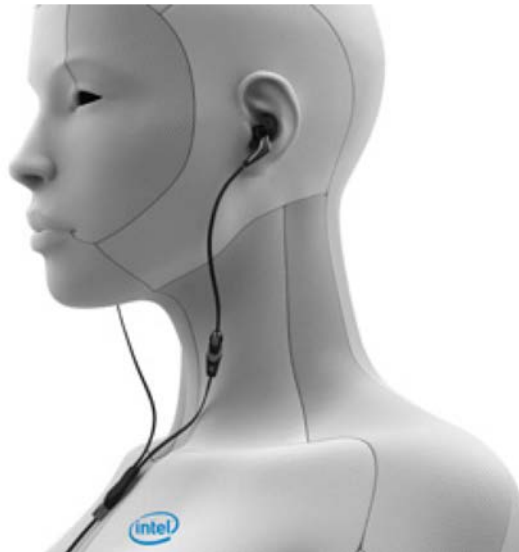


Yeend *et al.*, 2018



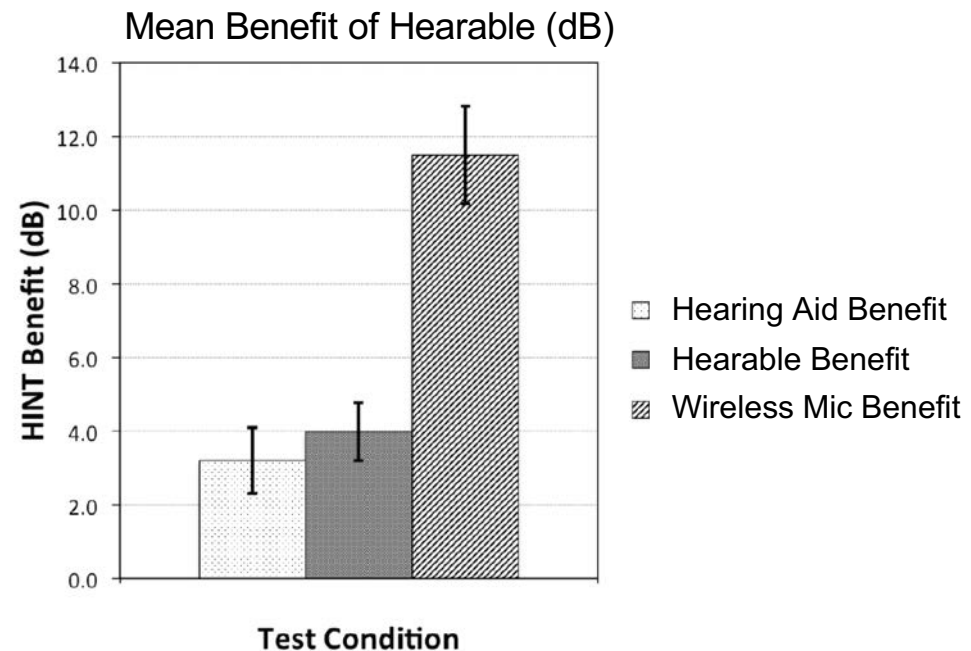
Yeend *et al.*, 2018

Hearables



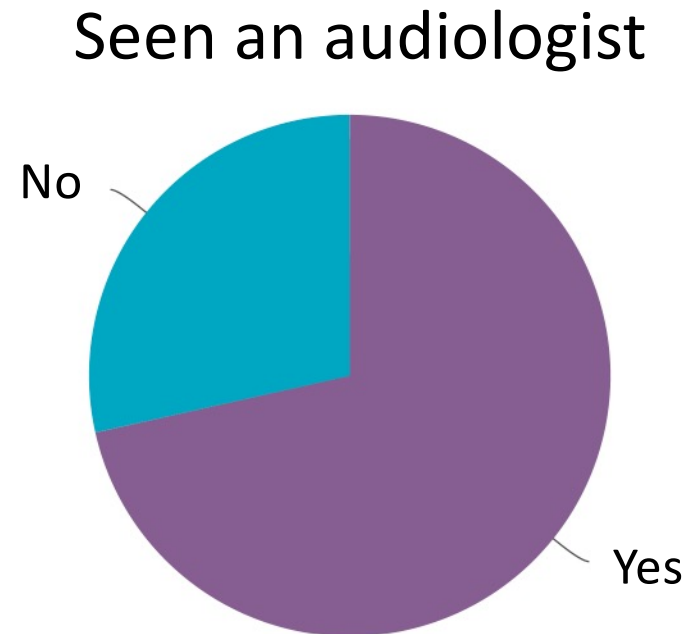


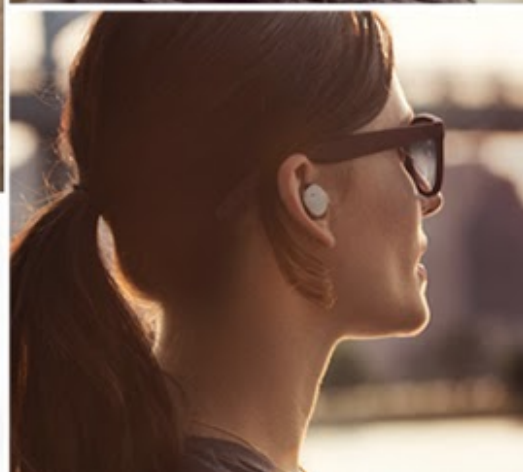
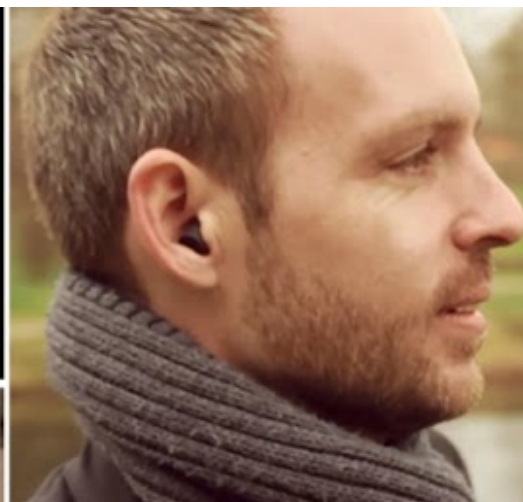
- Aided HINT re: unaided
 - RIC hearing aid
 - Hearable earpiece
 - Hearable wireless microphone



Hearable Owner Survey

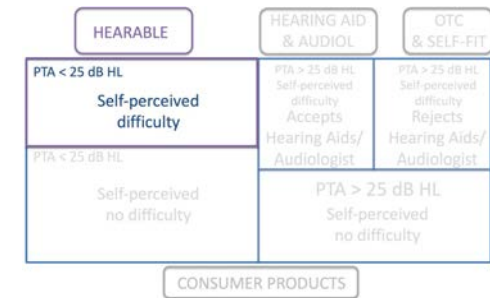
- 1060 hearable owners completed an online survey
- 72% have had an audiogram taken by an audiologist





No HL / Difficulty in Noise

Summary



- A large underserved population
- Challenge in providing a solution is in hardware usability/comfort/cosmetics
- Opportunity for HCPs to help this population

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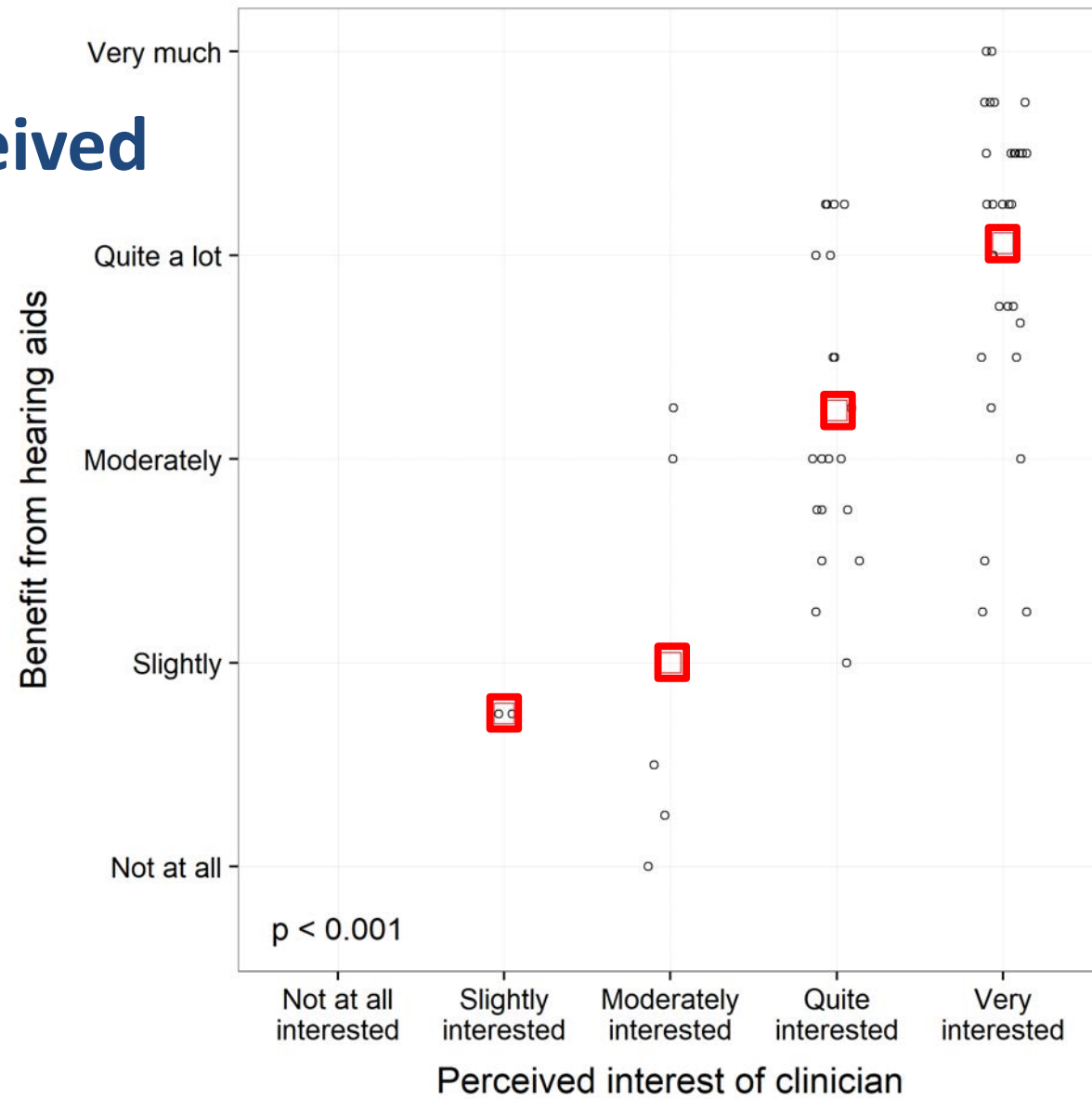
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CONSUMER PRODUCTS

Takeaway

- Hearing healthcare will reach beyond those currently being helped
 - **New definitions** of hearing health need, new patient categories and delivery systems
- **Teleaudiology** and **self-care** will address a growing demand for hearing healthcare
- **Audiologists' role** will change and grow with these innovations

Benefit versus perceived clinician interest



Thank you!



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