Sex Differences and the Effect of Female Sex Hormones on Auditory Function: A Systematic Review

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Background

- Gender has been suggested to have an effect on hearing[1].
- Young women have better hearing sensitivity, both in the peripheral and central auditory system, than men in the same age group [2].
- These differences on auditory function are thought to be connected either to overall differences in levels of sex hormone between men and women and/or the fluctuating nature of sex hormones in young women[3].

Aim

- To systematically evaluate the current evidence on the possible sex differences in auditory function, the influence of overall differences in sex hormone levels between men and women and the effect of female sex hormones fluctuation on auditory function.

Methods

The protocol of this review was registered in the International Prospective Register of Systematic Reviews (PROSPERO; Reference ID: CRD42020201480) in October 2020

Review Questions

1. Does auditory function differ in women and men?
2. Does auditory function of women fluctuate due to changes in female hormones levels?

Participants

- Studies of premenopausal women / adult men with normal hearing.
- Studies of premenopausal women with regular menstrual cycle, no use of hormonal contraceptives, no pregnancy, and no lactation.
- Studies of post-menopausal women / older men with normal hearing/ hearing loss.

Inclusion criteria

- Published studies in English, or if English translation is available.
- Studies done on human participants, adults (≥17 years).
- Pre-menopausal women.
- Post-menopausal women.
- Adult men.

Exclusion criteria

- Gray literature, systematic review, conference abstracts, book chapters, dissertations, theses, and clinical guidelines.
- Preclinical studies/ Animal studies.
- Studies that included female participants who breastfeeding, pregnant or use contraceptive bills or if not mentioned
- Studies including participants with additional health conditions or risk factors for ototoxicity, noise exposure and middle ear pathologies.

Information sources

EMBASE, PubMed, MEDLINE (Ovid), PsycINFO, ComDisDome, CINAHL, Web of Science and CENTRAL via Cochrane Library

Literature Search Flow Diagram

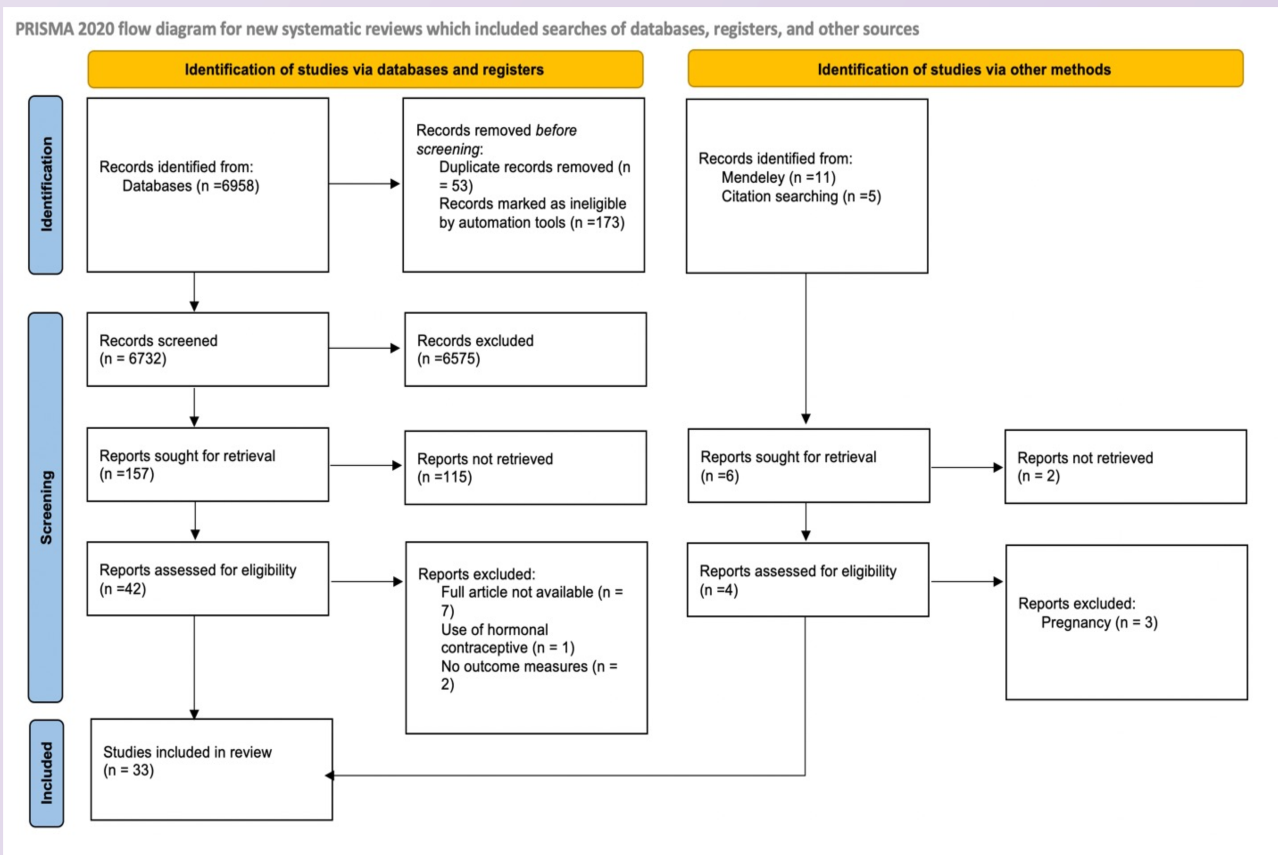

Fig. 1 PRISMA 2020 selection process flow

Studies Characteristics

33 studies were included in the review. The included studies were divided into three groups based on participants characteristics and studies design: 11 studies on the sex differences between premenopausal women and age-matched men in auditory function, 19 studies on the female hormones' fluctuation in premenopausal women, and 3 studies on the auditory changes in postmenopausal women.

Results

Sex Differences:

- Women were reported of having better hearing sensitivity (in peripheral and central auditory system).
- Women hearing sensitivity tend to rapidly decline soon after the start of menopause, which acts as the trigger of age-related hearing loss in women.

Fluctuation Across Cycle:

- Women's auditory function fluctuated during the menstrual cycle, where men tend to have more stable auditory function.
- During Higher level of oestrogen, the peripheral hearing was reported to improve, where it decreased during Higher level of progesterone. However, the role of oestrogen and progesterone in the central auditory system remains unclear.

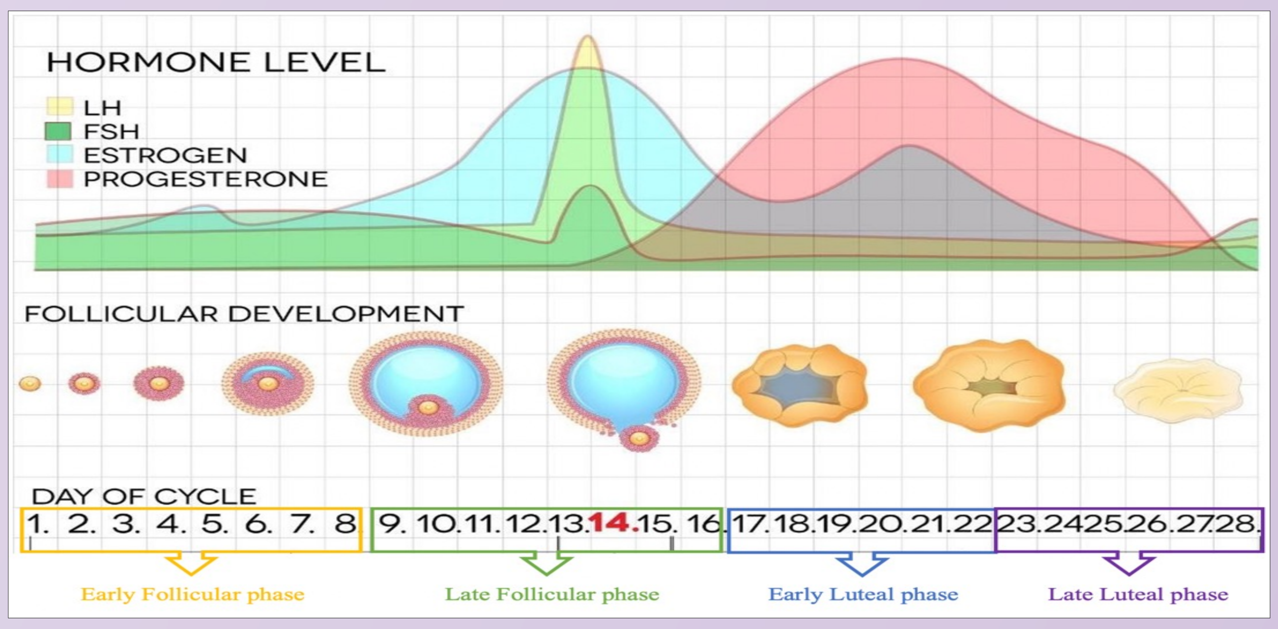

Fig.2 Schematic representation of the fluctuation of the hypothalamus and ovarian hormones during the average ovarian cycle [4].

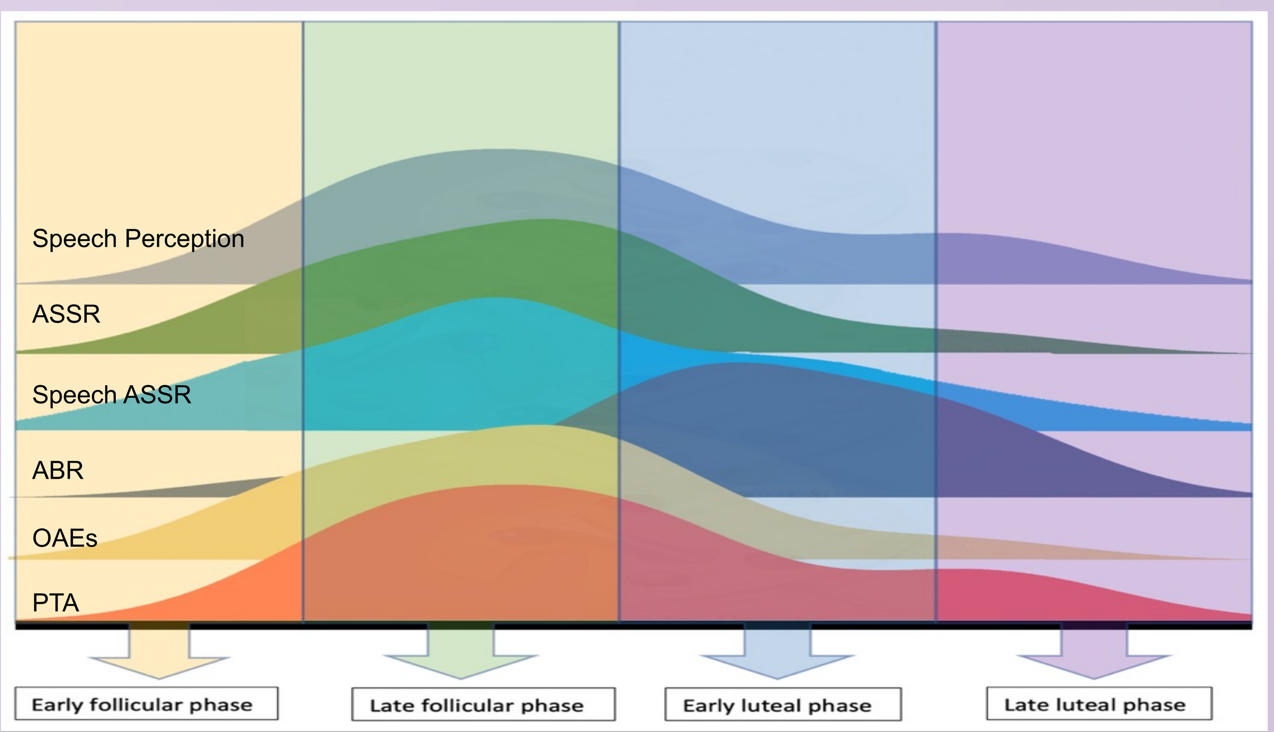

Fig.3 Illustration of the fluctuation of the audiological performances across the menstrual cycle, the peaks represent better performance.

	STATIC SEX DIFFERENCES						
	PTA	TEOAEs SOAEs	DPOAEs	ABR	Speech-ABR	Speech perception	40 Hz ASSR
Premenopausal vs. age-matched men	Women > Men	Women > Men	Women = Men The differences are related to the anatomical differences (i.e., the length of the cochlea)	Women > Men	Women > Men	Women > Men	Left-handed women > left-handed men. Right-handed women = right-handed men.

	CYCLICAL CHANGES/ HORMONAL FLUCTUATION	
	PTA	ABR
Postmenopausal vs. age-matched men	Postmenopausal women tend to show a steeper decrease in hearing sensitivity than men	
Postmenopausal women	Fast and rapid decline in hearing in high frequency after the start of menopause.	Longer wave latencies in women between 50-70 years old.

Table 1. Summary of the studies' findings.

Bias and Quality Assessment

The quality of evidence was assessed using Newcastle-Ottawa Scale (NOS).

- Only four studies were of good quality.
- Twenty-five studies were of fair quality (high risk)
- Four studies were of poor quality (very high risk).

The main concern were:

1. The outcome measures for hormones levels, as few studies used objective tests such as blood assays and saliva samples.
2. Only three studies had "appropriate" number of sessions for outcomes to occur, i.e. participants were tested in three or four sessions throughout one cycle.
3. Most of the studies in this review did not have a control group. Therefore, the quality of these papers was downgraded due to this concern.

Conclusion

- There are consistent sex differences in the auditory function, were women reported to have better hearing.
- For young women, there are consistent fluctuations in hearing with a clear better performance during late follicular phase (i.e., during the peak of oestrogen).
- The possible effect of female hormones on hearing remains unclear and may needs further investigation. As the included studies highlighted the need to implement a well-designed study in evaluating the influence of oestrogen and progesterone on hearing by including men as control groups, use objective tests to measure hormonal level, and to test participants at different points across the menstrual cycle.

References

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Acknowledgments

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Datalogging findings in adult cochlear implant recipients who never developed intelligible speech.

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Introduction

Cochlear implants (CI) are beneficial to most recipients' communication abilities, but questions remain as to how beneficial they are in recipients who never developed intelligible speech. The lower speech perception outcomes when compared to traditional CI recipients present questions as to whether these patients are good candidates for implantation. Often, there are also fears of sound aversion, non-use of device and appropriate management of expectations. Datalogging history of these patients, however, reveals significant daily usage of the devices, which could be an indicator of benefit.

Research Questions

1: Is speech intelligibility a predictor of long-term usage?
2: Is speech perception a predictor of long-term usage?
3: Is the time spent in each sound environment a predictor of high usage?
4: Are high hours of usage at early-stage post-implantation a good indicator that the candidate will remain a long-term user?

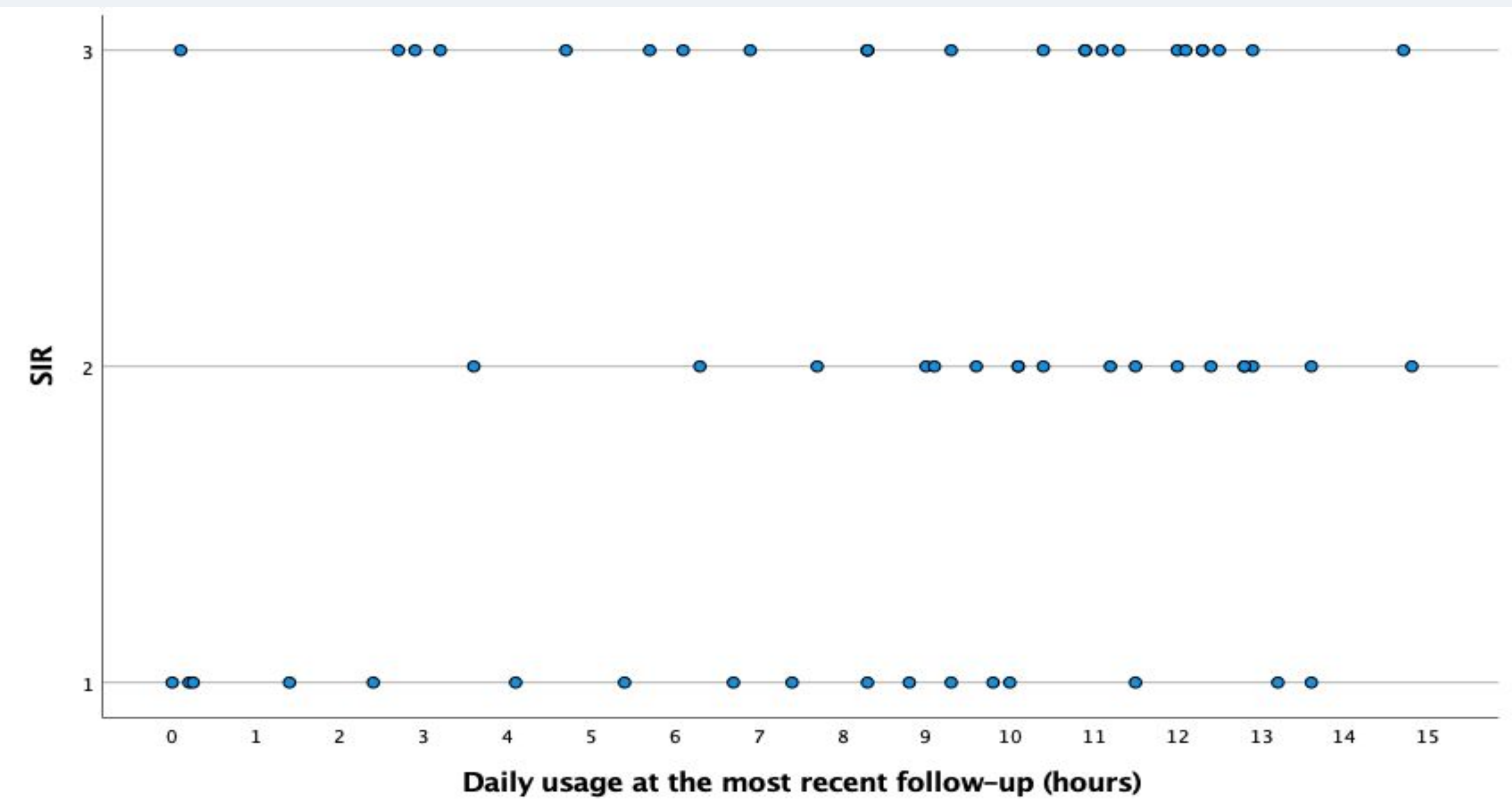
Methods

Non-traditional CI recipient is described as someone who was implanted in adulthood and scored 3 or below on the SIR test as an adult, irrespective of aetiology, of having prelingual or perilingual deafness, of being HA user prior to implantation and of communication mode.
A retrospective medical notes and clinical sessions review was performed. Simple linear regressions, multiple linear regression and logistic regressions were used to assess significance of predictive factors.

Results & Discussion

The results suggest NT CI recipients tend to wear their sound processors regularly (M = 8.7 hours/day, 95% confidence interval of 7.6 to 9.7) and favour specific listening environments (SiQ: M = 76.69%, 95% confidence interval of 71.15 to 82.22%; quiet: M = 51.56%, 95% confidence interval of 45.42 to 57.70%). These factors combined would imply most benefit from their sound processor in those environments.

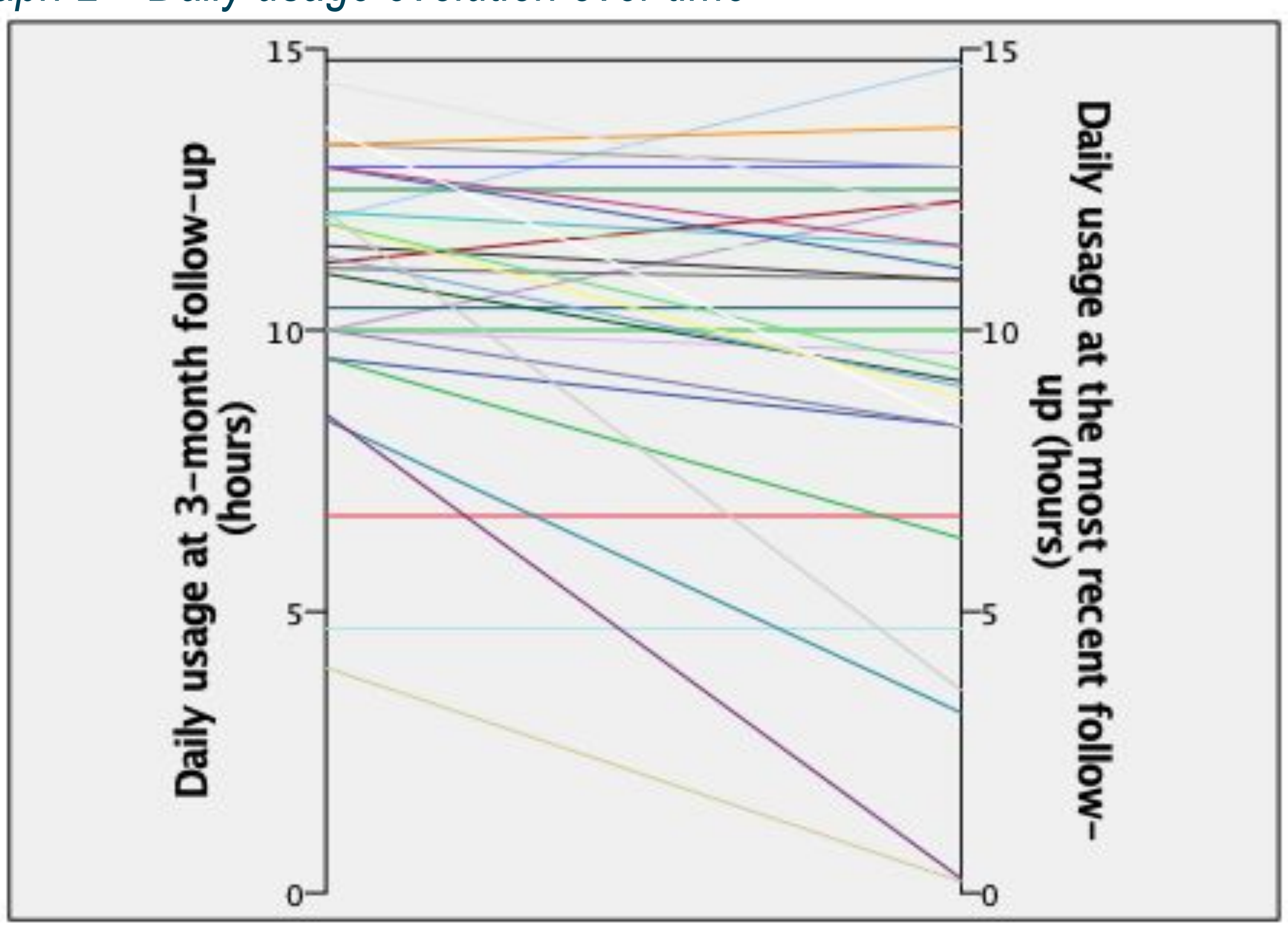
Graph 1 - Long-term usage grouped by SIR



Results & Discussion (cont.)

8.5% of the cohort (n = 5) were non-users (less than 2 hours of average daily usage).
The correlation between SIR and long-term usage was weak and non-significant ($r = 0.188$, $p > 0.05$), as was the correlation between speech perception and long-term usage ($r = -0.113$, $p > 0.05$). As seen in graph 1, patients with a higher SIR score are not more likely to be better long-term users.
No preimplant factors were predictors of long-term usage. Postoperative BKB scores did not improve significantly.
None of the environments in scene analysis were statistically significant predictors of long-term usage ($p > 0.05$), unlike daily usage at 3-month follow-up, which was found to be a significant predictor ($r = 0.741$; $F (1, 30) = 36.436$, $p < 0.05$; graph 2). Patients who wear their CI at 3-month follow-up are 1.947 times more likely to remain users ($X^2 (1) = 6.062$, $p < 0.05$), explaining 46% of the variance and correctly identifying 93.8% of cases.
These findings indicate that intense rehabilitation and encouragement to use their sound processors in the first 3 months after implantation makes long-term benefit more likely, demonstrating the importance of establishing use early on and supporting patients to achieve this.

Graph 2 – Daily usage evolution over time



Conclusion

This study implies substantial benefit to the cohort of NT CI recipients that is not directly witnessed through speech intelligibility or speech recognition, neither of which should be used to influence decisions about implantation criteria. It also offers valuable insights of user statistics for both the assessment and rehabilitation of non-traditional recipients. NT CI candidates who are users at 3-month follow-up can expect to be and remain good long-term users, favouring listening with their CI in SiQ and quiet environments. Future studies in larger NT CI groups should focus on in-depth user statistics and the development of CI-specific subjective benefit PROMs.

List of Abbreviations: SIR – Speech Intelligibility Rating; HA – hearing aid; BKB – Bamford-Kowal-Bench sentence test; NT CI – non-traditional cochlear implant recipient; SiQ – Speech in Quiet

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Who's Here for Glue Ear?

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Introduction

Glue ear is the most common cause of childhood hearing loss and is particularly prevalent in children under 5 (1). It's importance can be overlooked when seen as self-limiting or easily resolved with grommets. However, there can be associated long term auditory difficulties following glue ear (2) and any hearing loss in the early years requires attention and research.

To better understand the course of glue ear locally, we conducted a retrospective study measuring the effects of age and time on glue ear persistence and associated hearing loss.

Methods

84 children under 12 years with bilateral type B tympanometry at their initial assessment were included.

The patient management system was used to document age, interval between assessments, tympanometry results and hearing levels at the initial and monitoring assessments.

Statistics were calculated using Excel.

Results

- 70% of children with bilateral glue ear were under 5 years.
- Tympanometry remained type B at the review appointment for 50% of ears in 1-2 year olds, 51% of ears in 3-4 year olds and 48% of ears in children aged 5 and over (*figure 1*).
- At 3 months our data had 45% fewer ears with improved tympanometry compared to the literature (3). This pattern persisted at 6 months (17% fewer ears), 9 months (25% fewer ears) and 12 months (13% fewer ears) post glue ear diagnosis (*figure 2*).
- There was a significant improvement in mean hearing levels at the monitoring appointment (P=0.0005) but great variability and no clear pattern related to age (*figure 3*).

Figure 2

	Ages included	n	% non B tymps at Review			
			3 Months	6 Months	9 Months	12 Months
Rosenfeld and Kay 2003 (3)	2-8 years	479-618	56%	72%	81%	87%
Our Data	2-8 years	18-64	11%	55%	56%	74%

Figure 1

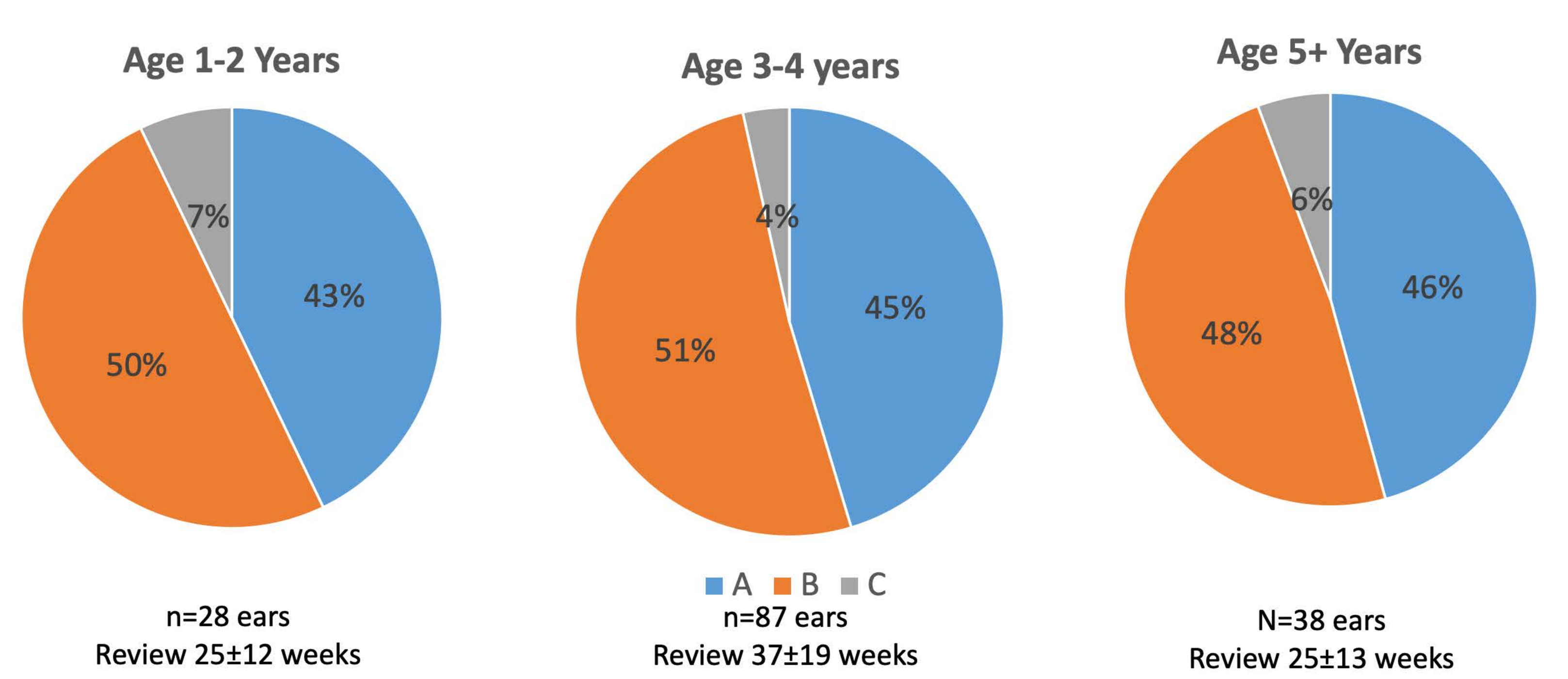
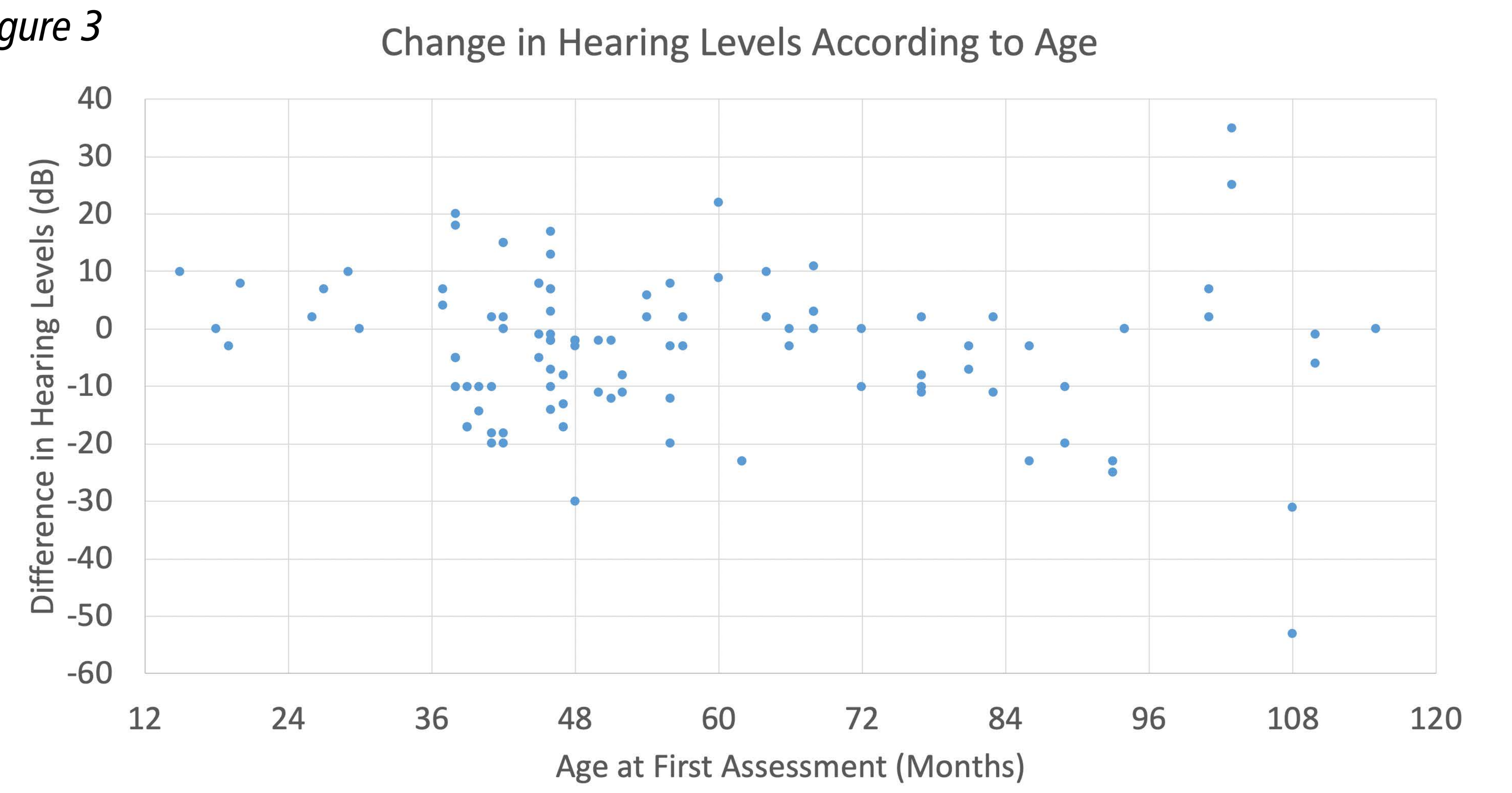


Figure 3



Conclusions

Our research shows a higher prevalence of glue ear in children under 5, but equal persistence across ages with no pattern of improved hearing levels in older children. Therefore, glue ear is less common in our school aged patients, but just as likely to persist and require management.

Glue ear appears to be more persistent in our patients compared to the literature. Although our limited numbers should be considered, environmental factors in our area such as high child poverty, low breastfeeding rates and high smoking rates (4) may be at play (1).

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4. Public Health England (2020) Sunderland Local Authority Health Profile 2019.

Questionnaire Screening for BPPV

for an adult direct referral balance clinic

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GIG CYMRU NHS WALES | Bwrdd Iechyd Prifysgol Cwm Taf Morgannwg University Health Board

Introduction

- Patients with uncomplicated BPPV do not require long appointments for balance assessment.
- Clinic time can be saved by identifying uncomplicated BPPV prior to booking and using shorter appointments.[1]
- Previous studies have shown success in identifying BPPV using subsets of questions from the Dizziness Handicap Inventory (DHI). [2,3]
- Pre-appointment screening offers the potential to stream patients into more efficient pathways.

Methods

- The questionnaire used in this study comprised the 10-item short-form DHI (S-DHI)[4] and five questions from the DHI that ask about BPPV symptoms.[2,3]
- The questionnaire was posted to 200 patients as part of a waiting list validation letter.
- Patients completed the questionnaire at home using either a paper form or an online form (QuestionPro.com).
- A prompt letter was sent if there was no response.
- The response rates are shown in figure 1.
- The questionnaires were scored the same as the DHI:

No=0; Sometimes=2; Yes=4

Figure 1: How Patients Responded (%)

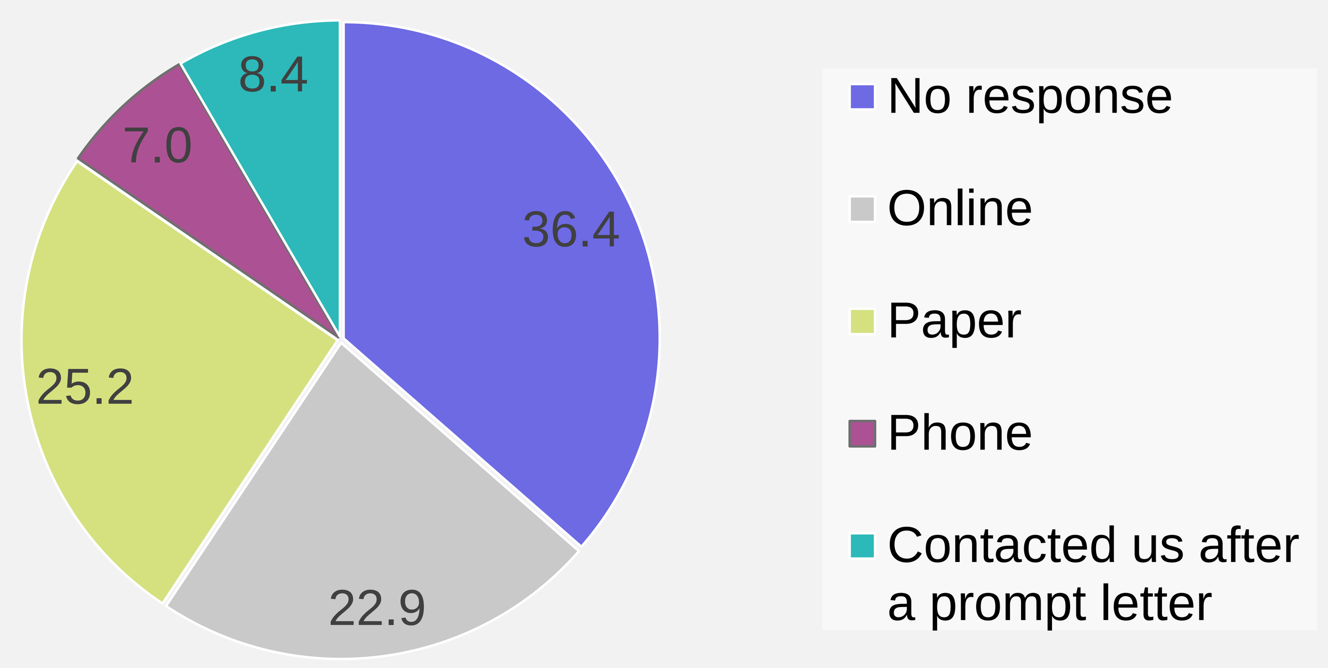
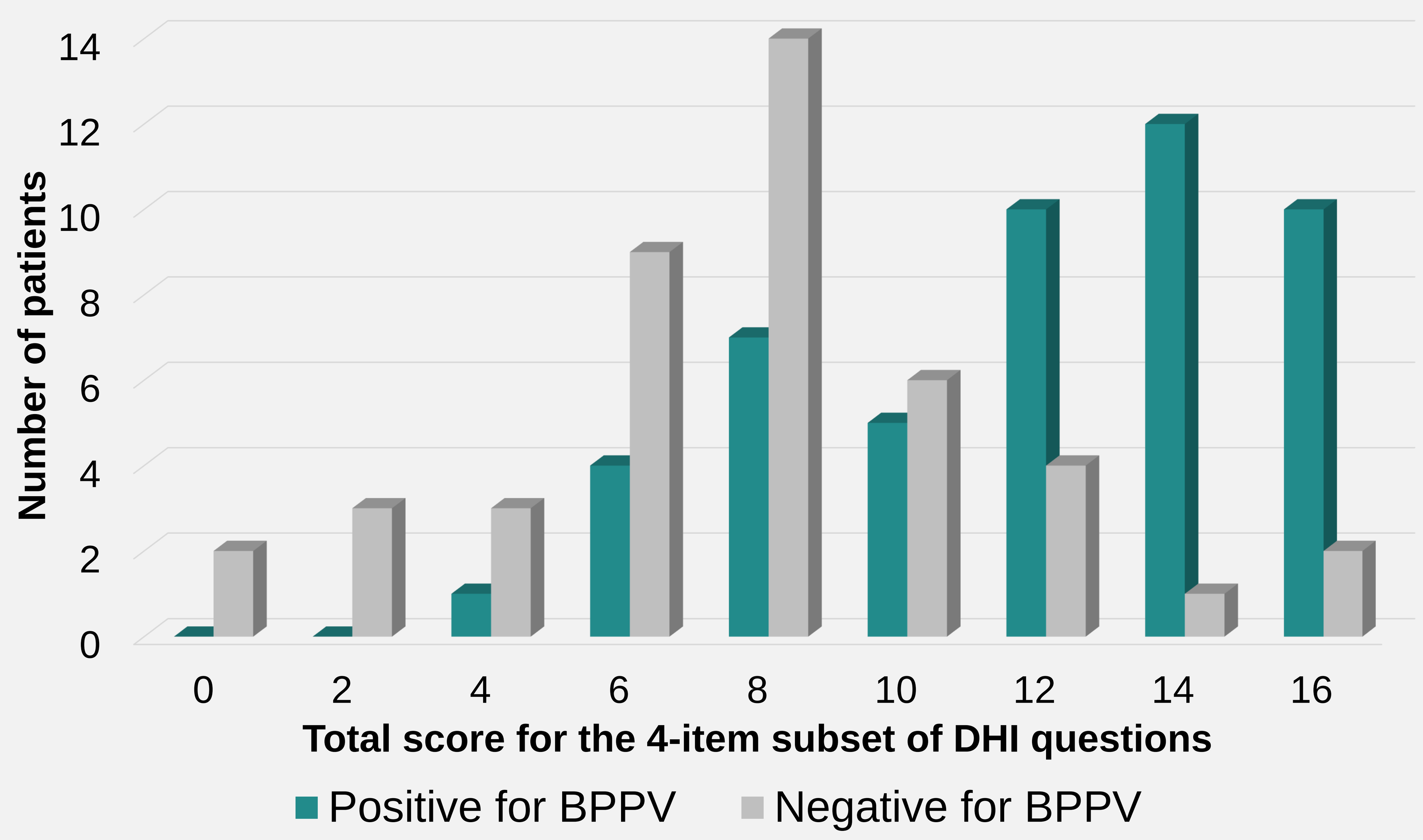


Figure 2: Scores for DHI BPPV Questions



BPPV Testing

- For patients who attended clinic, 61 patients tested positive for BPPV (31 with co-occurring conditions); 61 patients tested negative for BPPV.
- Questionnaire scores were compared between patients who tested positive for BPPV and negative for BPPV.
- **The scores on the BPPV questions were significantly different between BPPV and non-BPPV groups.**

(Chi-squared goodness of fit $p<0.05$, using a 4-item or 5-item subset.) The 4-item scores are shown in figure 2.

S-DHI

- The S-DHI was included to identify patients with multifactorial imbalance, unsuited to a short appointment.
- While these patients scored highly on the BPPV questions, they also scored very highly on the S-DHI.
- High S-DHI scores were associated with additional health problems, such as:

endometriosis migraine diabetes poor health
brain surgery fibromyalgia stroke
Arnold Chiari intracranial hypertension
neuralgia dystonia PTSD epilepsy head injury

Pre-Appointment Screening Criteria

- The aim was to identify **uncomplicated BPPV, suitable for a shorter appointment.** This needed to:
  - ❑ Include patients who scored highly on the BPPV questions.
  - ❑ Exclude patients who scored highly on the S-DHI
- The most effective criteria are shown in table 1.

Table 1: Most effective screening criteria

BPPV score more than	S-DHI score less than	% Positive Predictive Value*	% of Patients Meet Criteria**
14	30	100	19
10	30	96	36
10	32	90	41
10	34	86	48

*For patients whose scores matched these criteria, this is the percentage who had BPPV as their main diagnosis in clinic.
**This is the percentage of balance patients who will be booked for a shorter appointment if we use these criteria in practice.

Summary

- A 4-item DHI subset was found to be the most effective at predicting a positive test for BPPV. This comprised DHI questions:

1 (looking up) **5 (getting in and out of bed)**
13 (turning over in bed) **25 (bending over)**

- Combining this subset of DHI BPPV questions with the 10-item S-DHI was an effective pre-appointment tool for identifying uncomplicated BPPV.
- **Positive predictive value up to 100% was possible.**
- When choosing criteria to use in practice, there is a trade-off between positive predictive value and the number of patients potentially streamed into a shorter appointment (BPPV pathway).

References

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2) Whitney, S L *et al. Otology & Neurotology.* 2005; 26; 5; 1027-1033
3) Chen, W et al. *Neurol Sci.* 2016; 37; 1241–1246
4) Van Vugt, V A *et al. Journal of Clinical Epidemiology.* 2020;126; 56-64

School of Psychology

CO-DEVELOPING A PSYCHOLOGICAL SUPPORT PACKAGE FOR PEOPLE WITH VESTIBULAR CONDITIONS

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Introduction & Aims

Up to 60% of people with vestibular conditions experience psychological distress encompassing cognitive, mental health, and somatic problems. These can compound patients' suffering and impede clinical recovery. This has prompted interest in psychological aspects, and NICE recommend incorporating psychological support into vestibular care as best practice.

Currently there are no clinical guidelines to show how to assess and manage psychological aspects, leading to variation in care received. Through stakeholder consultations, adopting a person-centred approach, this project will iteratively develop a support package for the psychological aspects of vestibular disorders.

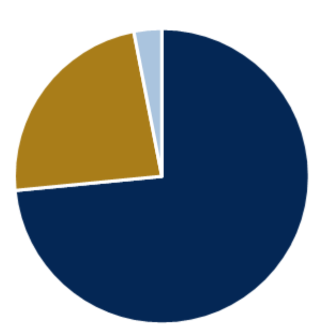
Phase 1: National Survey of Clinical Practice

Establish how psychological distress is currently addressed within usual care. An online survey was completed by 101 healthcare professionals who treat vestibular conditions.

Service Configurations

M= 82.89 (1 to 2000) Vestibular patients seen per week by service

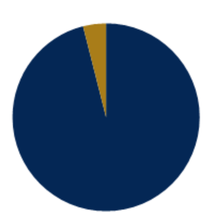
MDT and single disciplines

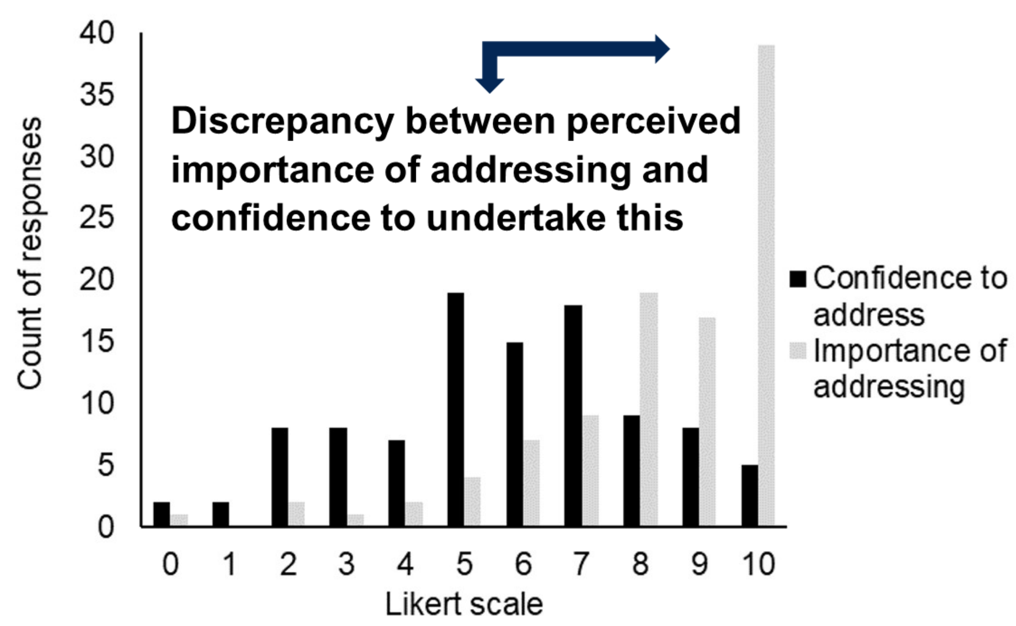


Years experience working with vestibular conditions: *M*= 13.44 years (1 to 50 years)

Attitudes and Perceptions

Do you think there is a psychological component to vestibular conditions?





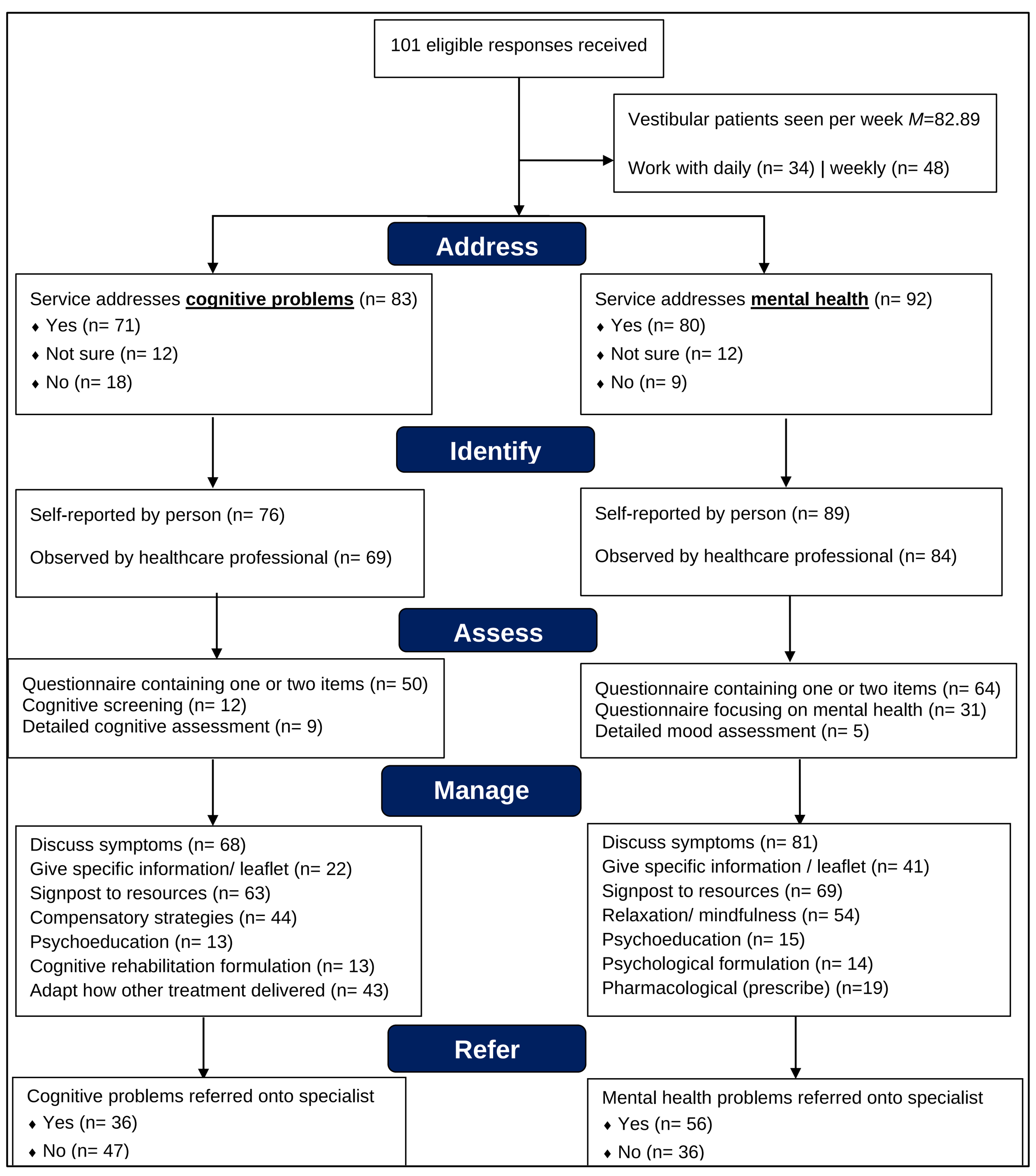
Those with more confidence had worked with vestibular conditions for longer [$r(101)=.277$, $p<.05$]

Current Practice

I feel I can recognise disorders and distress, acknowledge their presence and relevance but then am limited in the support I can give with these issues *(Physiotherapist, R_69)*

Important that patients' understand impact of anxiety/ fight and flight thought processes that can lead to increased symptoms (*Physiotherapist, R_89*)

Although recognised and sought routinely I have no clear pathway/service to refer into for these patients. *(Neuro-Otologist, R_03)*



I am often reliant on use of CMHT and IAPTS services, which can be counterproductive at times due to their unfamiliarity with more complex variations/influence of bi-directional impact. *(Audio-Vestibular Physician, R_58)*

Phase 2: Qualitative Investigation

Qualitative interviews explored what stakeholders thought a psychological support package should comprise and how it could be delivered.

1-1 semi-structured interviews were conducted with people with vestibular conditions (n=20), their family members (n=10), and charity (n=1) and healthcare (n=17) professionals.

Key Intervention Features

Stakeholders provided insights into the key features that a support package should contain to address the psychological aspects of vestibular disorders.

Key Feature	Supporting Quote
Normalisation and Validation	"Somebody acknowledging that what I'm feeling is not because I'm lazy or not because I'm milking it or can't be bothered, it is an actual thing and … it is a genuine feeling that I'm actually having" *Patient*
Education	"I always explain it to my patients as kind of the heightened autonomic nervous system – they're in fight/flight mode or freeze – and so we've got to get them to be able to self-regulate" *Audiologist*
Positive Values	"She helps me see that I'm doing good things that are consistent with my values I have in life" *Patient*
Adjustment	"There can be grief and loss around the person who you were before this condition emerged" *Counsellor*
Self-Management Strategies	"I suggested things like meditation to help her ground herself in her body and be present in a day and grateful for the days that she's well" *Family*
Breaking Negative Cycles	"The maladaptive cycles people get stuck in and how we can recognise that in ourselves and how we can help to recover from that" *Clinical Scientist*
Shared Experience	"I think some people would find that very helpful to know that it's not just them, that there's other people feeling similar kind of feelings to what they do …places where you can pick up on ideas what's worked for others" *Clinical Scientist*
Psychological Formulation	"If you felt that there was aspects of patient symptoms that were there because of psychological aspects or things that have happened to them in the past in their childhood…, then they might need a deeper aspect of counselling rather than Talking Therapies" *Audiologist*

Mechanisms for Implementing the Intervention

Stakeholders provided insights into mediating factors for implementation.

Barrier or Challenge	Facilitator or Enabler
Setbacks to diagnosis and treatment	• Timely intervention • Broader vestibular awareness
Experience and expertise	• Training and education • MDT working and joint clinics • Tailored information
Time constraints and pressured workloads	• Flexible delivery formats • Triage framework • Empowerment, self-management
Complex interactions between psychological & vestibular systems	• Holistic approach • Therapeutic alliance

Conclusions and Future Directions

Psychological distress is frequently identified, but suitable psychological treatment is not routinely offered. Training opportunities, effective referral pathways, and appropriate services could help address this gap. Treatment should validate patients' experiences, unpick interactions between the vestibular and psychological systems, and promote self-management. Our therapeutic model now needs to be refined and tested.

Ménière's Society

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The use of auditory evoked potentials for people with learning disabilities: A scoping review summary

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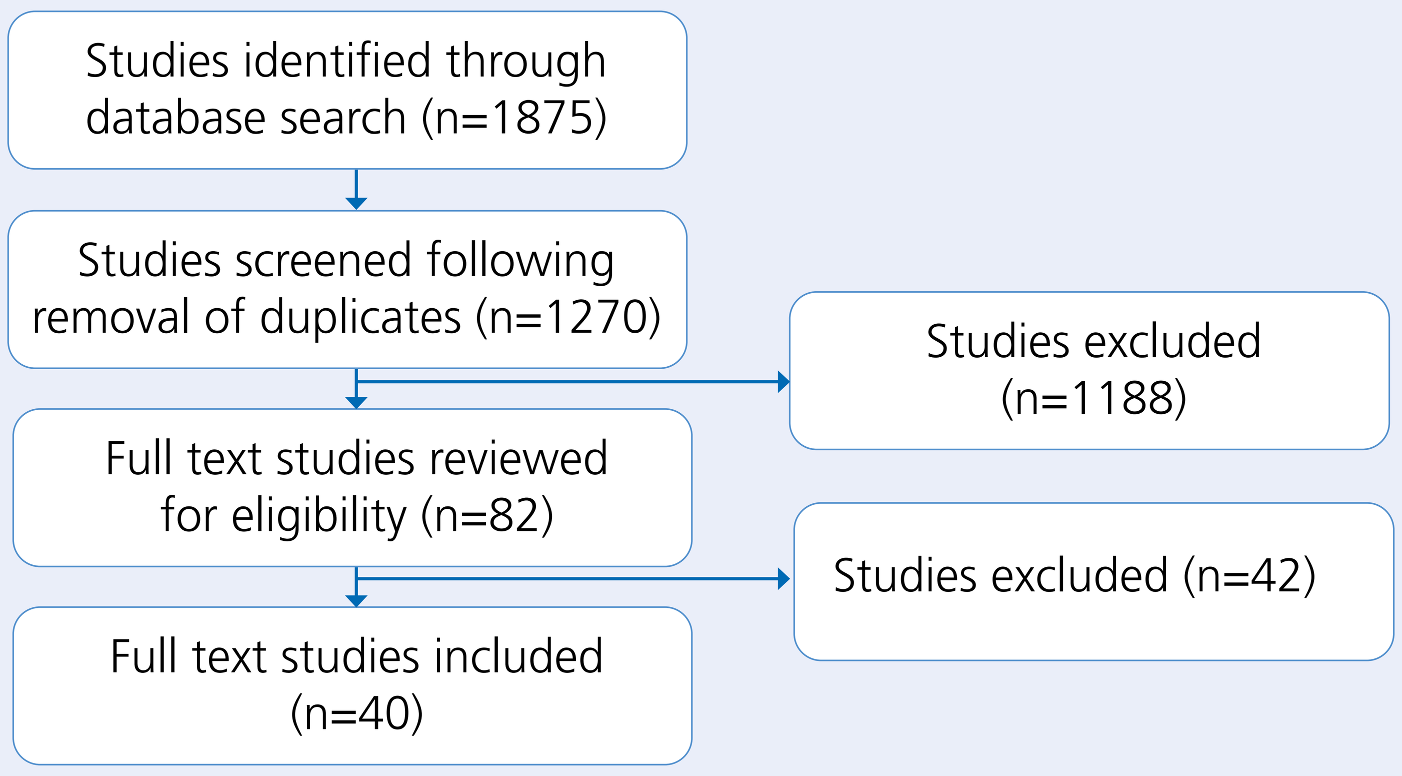
Introduction

Auditory evoked potential (AEP) testing is often recommended for objective assessment of hearing in people with learning disabilities unable to complete behavioural hearing assessment[1,2]. The theoretical rationale for using AEP testing in this population is clear, however the evidence base underlying these recommendations is generally not cited. The aim of the scoping review was to assess the robustness of the evidence underlying such recommendations.

Methods

The review was conducted according to the JBI methodology for scoping reviews[3]. Studies evaluating adults and children aged 4 or over were included. Non-English language publications were excluded. Specific concepts assessed include the required frequency, feasibility, acceptability, and accuracy of performing AEP testing in this population.

Four electronic scientific databases were searched using combinations of key words associated with learning disabilities and AEPs such as auditory brainstem response (ABR), middle latency response (MLR), cortical auditory evoked potential (CAEP) and auditory steady-state response (ASSR). Articles were processed by independent reviewers against the inclusion criteria:



Review Findings

A total of 40 papers provided data for three test types; ABR (n=30), CAEP (n=10) and MLR (n=5). Four papers examined more than one test type. Despite including the search terms "auditory steady state response" and "ASSR", no studies were found using this test type with this population.

Much of the literature in this area is dated, with almost half (44%) being over 30 years old. Only one study was published within the last 5 years (Fig. 1).

The majority of studies were conducted in the USA (29%). Only three countries provided data for use of MLR, and five countries for CAEP. Just one study was completed in the UK (Fig. 2):

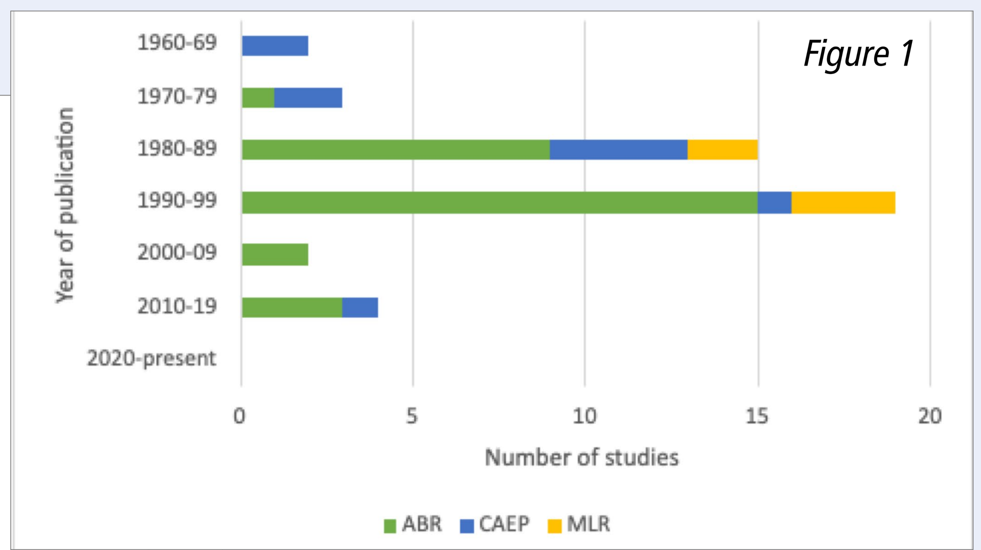


Figure 1

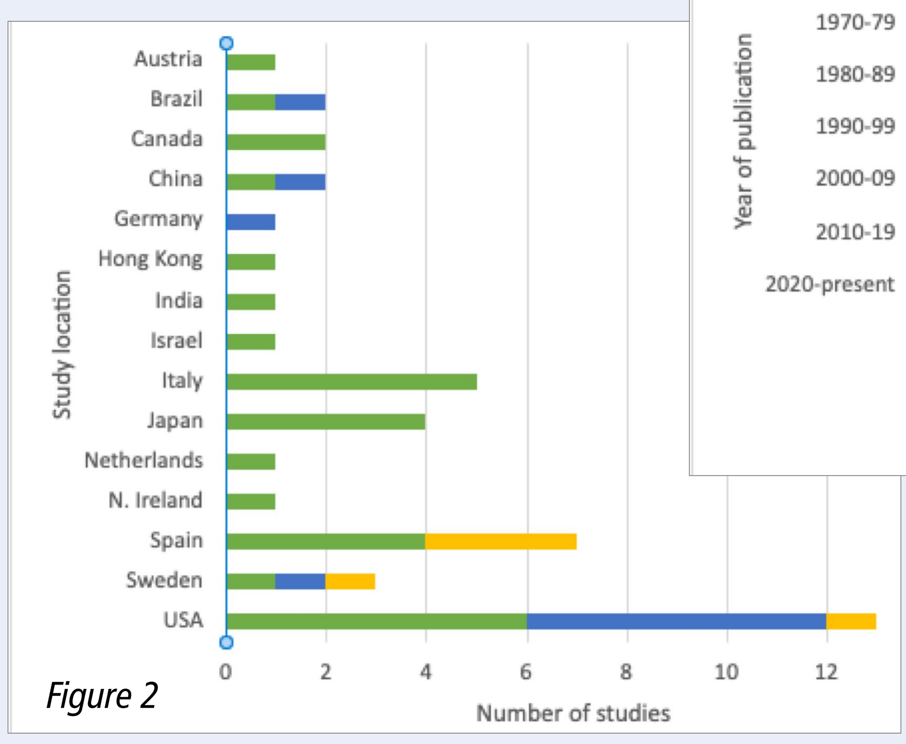


Figure 2

Acceptability (patient / carer perspective)

None of the studies reviewed aimed to assess the acceptability (to the individual or caregiver) of performing AEP testing in this population. This is unsurprising, as that the majority of studies were conducted 30-40 years ago and a participatory research paradigm (involving qualitative or mixed methodologies) is a more contemporary approach to including people in research generally, particularly those with learning disabilities.

The majority of studies did not address the issue of consent directly, so there remain unanswered questions regarding inclusion and acceptability.

Feasibility or practicality (clinician perspective)

Whilst some studies did mention reasonable adjustments that were made to encourage participation in testing, only two CAEP studies examined feasibility as a stated aim. However, these studies are over 50 years old using older equipment and testing protocols.

Sedation or "light anaesthesia" was used in 10/35 (29%) of non-CAEP studies. This has implications for study settings, ethical considerations and research personnel if sedation is required.

Studies commonly excluded participants on the basis of "ability", "co-operation", or "movement". This often reduced participant numbers and may have impacted the statistical power of results.

Accuracy (concordance with behavioural testing & waveform interpretation)

Data regarding the accuracy of AEPs in determining hearing thresholds was only reported in three studies, all of which assessed individuals with Down's Syndrome. Indeed there is a strong preponderance in the literature towards testing those with Down's Syndrome as a study population, and use of click ABR as a test method (Fig. 3). There is no published data regarding the accuracy of AEPs in the hearing assessment of those with other learning disabilities.

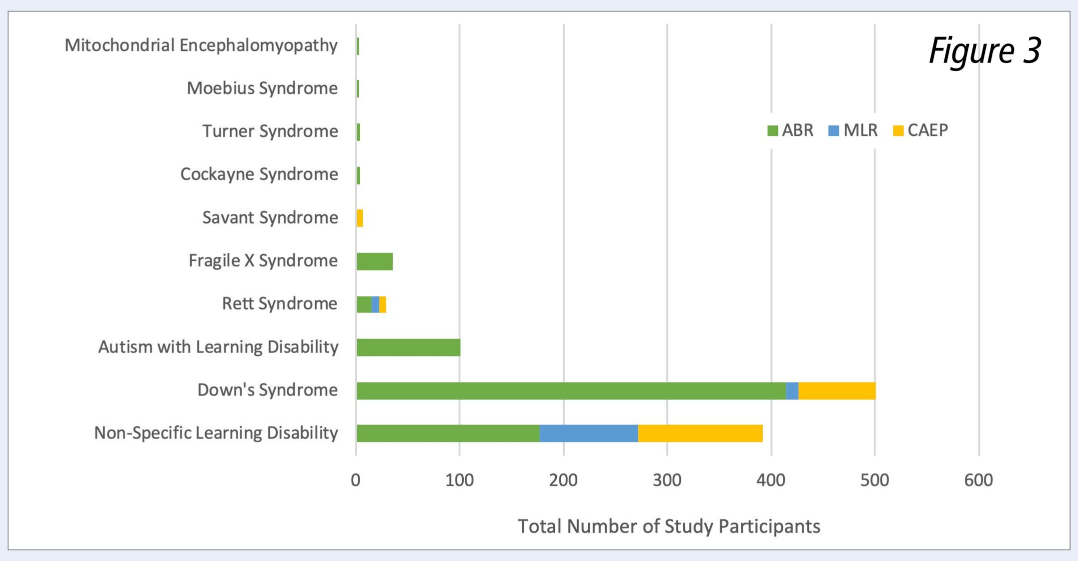


Figure 3

None of the studies assessed concordance of MLRs, CAEPs, or frequency-specific ABRs with behavioural testing. Indeed many studies excluded those with pre-identified hearing loss. Several studies did compare click ABR testing to behavioural test results in those with a variety of learning disabilities.

The most commonly-assessed concept throughout the studies reviewed was the comparison of AEP waveforms between those with and without learning disabilities. Across all types of AEP, the consensus is that testing yields interpretable waveforms in the majority of cases, although there are often statistically significant differences in waveform latency and sometimes suprathreshold amplitude, often speculated to be related to the differences in neurophysiology underlying the learning disability. Given that waveform latency is not a primary consideration when estimating hearing threshold, this should not preclude the use of AEPs for this purpose.

Required frequency of resorting to AEP testing

Due to the time- and resource-consuming nature of testing, AEPs are only used in the general population for those for whom behavioural results cannot be obtained reliably. None of the studies considered in this review evaluated how frequently AEP testing was required to obtain hearing thresholds in a clinical setting.

Discussion

The evidence base underlying the use of AEP testing in individuals with learning disabilities is limited. There are clear opportunities for future research in this area:

- An evaluation of the adaptability of assessments and the inclusion of people with learning disabilities.
- Feasibility studies using contemporary equipment and testing protocols.
- Frequency–specific comparison with behavioural testing.
- Determination of how frequently AEP testing is required to test individuals with learning disabilities.

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A pilot study exploring clinicians' decisions to implement video consultations for vestibular rehabilitation.

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Introduction

- Despite a huge increase in the use of remote care since the start of the COVID-19 pandemic, uptake within vestibular care has been sporadic.[1]
- Studies in musculoskeletal rehabilitation describe clinicians' experiences with video consultations but do not explore how clinicians decide to implement them.
- Evidence specific to vestibular rehabilitation is limited but does begin to identify factors that may influence decisions[2].
- This study aims to understand the process of decision-making regarding implementation of video consultations for vestibular rehabilitation (VVR) and the factors that influence this decision.

Methods

- Online recruitment was conducted through Audiology and Physiotherapy professional bodies. Completion of a recruitment questionnaire allowed maximum variation and theoretical sampling of participants.
- Qualitative semi-structured interviews using Microsoft Teams and telephone. UK clinicians involved in VR were asked about their experiences of VVR and decisions to implement and sustain VVR.
- Interviews analysed using Grounded Theory methods as described by Corbin and Strauss[3]. Member checking and peer review were used to increase credibility.

Findings

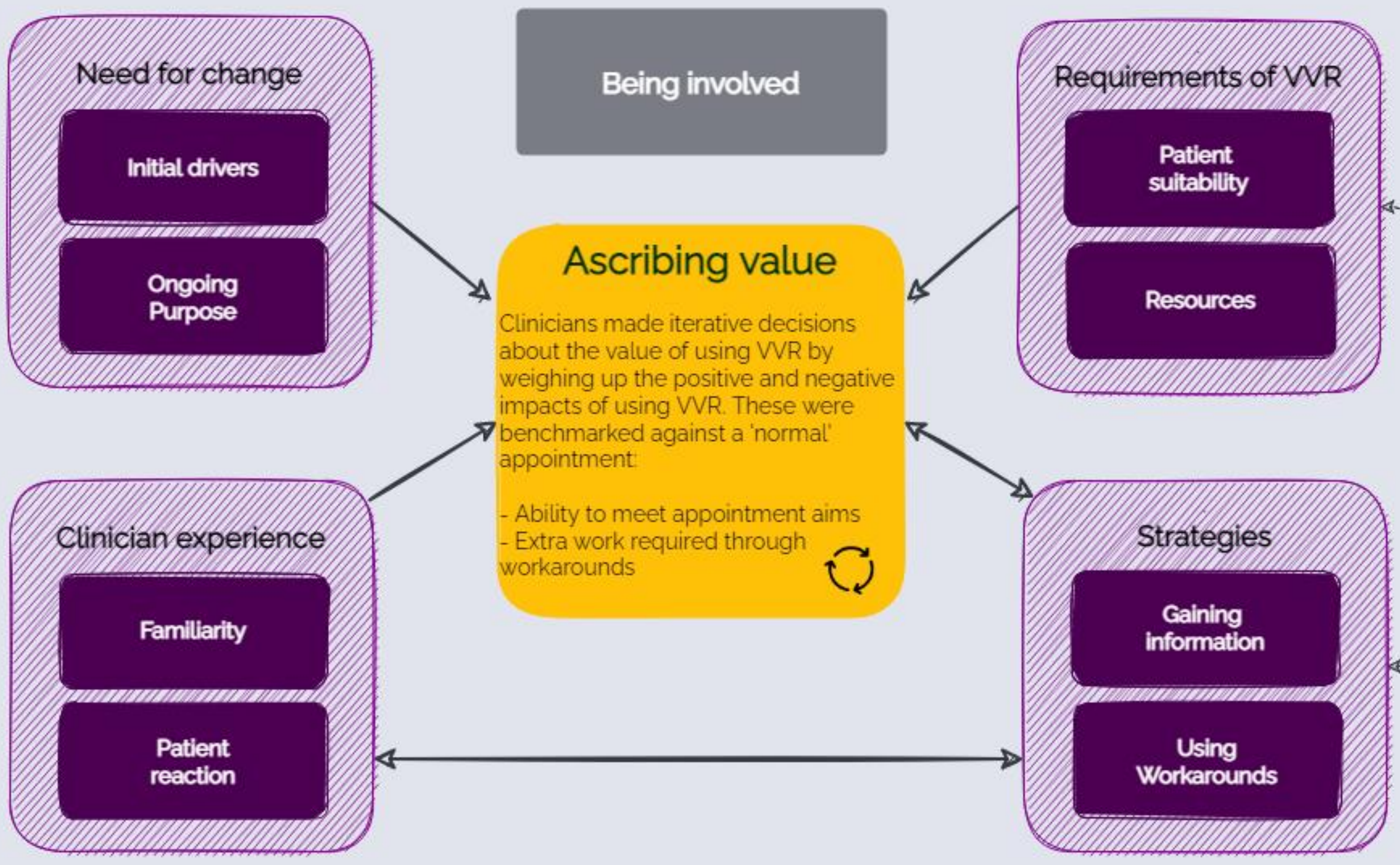
Participants consisted of six audiology and five physiotherapy professionals working across England and South Wales. Nine worked solely in the NHS and two had additional private practices. Four clinicians worked alone. Years of experience ranged from; 0-5 (4), 5-10 (1), and 10-20 years (6).

"Well, it was probably Boris Johnson's decision not mine!" (P2).

"offering remote appointments is a big, for some people it's a big step forward in terms of how the NHS is perceived" (P8)

"I think it worked out better than I expected it would to be honest…because I didn't think it would go well" (P2)

"Their belief is that face, you know, face-to-face is better, the therapist can get a better idea of what I'm, how I'm moving around and what my problems are" (P12)



"and it's weighing up that sort of, yes, I can do a certain amount via a video call but I can't put my hands on the patient." (P3)

"It really, really depends on the patient involved. So I think that, for some people, who were travelling a long distance, who are very comfortable with technology and happy with that, then it can work really well" (P12)

" I just spent the time thinking […] 'how am I going to do it?' So it took a lot of time and I basically went to the literature" (P3)

when we're asking them to do something which might challenge their balance, then we're making sure that they're in a place where they've got a surface nearby if they're on their own, or if they've got family members with them" (P5)

Discussion

- Decision-making was prompted by a need for change and change sustained by the perceived ongoing purpose of VVR. Clinicians iteratively assessed whether VVR added value when compared with usual care, but needed technological and support-based resources and a 'suitable' patient to enact this decision. Not being involved in decision making caused tension. Strategies of gaining information and using workarounds increased clinician's familiarity with VVR and reduced its negative impacts. Clinicians experienced decision outcomes first hand and were able to see patients' views on VVR, which informed future decision-making.
- The model can be abstracted onto the COM-B model of behaviour change[4].

Conclusions

- This study describes a preliminary model of how clinicians decide to implement VVR.
- For VVR to be sustained, a clear vision of the purpose of VVR beyond COVID-19 must be communicated. Further work will be needed to integrate VVR into long term clinical care, and resources such as time, training and support are essential to achieve this.
- For many settings a hybrid model of care is the most appropriate, with clinicians continuing to decide when, and for whom, VVR will add greatest value.
- Research should to look to explore patients perceptions of VVR, as these significantly affected sustainability, and to develop assessment and monitoring methods which are amenable to remote care.

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With thanks to Dr Helen Pryce and Matthew Richards of Aston University.

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An exploratory study identifying a possible response shift phenomena of the Glasgow Hearing Aid Benefit Profile

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Background and Research Question

- Response shift can be defined as a change in the subjective opinion or belief related to a clinical intervention over a time period during a sustained period of illness or chronic condition
- Response shift can be observed in various health related quality of life (HR-QoL) patient reported outcome measures (PROMS)
- In the Audiology profession, the Glasgow Hearing Aid Benefit Profile (GHABP)[1] has been widely used across the United Kingdom (UK) and internationally.
- Researchers, including those in audiology, have described three reasons for response shift[2]:
    1. Recalibration, for example, changes in perception of hearing disability post Hearing Aid (HA) fitting.
    2. Re-prioritisation, for example, changes in perceptual importance of HR-Qol.
    3. Reconceptualization, a redefinition of a target construct. For example, a questionnaire examining mental health, might be understood later in time as a something measuring loneliness.

Research Question

Does the GHABP question exhibit a possible response shift?

How To Assess Response Shift

The then-test is one of the most common that can be applied to a given outcome measure. Only one study has described response shift in those with hearing loss[3]. The response shift in HA respondents was measured using EuroQol-5D. The authors suggested response shift is an important factor when assessing PROMs related to the clinical effectiveness of medical interventions. Moreover, response shift could have an impact on health economic aspects of various interventions, if not fully understood[3].

Methods

Participants Sixteen adults attending an Audiology clinic in Cwm Taf Morgannwg University Health Board, South Wales, UK were invited by letter to participate in this study. Inclusion criteria were: referred to the Audiology clinic for initial assessment; fitted with digital HA's optimally programmed to NAL-NL1; invited for first follow up after hearing aid fitting appointment; able to give informed consent and proficient in the English language.

The **first stage** of data collection (T_0) took place at the initial hearing assessment. Demographic information together with information about the average hearing loss of individual ears and mean hearing loss were collected. The **second stage** of data collection (T_1) took place 14 weeks later at the post HA follow-up appointment. At this appointment participants were asked to complete the GHABP (part I) questionnaire again (T_1) and GHABP (part II). During this appointment participants were asked to think back to before they had their HAs fitted, to re-establish the disability and handicap scores (T_1)

Patient Reported Outcome Measure Used

- The GHABP[1] questionnaire measures self-reported auditory disability (degree of hearing problems), handicap (degree to which hearing problems impact on day-to-day life) and HA use pre- and post- intervention.
- The pre- (part I) and post- HA fitting (part II) questionnaires show the effectiveness of the HA intervention.
- The GHABP questionnaire examines responses in 4 pre-defined listening situations: 1) listening to television with other family or friends when volume is adjusted to suit others; 2) having a conversation with one other person when there is no background noise; 3) carrying on a conversation in a busy street or shop; and 4) having a conversation with several people in a group. Individuals are initially asked to answer "yes" or "no" to having difficulty in hearing in each of these listening environments. If respondents answer "yes", they are asked to grade how much difficulty they have in that situation. There are five response categories along the lines of a Likert scale, namely: not applicable, not at all, only a little, a moderate amount, quite a lot and very much indeed.

Results

Figure 1 shows the GHABP (disability) scores in percentages showing the change observed in T_0 and T_1. Every T_1 value shows an **increase** compared with the T0 value.
Figure 2 shows T_0 and T_1 values for GHABP (handicap). As both sets of scores for disability data were normally distributed a paired T test was appropriate and indicated that the GHABP disability (T_1) group score was higher than the GHABP disability group score at T_0 (t=5.95, p=0.000027). This score was **statistically significant.** The handicap (T_1) group score was not normally distributed so the non-parametric Wilcoxon Signed Ranks test was used. There was **no significant difference** between [GHABP (handicap) T_1] and [GHABP (handicap) T0] (Z=67, p=0.132).

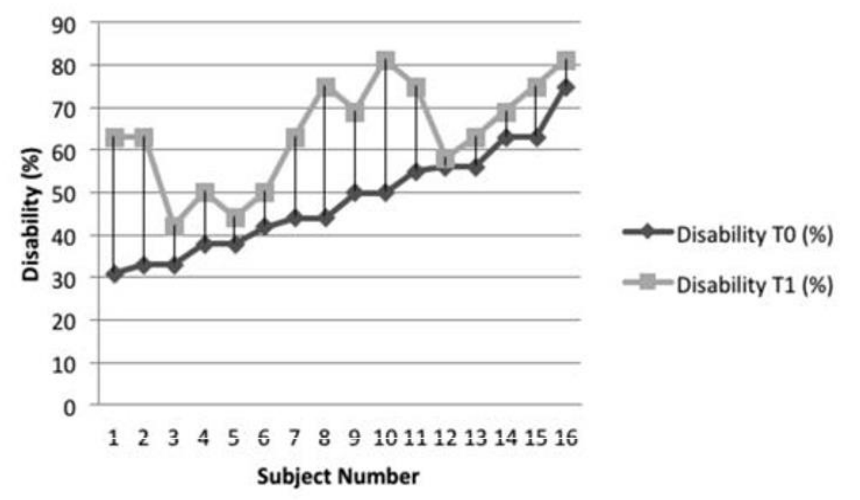

Figure 1. T_0 and T_1 disability scores for each subject.

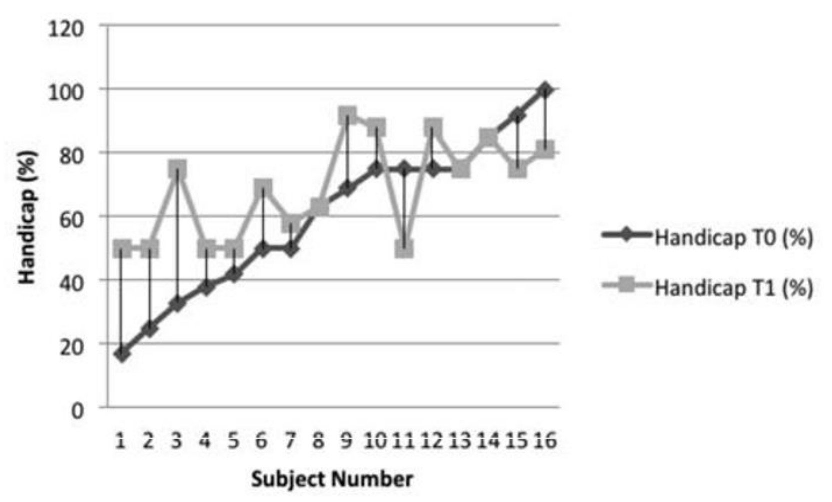

Figure 2. T_0 and T_1 handicap scores for each subject.

Conclusions

1) Participants might be demonstrating a level of recalibration of their own perception of hearing disability. This could mean participants initially underestimated their hearing difficulties when seen during the first appointment.

2) It could be that at T_1 participants' answers represented their reality prior to hearing aid fitting with greater accuracy. This suggests that at T_0 participants underplayed the extent of their hearing loss. Drawing on Luterman[4] and Schum[5], this may relate to the possibility that at T_0 participants were in denial of their hearing disability: disability denial [4,5].

3) Participants in this study may have initially underplayed the degree of hearing loss disability experienced to reduce the likelihood of the HA intervention and the perceived associated risk of enacted stigma.

4) The findings reported here have implications for clinical practice not least because they suggest that patients underplay the extent of their hearing loss. This may relate to a re-calibration effect or a denial of disability effect. This may suggest that the HA intervention has a larger reduction in disability when taking the response shift into account.

Summary

Clinicians should be aware that response shift can affect some administered PROMS. PROMS that are used to inform treatment options and those PROMS that are administered before and after a clinical intervention may be more prone to response shift. Larger response shifts might be seen where clinical interventions are stigmatising, undesirable or those that may involve patient cooperation such as rehabilitation packages. Awareness of response shift to avoid bias is therefore an important consideration in research studies and clinical practice and thus may have implications for clinical effectiveness or health economics issues.

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GIG CYMRU NHS WALES Bwrdd Iechyd Prifysgol Cwm Taf Morgannwg University Health Board

CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD

Prifysgol Abertawe Swansea University

Are patients aware of what their hearing aids can do?

Louise Wakley, Heather Dowber and Laura Finegold

GN Hearing UK

danalogic GN

1. Introduction

The danalogic website is a support tool for both patients and audiologists. In the last year, it had around 80,000 unique visits. From June 2021 to November 2021, we placed an optional survey onto our website which was completed by 710 patients from across the UK. A copy of the survey is available upon request.

2. Aim

Our aim is to engage with users of NHS hearing aids, to better understand their needs and ultimately apply this knowledge to improve the technology and services we currently offer to NHS Audiology departments.

3. Methodology

Step One

The survey included a number of closed questions on the following areas:

- Hearing aid technology
- The use of apps and smartphones/tablets
- Attitudes to remote care in a wider healthcare context

Plus the following open question:

- If you wanted something specific from a future range of NHS hearing aids, what would it be?

Step Two

We conducted in-depth follow up discussions with respondents who expressed an interest to speak to us about their lived experience with hearing aids.

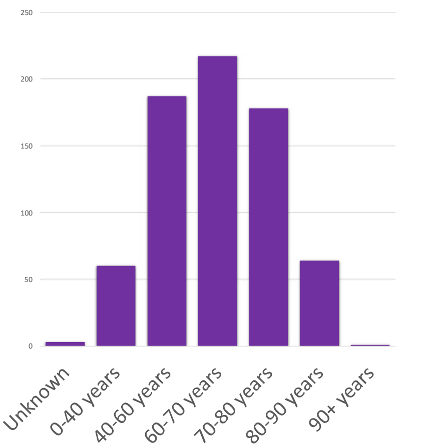
For this poster, we have focussed on the respondents' views of hearing aid technology.

4. Findings

Of the 710 patients who completed the survey, 459 answered the question **'If you wanted something specific from a future range of NHS hearing aids, what would it be?'**

The age range of respondents can be seen in Fig. 1.

Age Group Fig. 1



We were able to categorise their comments into 9 areas which are displayed on the pie chart in Fig. 2.

45% of respondents would like their hearing aids to connect to other electronic devices via Bluetooth. This includes for streaming purposes and hearing aid management.

11% of respondents wanted a smaller/more discreet hearing aid

10% of respondents responded with an answer which fell into the 'Ability to Adjust' category.

Fig. 3 shows some examples of the key findings in the respondents' own words.

All of the key features requested by the respondents are available in the NHS range from danalogic GN.

If you wanted something specific from a future range of NHS hearing aids, what would it be? Fig. 2

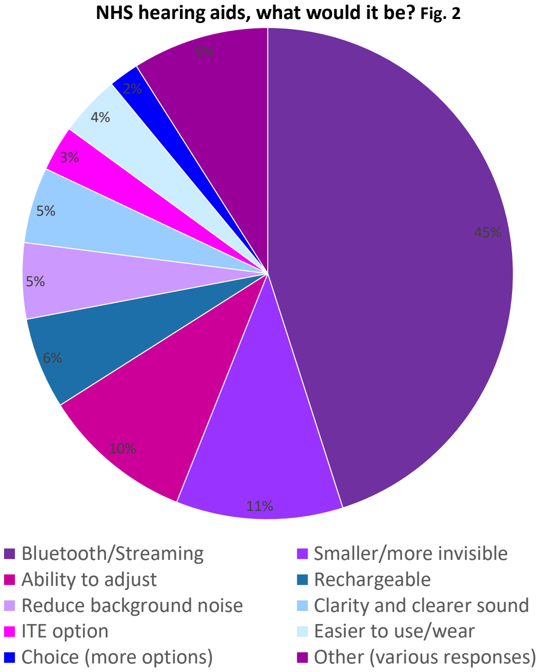


Fig. 3

5. Discussion/Conclusion

Based on the data collected, we can conclude that patients are not always aware of the additional functionalities available within their hearing aids.

Some of the reasons for this could be:

- The ability to retain information (40-80% of medical information provided by healthcare practitioners is forgotten immediately [1])
- Information on wider functionality not being provided by their audiologist either due to
  - time constraints
  - a conscious decision to reduce information overload

As a result, many patients are not benefiting fully from the technology they have at their disposal.

- As a manufacturer, do we need to support audiologists more?
- Are we utilising the most effective and efficient ways of sharing information with audiologists?
- Do we recognise the many different ways in which patients absorb information and produce resources accordingly?
- What barriers exist which prevent this information from being shared and/or retained?
- Do we need to rethink how a typical hearing aid fitting appointment is structured?

The first action we have taken based on the outcome of the survey is to further develop our online resources for patients.

To find out more about our patient portal, please visit us at Stand 30.

You are also welcome to email us at:
danalogicuk@gnhearing.com
www.danalogic.co.uk

Reference:

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Outcomes of a fully-remote clinical pathway adapted for NHS

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Introduction

Provision of audiological care using teleaudiology is becoming more available. In most instances, this takes place via a combination of in-person and remote care.

Lively Hearing Corporation, USA, has developed an audiologist-supported hearing care pathway in which every step, from ear disease assessment to hearing aid (HA) support, is conducted remotely.

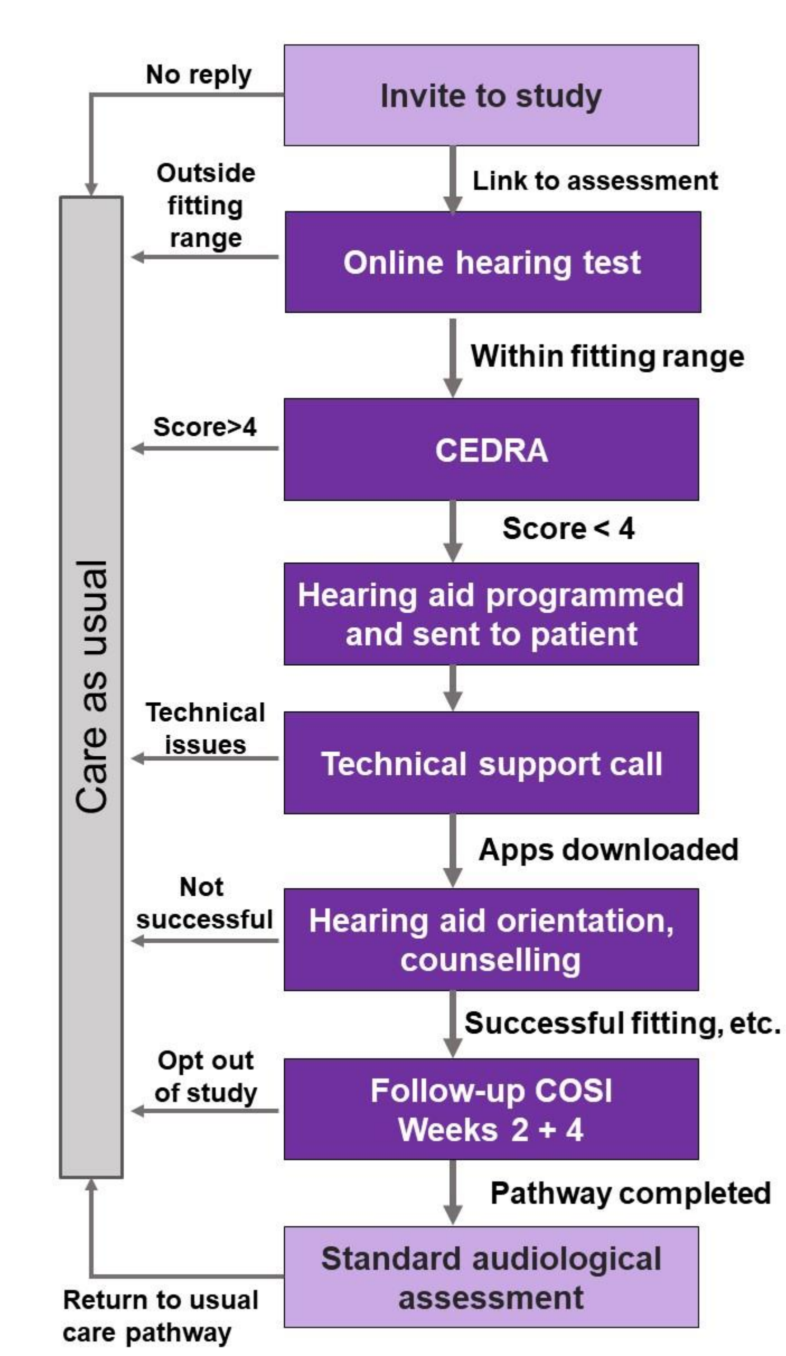
However, there are questions regarding how such a pathway affects identification of ear disease, measured hearing thresholds and hearing aid output.

This study addressed these questions by implementing an adapted version of the fully-remote pathway in an NHS audiology department.

Methods

Patients referred to the Withington Community Hospital Audiology Department between 15th Jun and 10th Nov 2021 were offered the option of care via the adapted fully-remote pathway (Figures 1 and 2). These patients also attended an extra in-person audiological assessment 3-4 months after their remote HA fitting. All other patients received care as usual.

Figure 1. Fully-remote care pathway



- THE CEDRA (Consumer Ear Disease Risk Assessment) is a 15-item questionnaire used to identify ear disease of 90% sensitivity and 72% specificity (Kleindienst et al., 2017). See https://sites.northwestern.edu/cedra/.
- The study HA was the Resound LiNX Quattro programmed using QuickFit to NAL-NL2 using online thresholds. The HA can be programmed remotely both synchronously and asynchronously and can be fine tuned by the user.
- A technician conducted the technical support call.
- An audiologist conducted the hearing aid orientation and counselling.
- Light purple boxes indicate a diversion from the Lively model. Further, Lively provides 3 & 6 mth. follow-ups; and CEDRA failures can re-enter the pathway following further audiological consultation.

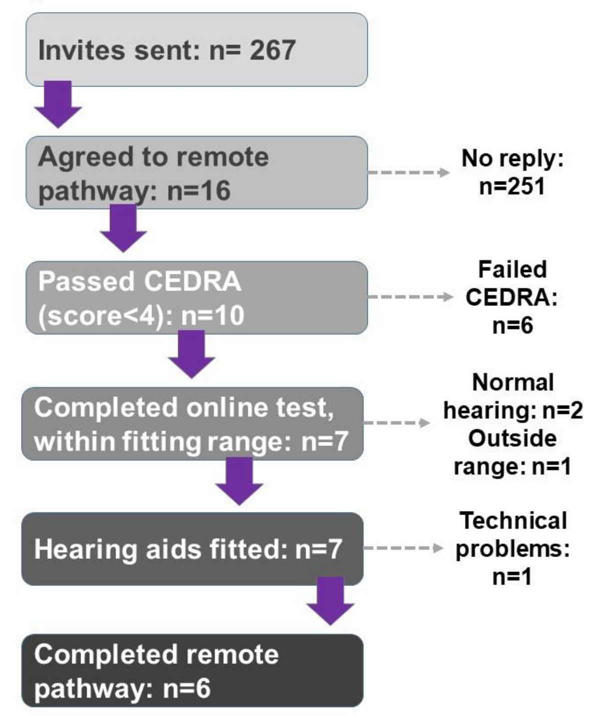
Figure 2. Online hearing test interface

Online testing is via headphones with computer volume set to maximum for pure tones of 0.5, 1, 2 & 4 kHz for each ear separately.

Participants

Figure 3 shows the patient flow through the study.

Figure 3. Patient flow

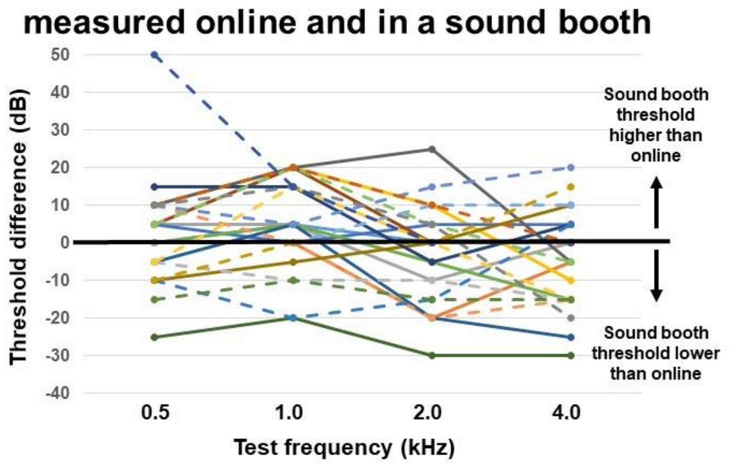


- Only 6.3% of patients opted for the fully remote pathway.
- Patients who joined study were younger than those who did not (mean: 55.6 yr. vs. 66.3 yr.).
- 1 of the 6 who failed the CEDRA required onward referral, the other 5 were false positives.
- There were no CEDRA false negatives i.e. none who passed the CEDRA required referral.
- The technical problem was inability to pair the phone to hearing aids.

Results

Comparison of online and standard audiometric thresholds

Figure 4. Difference between thresholds measured online and in a sound booth



Right ears: dashed lines
Left ears: Solid lines

65% of thresholds within 10dB of each other

Mean absolute diffs between thresholds are:

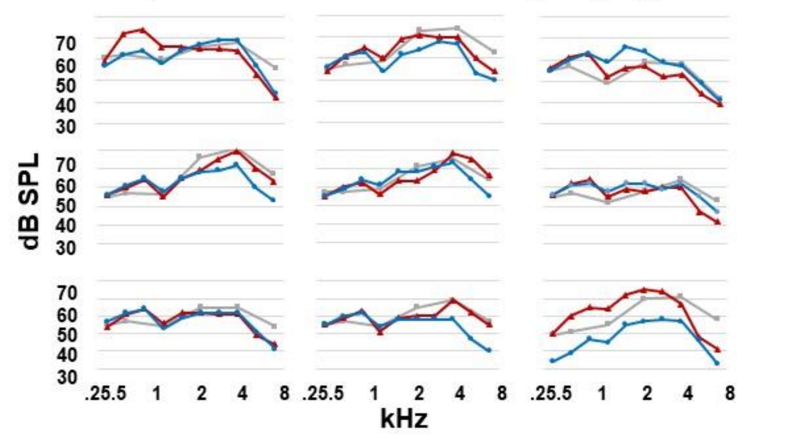
- 0.5kH: 6.3 dB
- 1.0 kHz: 5.8 dB
- 2.0kHz: 8.7 dB
- 4.0kHz: 7.1 dB

Wilcoxon signed rank test showed no sig. diffs at any frequency ($p>0.05$)

Comparison of Quickfit HA coupler output at 65dB SPL

Figure 5 shows quickfit HA outputs relative to NAL-NL2 target (computed from booth-based thresholds) for 9 participants who had a HA fitting.

Figure 5. Quickfit HA coupler output for the 9 participants with HA fittings using online (blue) and booth-based (red) thresholds, shown relative to NL-NL2 targets (grey)



HA coupler outputs programmed with the two sets of thresholds on average deviate to a similar extent from the NAL-NL2 target. Statistically, the deviations do not differ for any frequency below 8kHz. At 8kHz outputs were closer to NAL-NL2 for booth-based testing than online testing.

Reported HA benefit

Reported HA benefit was equivalent to that of the audiology department. Specifically, at week 2 post-fitting, 50% of study patients reported their hearing was 'better' or 'much better'. By week 4 this had increased to 86%. Withington departmental average is 80% at ~8 weeks.

Discussion and Conclusions

This fully-remote pathway yielded hearing thresholds, HA output and reported benefit that were almost equivalent to those obtained in a clinical test booth. However, few patients opted for the remote pathway (possibly due to no waiting times for in-person appointments), some encountered technical issues, and the CEDRA led to false positive failures. Nonetheless, this small study suggests such a pathway could be implemented into NHS care for younger patients who are open to receiving care remotely.

Acknowledgments

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Click vs CE-Chirp ABR in relation to pure tone thresholds in Adults with Normal Hearing and Sensorineural Hearing Loss

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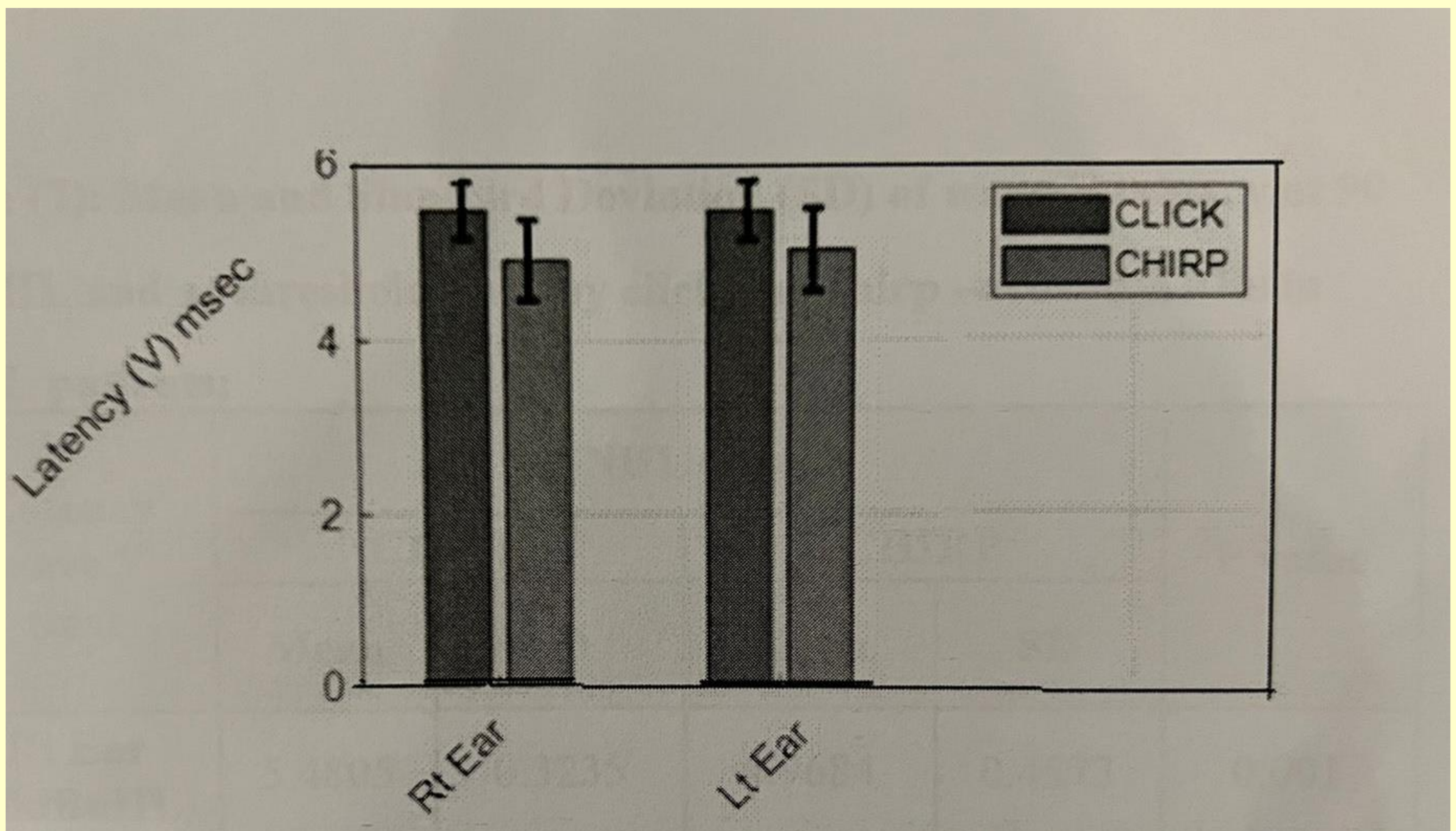
1. Introduction

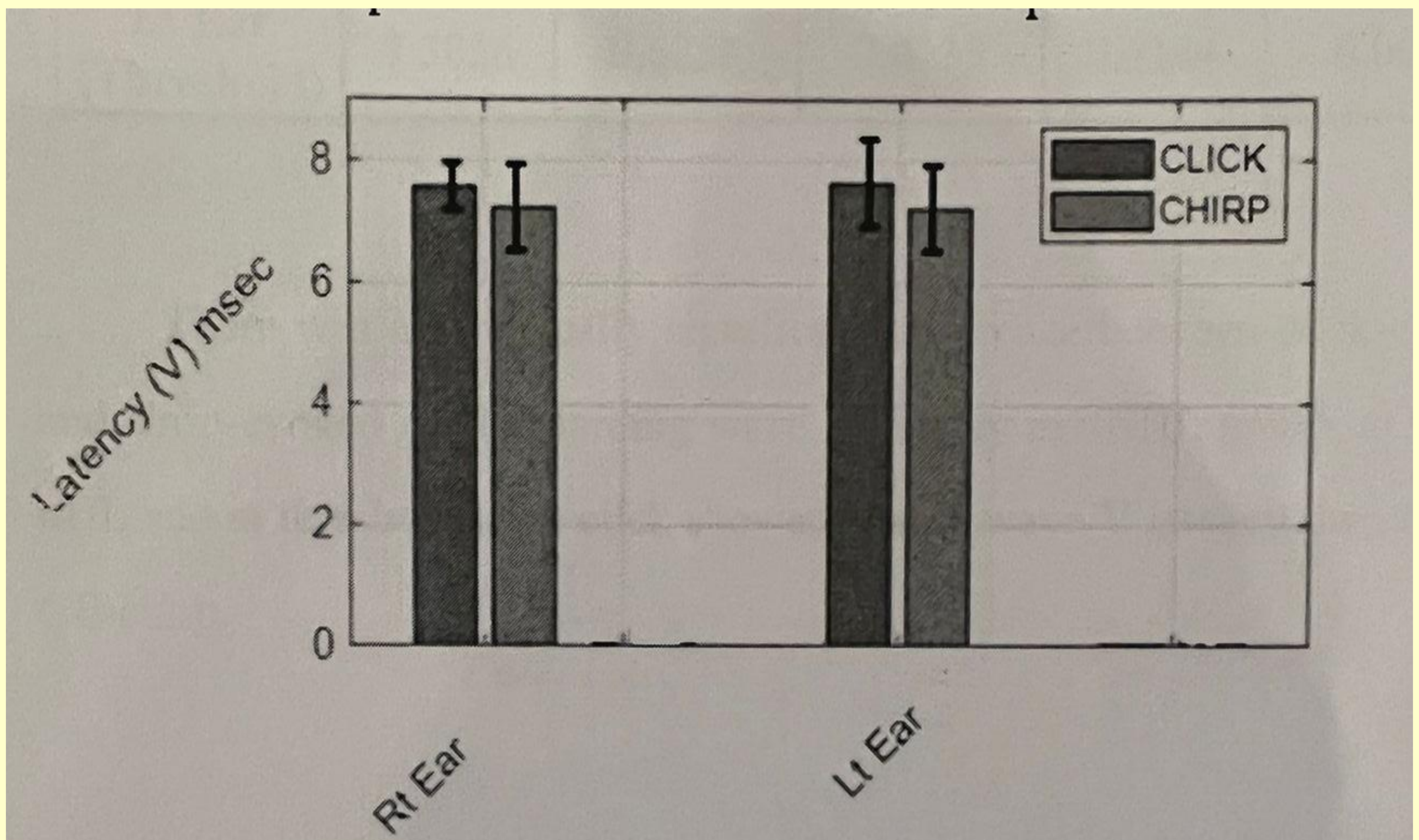
- ABR (auditory brainstem response) represent the primary tool for both identification and diagnosis of hearing loss. ABRs are evoked potentials that appear between 2 and 12 milliseconds after auditory stimuli are delivered.
- Click-ABR is the most popular and widely used method for ABR recordings.
- The time interval for a sound wave to reach the cochlear apex is extended in Click ABR measurements.
- The peak point of the response appears milliseconds after the region of high frequency in a lower frequency area. As a result, basal membrane cells are not stimulated at the same time.
- Claus Elberling and his collaborators created the CE-Chirp stimulus to compensate for temporal dispersion in the cochlea due to travelling wave delay by aligning the arrival time of each frequency component in the stimulus to its place of maximum excitation along the basilar membrane.
- The difference between CE-Chirp and Click stimuli is due to the delivery times of components with low, moderate, and high frequencies, which allow for simultaneous stimulation of all frequency areas.

Aim:

- To correlate thresholds obtained by click and CE-Chirp with the behavioral thresholds in normal hearing subjects and patients with moderate sensorineural hearing loss and to assess the effectiveness of chirp evoked ABR in predicting thresholds.



Comparison between wave V latencies both ears in ABR using click and CE-chirp stimuli at 90 dB nHL in normal patients.



Comparison between wave V latencies both ears in ABR using click and CE-chirp stimuli at threshold level in normal patients.

2. Subjects & Methods

- This study consisted of 40 patients (80 ears)
- The control group consists of 20 normal –hearing adults.
- The study group consists of 20 adults (13 males and 7 females) with moderate Sensorineural Hearing Loss. All subjects were submitted to:
  - Full history taking
  - Otologic Examination
  - Audiometric assessment (pure tone audiometry
  - Immittancemetry
  - Auditory Brain Stem response using click and CE-Chirp stimuli.

3. Results & Discussion

- In our study, procedural time of CE-Chirp ABR test was shorter than that of Click ABR test.
- The analysis of wave V latency in the control group with both click and CE-Chirp stimuli at intensity levels of 90 dBnHL and threshold level revealed a highly statistically significant shorter wave V latency caused by CE-Chirp stimuli compared to click stimuli.
- The average amplitudes of wave V with the CE-Chirp stimulus were significantly greater than those recorded with the click stimulus at all intensity levels (90dBnHL and threshold level).
- When we compared CE-Chirp ABR threshold values to Click ABR threshold values, we discovered that CE-Chirp ABR threshold values were closer to PTA 1, 2 KHz threshold values, whereas Click ABR threshold values were closer to 4 KHz behavioral threshold values.
- According to literature reviews, patients with normal hearing acuity were more frequently compared to CE-Chirp ABR and Click ABR methods.

4. Conclusions

- CE-Chirp ABR test was shorter than that of the Click ABR test.
- The CE-Chirp ABR threshold values were higher in both ears than the Click ABR threshold values.
- Finally, when evaluating patients with bilateral sensorineural hearing loss, we discovered that the CE-Chirp ABR method was superior to the Click ABR method.
- In normal hearing patients, CE-Chirp elicited larger responses than click stimuli at (90dB nHL) and at thresholds.
- At threshold, however, there was no difference between the two stimuli in the SNHL group.

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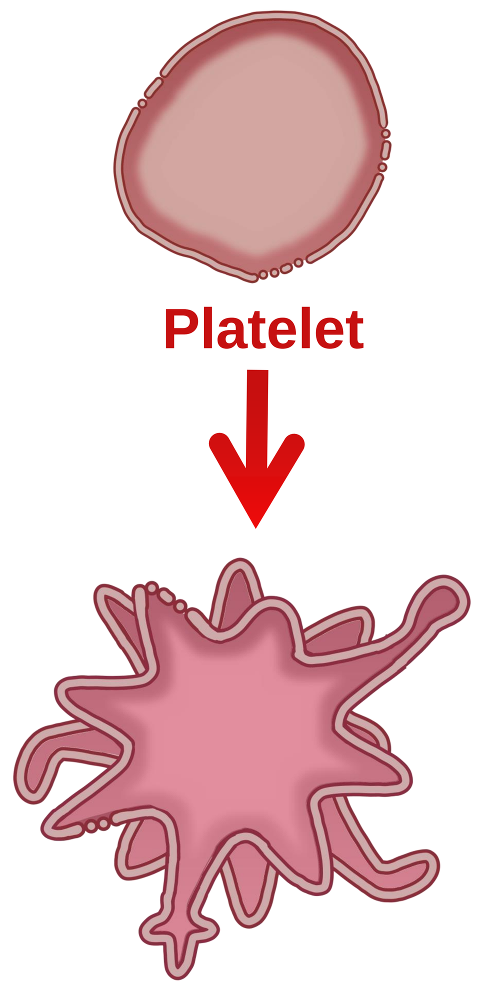
Potential inflammatory biomarkers for tinnitus in platelets and leukocytes: a critical scoping review and meta-analysis

Raheel Ahmed, Alice Shadis & Rumana Ahmed

Aims and Objectives:

i. To explore the association between platelets or leukocytes and tinnitus.
ii. Whether any association exists between platelets or leukocytes and tinnitus and;
iii. How any otological characteristics define this association.

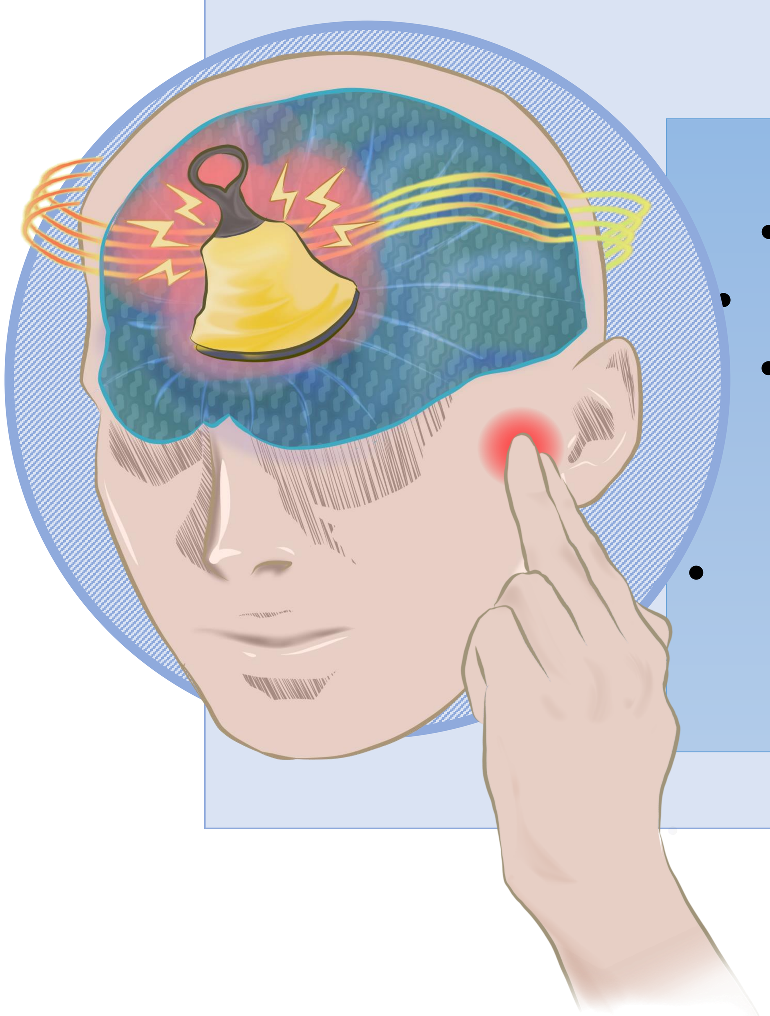


Background

- Platelets, leukocytes and cytokines are involved in inflammation and neuroinflammation;
- The aetiology of tinnitus remains unknown;
- Biomarkers would help categorise tinnitus and elucidate a possible neuroinflammatory model of tinnitus

Search Strategy

MEDLINE, CINAHL, Web of Science Core Collection, SCOPUS, PubMed and reference lists were searched;



Searched:
- Leukocytes
- Lymphocytes
- Neutrophils
- Platelets
- MPV
- Thrombocytes

AND
- Tinnitus

1935 identified → **61** after screening → **42** full-text articles → **11** articles included

Excluded: 19 syndrome case reports; 1 non-English study; 8 animal studies; 22 established vestibular pathology

Results:

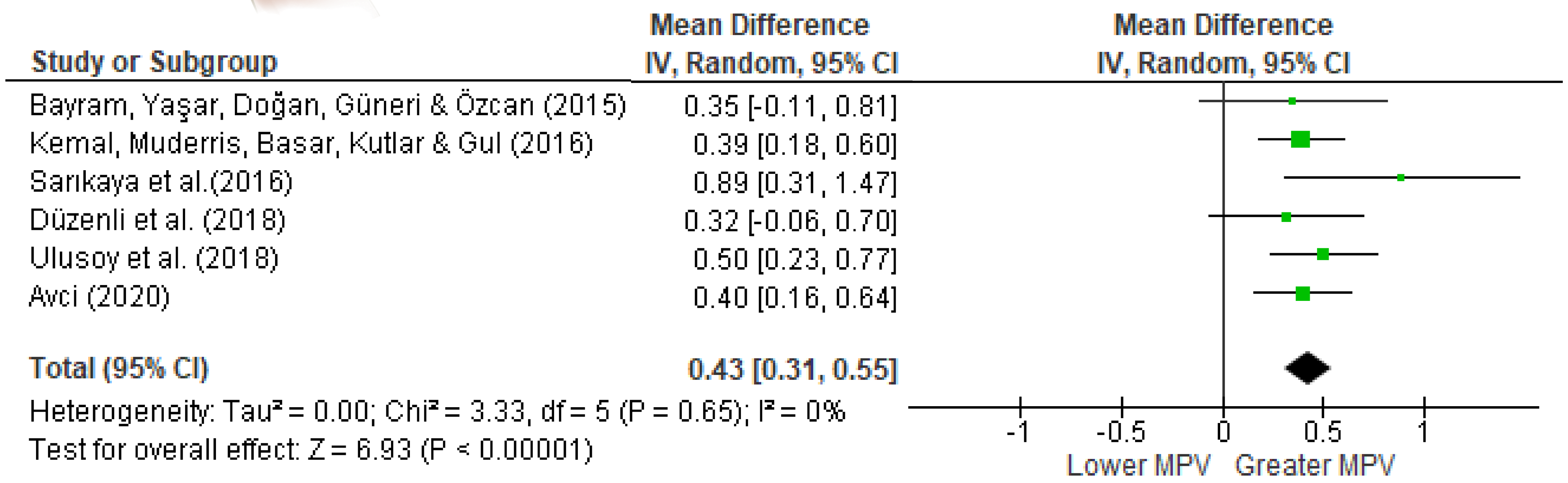


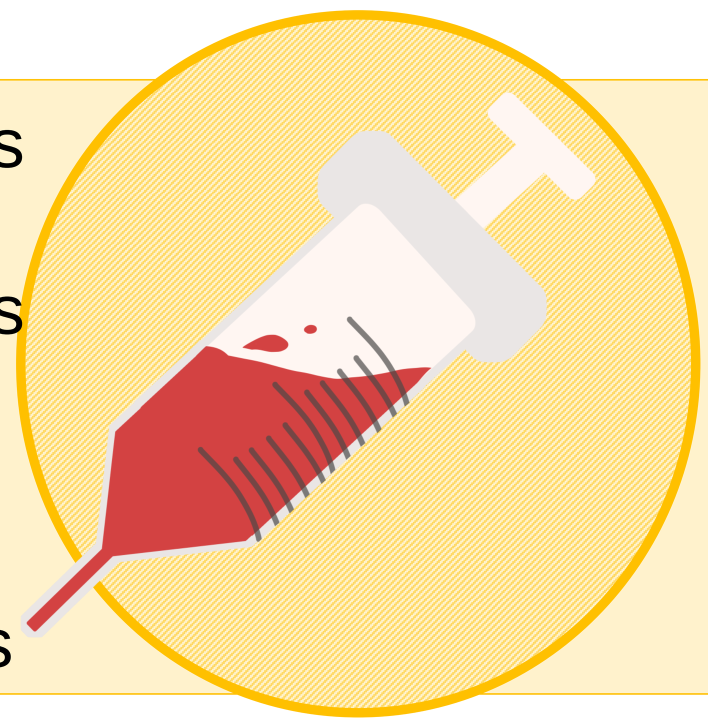
Figure 1: Random-effects pooled mean difference of MPV between a tinnitus group and age and sex matched controls

Conclusions:

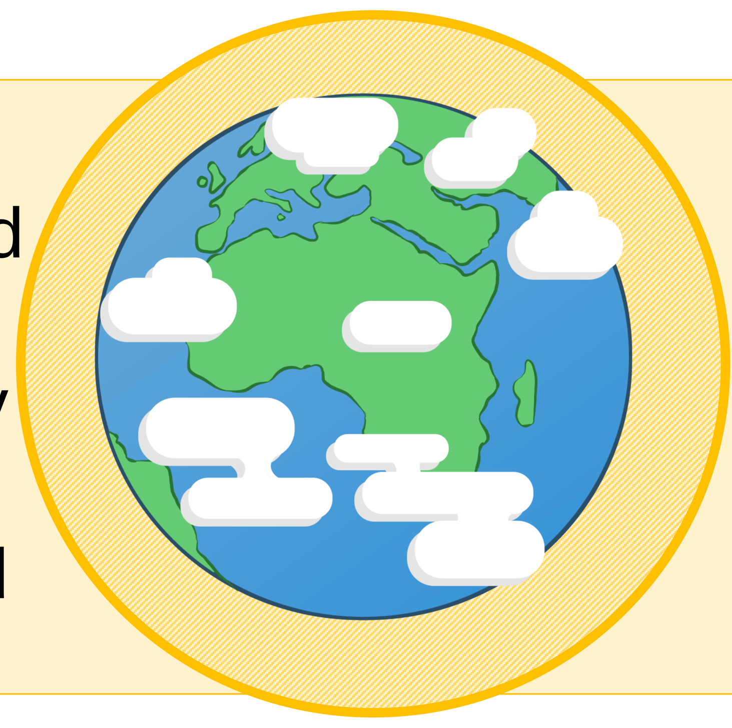
- Mean platelet volume is increased in individuals with tinnitus;
- There is no consensus in the literature on a link between leukocytes and tinnitus.

Recommendations:

Stress questionnaires as part of a multivariate analysis in future studies may help differentiate between tinnitus related and stress related haematological changes



Blood sampling and haemogram methodology need to be standardised



Further studies reproducing the current findings in different populations.

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Auditory Training: an *app* with Noise

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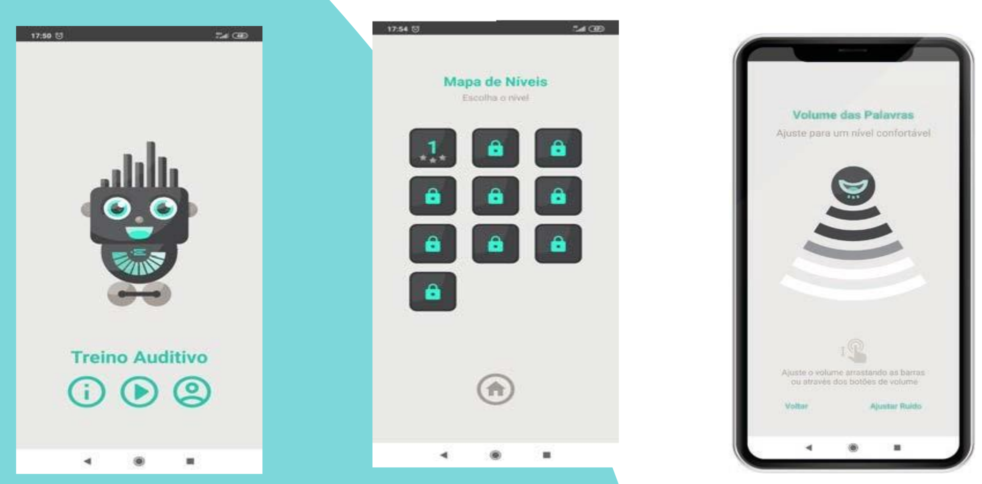
INTRODUCTION

Difficulty perceiving speech in noisy environments is one of the main hearing complaints, often due to hearing loss and/or auditory processing disorders. This complaint usually increases with aging, when the speed of cognitive processing decreases and/or hearing loss is present, increasing auditory effort in correct speech perception. Apps for mobile devices can offer opportunities for hearing self-care, with low investment and considering that access to smartphones and tablets is relatively easy nowadays. (Cruz & al., 2013; Henshaw & al., 2015)

OBJECTIVE



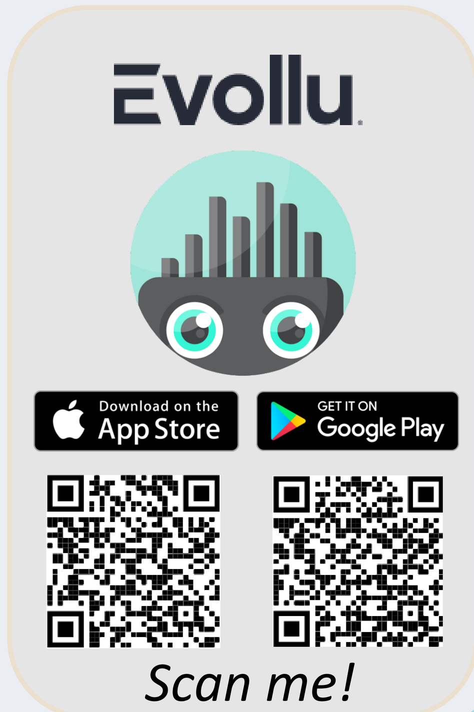
The objective of this study was to verify if the training performed with the auditory training *app* developed by EVOLLU was effective in individuals between 14 and 77 years of age.

Evollu is a company that, together with the academy, is developing *apps* that can be used both for self-care and by the audiologist as a counseling aid or even as information collection tools.

METHODS

Conducting the filtered speech test in

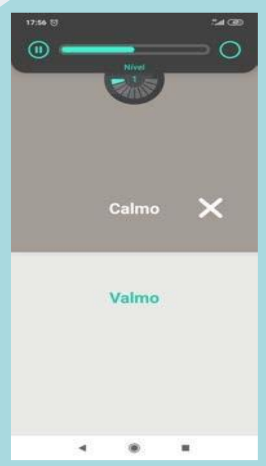
- An training group (TG), before, immediately after, and after four weeks of auditory training performed with the app.
- And a control group (CG) in which the same tests were applied with an interval of four weeks.
- The two groups were matched according to age and educational level.



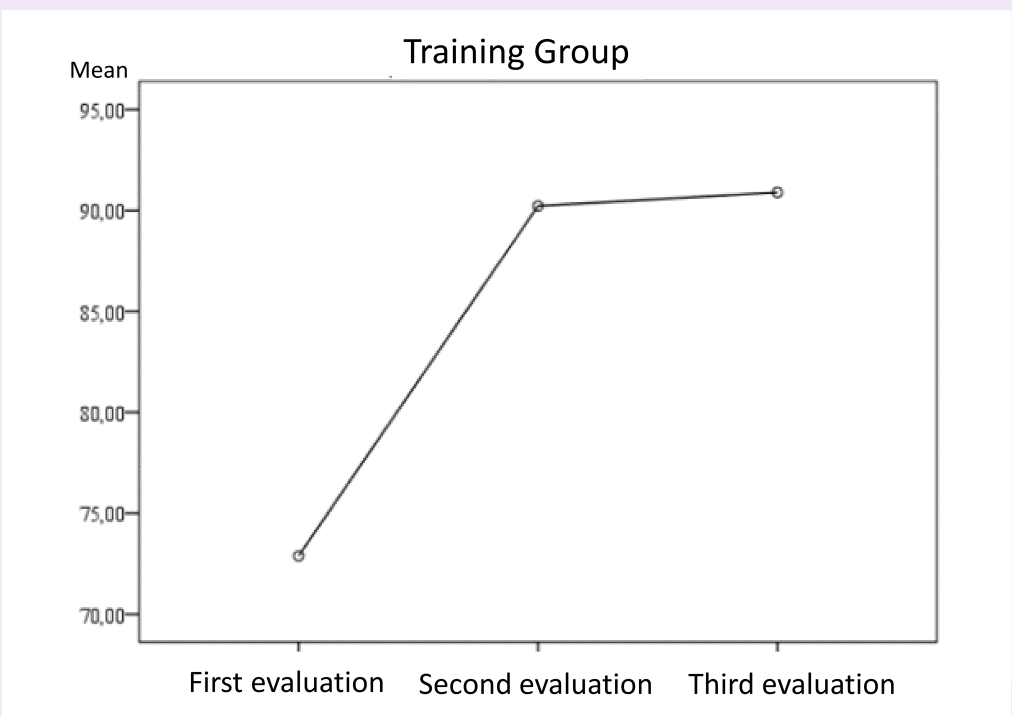
Scholarity /Age	4 years		5-6 years		7-9 years		9-12 years		BS		MD		PhD	
	TG	*CG*	*TG*	*CG*	*TG*	*CG*	*TG*	*CG*	*TG*	*CG*	*TG*	*CG*	*TG*	*CG*
less 25					♀	♀	♀♂ ♂♂	♀♀ ♂♂						
25-54	♀	♀	♀	♀							♀	♀	♀	♂
55-64	♀♀ ♀	♀♀ ♂			♀	♂	♀♀ ♂♂	♀♀ ♀♀						
Over 64	♀	♀												

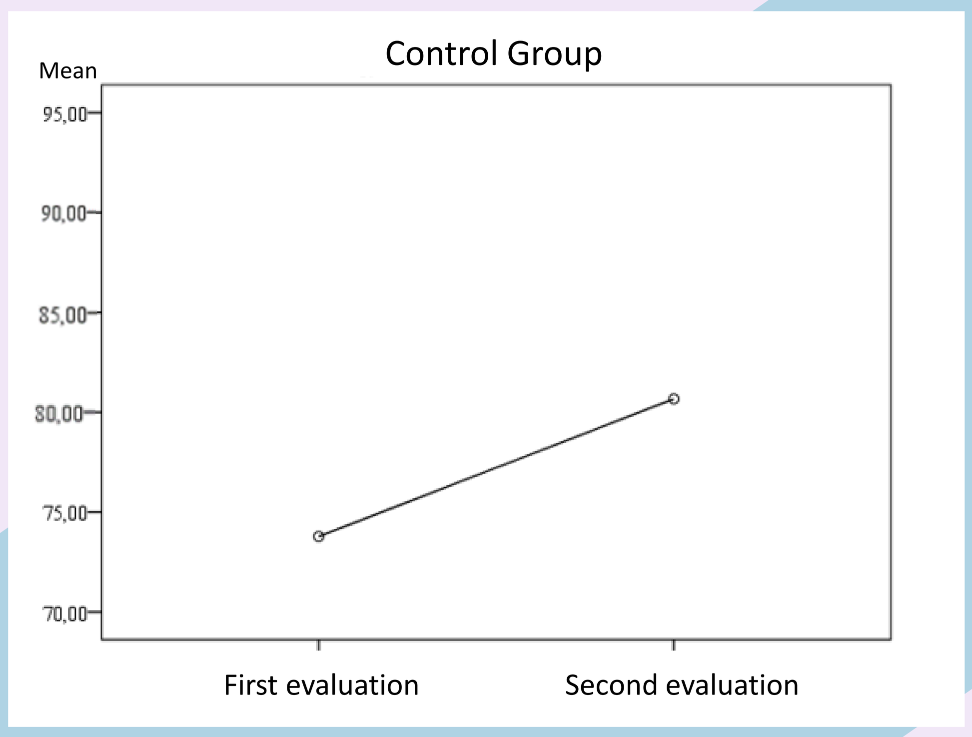
Training:

- The individual heard words or pseudowords with noise and after hearing each word, two options were presented that only varied between them in one phoneme, the individual chose the one he heard.
- Was performed twice a week for four weeks. Each time a level of the app was successfully completed, the noise intensity increased at the next level.



RESULTS





Training Group:

- marked improvement in the filtered speech test ($p<0,05$), which was maintained after four weeks.

Control Group:

- improvement in the filtered speech test, perhaps due to the vacation that subjects took between assessments

DISCUSSION

The EVOLLU ear training *app*:

- Promotes an improvement in speech perception in noisy environments that is maintained after the end of training sessions.
- This last fact confirms the day-to-day use of the skills developed with auditory training.
- Can be an important tool in improving speech perception in adverse environments, even in normal hearing people, regardless of the person's age and education level.
- May be an instrument that contributes to the deceleration of cognitive decline.

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Decreased sound tolerance in autism spectrum disorder: a scoping review

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1. Introduction

- Decreased sound tolerance (DST) is a common yet poorly understood feature of autism spectrum disorder (ASD)
- Currently there are no clinical guidelines recommending appropriate assessment and management options for DST[1]
- Numerous terms are used in clinical and research contexts to describe DST, creating challenges in accessing the current evidence and identifying where further research is required[1]

2. Methods

- A scoping review – JBI methodology[2]
- Patient and public involvement sessions
- Aimed to identify (within an ASD context):
  1. Terminologies used to describe DST
  2. Definitions of each DST-term
  3. DST assessment and management options

PubMed, Web of Science, CINAHL, Embase, Scopus

3. Results

2369 studies identified → **1006** screened by abstract → **104** screened by full-text → **65** studies included

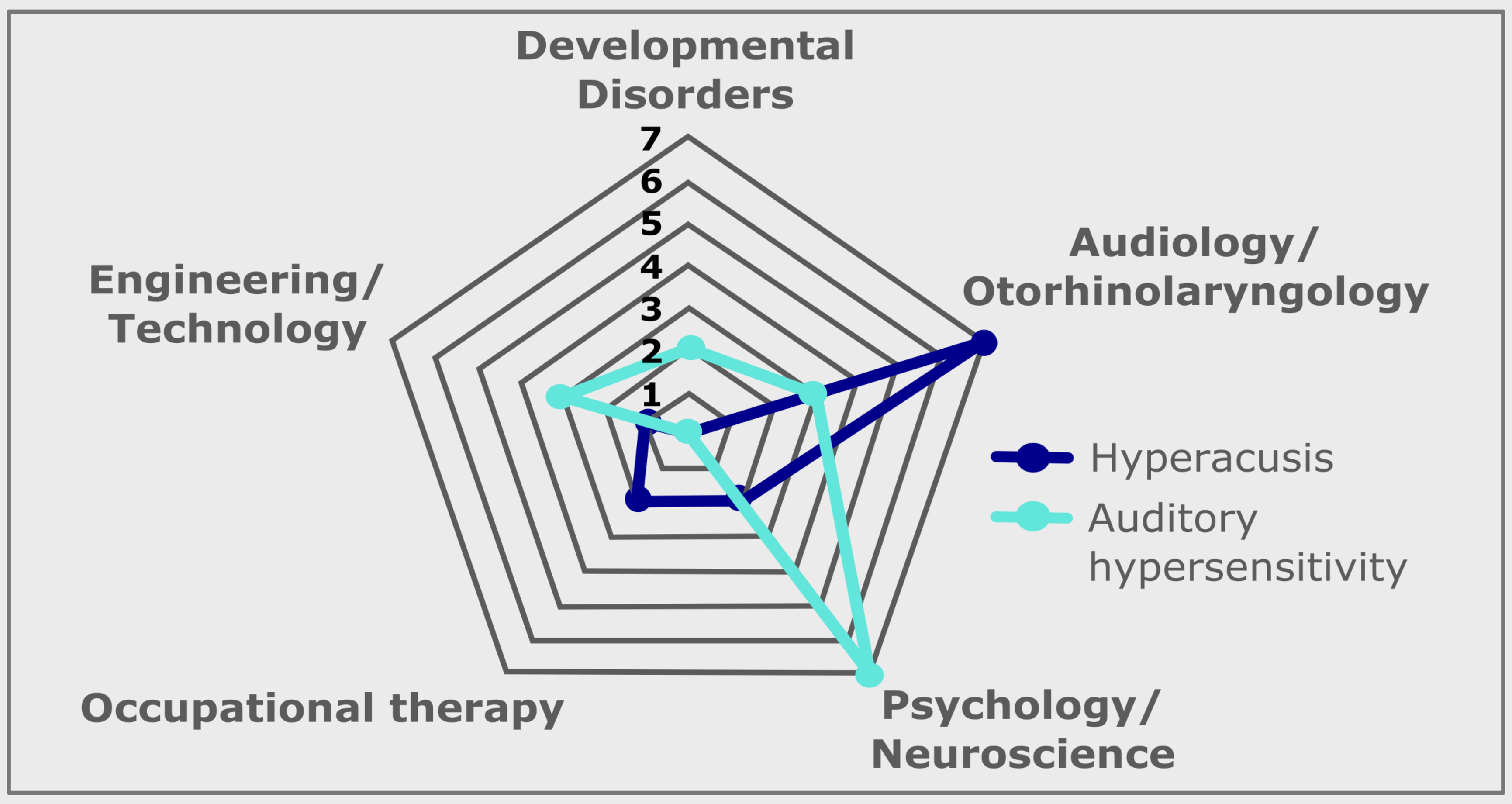
1363 duplicates removed; 902 irrelevant; 39 excluded

3.1 Terminology

- 26 terms were identified…

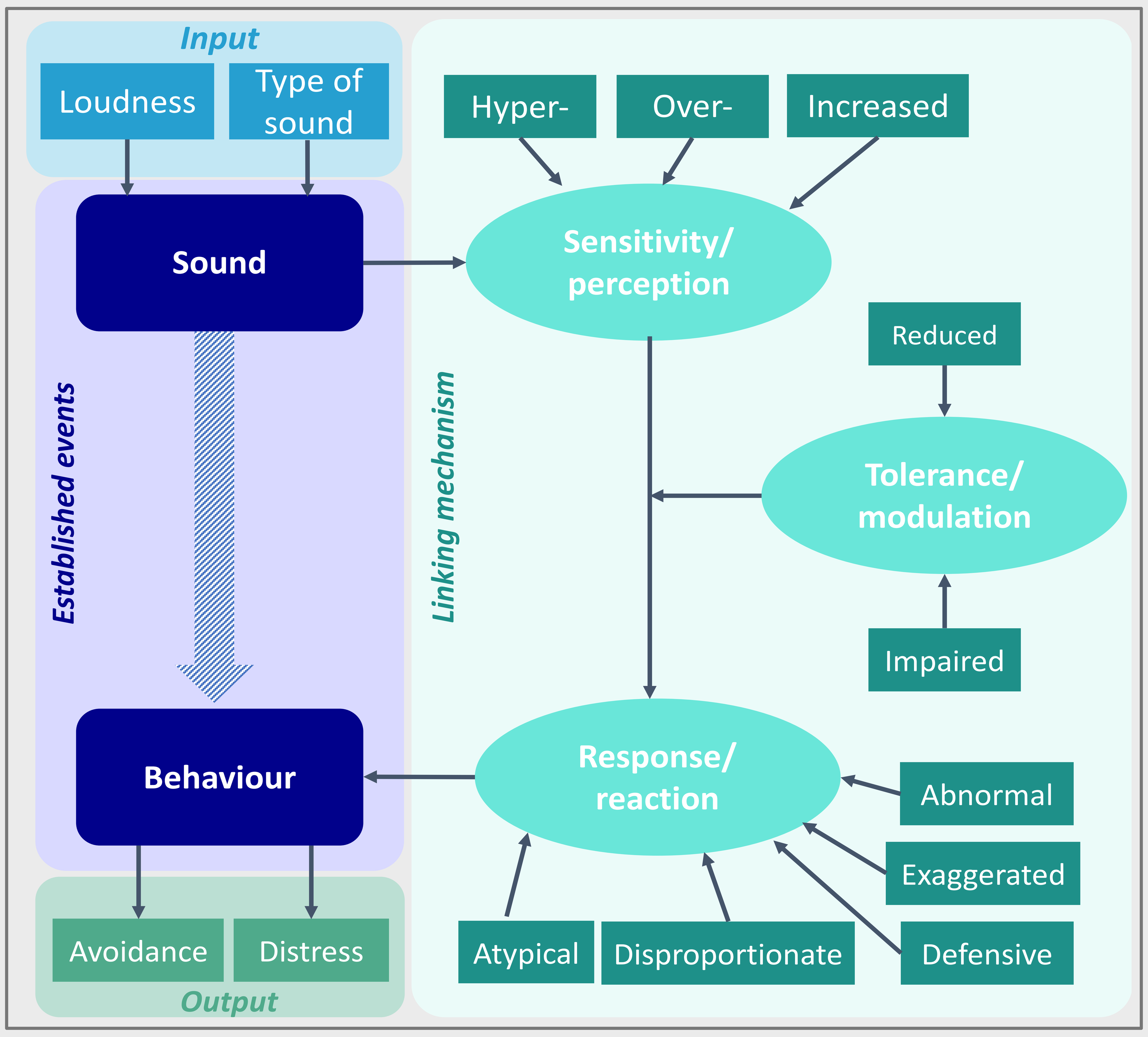
Increased Loudness Perception, Hyperacusis, Noise Hypersensitivity, Misophonia, Noise Sensitivity, Hypersensitive Hearing, Hypersensitivity To Loud Sounds, Hypersensitivity To Sound, Auditory Sensory Over-responsiveness, Atypical Sensory Reactions, Disproportional Behavior To Sounds, Auditory Hyper-reactivity, Abnormal Auditory Sensitivity, Auditory Hypersensitivity, Auditory Over-responsiveness, Decreased Sound Tolerance, Auditory Sensory Over-responsivity, Hyper-reactivity To Auditory Stimuli, Sound Hypersensitivity, Auditory Hyper-responsiveness, Sound Sensitivity, Hypersensitivity To Auditory Stimuli, Atypical Auditory Characteristics, Auditory Modulation Difficulties, Auditory Dysfunction, Auditory Defensiveness, Auditory Sensitivity

- … with varied use across disciplines



3.2 Definitions

- Distinct themes for inputs (i.e. features of sound), outputs (i.e. resultant behaviours) and linking mechanisms were identified:



3.3 Assessment and management

- **Assessment:** questionnaires, clinical interviews, observation, objective testing (e.g. loudness discomfort levels)
- **Management:** desensitisation (e.g. auditory integration therapy, behavioural reinforcement, 'Serious Games') or avoidance (e.g. noise-cancelling headphones, acoustic modification)

4. Conclusions

Scoping review findings:

- Widespread lack of consistency in terms and definitions used for DST in ASD, both within and across disciplines
- Varied assessment and management options with contrasting underlying principles – strongly influenced by the chosen DST definitions

Future research:

- Stakeholder and cross-disciplinary involvement to reach a consensus on a 'common language'
- Multi-disciplinary research to develop validated, clinically meaningful assessment and management tools, allowing for the creation of evidence based clinical practice guidelines

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DIAGONISTIC RELIABILITY AND VALIDITY OF CERVICAL VEMP IN PATIENTS WITH DIABETES MELLITUS-2.

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INTRODUCTION:

Diabetes mellitus is a metabolic condition in which blood glucose levels are consistently higher than normal due to a shortage of insulin. Due to poor glucose control, vertiginous crises are common in people with type 2 diabetes. Balance requires the integration of vestibular, visual, and somatosensory signals to develop motor responses that maintain upright position and respond to destabilising pressures. Vestibulo-spinal and occular reflexes keep you balanced. Cervical vestibular evoked myogenic potentials can be used to test spinal reflexes (cVEMP). A test for individuals with balance and vestibular difficulties that is part of a clinic's test battery. VEMP is a short-latency electromyographic response to sound or vibration stimuli that is considered to demonstrate ipsilateral saccular and inferior vestibular nerve functions (cervical VEMP), as well as contralateral utricular and superior vestibular nerve functions (ocular VEMP) (Rosengren and Kingma, 2013; Colebatch et al., 2016). Since its first description by Colebatch and Halmagyi in 1992, VEMP has become a significant part of the vestibular test battery as an objective measurement tool. During VEMP testing, surface electrodes are placed on the patient's skin for recording myogenic potentials in response to sound or vibration to provide quick, safe and reliable otolith function measurement. Cervical VEMP (cVEMP) measures the inhibitory myogenic potentials of the ipsilateral tensed sternocleidomastoid muscle (sacculo-collic reflex) and is considered to evaluate saccular vestibular signals conducted via the vestibulospinal tract (Rosengren et al., 2010; Rosengren and Kingma, 2013; Rosengren and Colebatch, 2018).

METHODOLOGY:

Total 40 participants were divided into two equal-sized groups: Amc (control group) and PwDM (experimental group) with 30 to 55 years of age. Detailed case history Audiological tests - Pure tone audiometry,Impedance audiometry,AC cVEMP were done. After 3 days of recording 1 as intersession retest recordings(R2) was carried out to see reliability of cVEMP in two groups.

Once all the above mentioned tests were done c-VEMP was carried out. Cervical vestibular evoked myogenic potentials were recorded from all the participants in both the groups. The non-inverting electrode was placed at around 3/4th length of sternocleidomastoid muscle, inverting electrode on sternoclavicular joint and ground electrode was placed on forehead. Subjects were seated in a sound proof room in a comfortable position and were given response LED to monitor the muscle activity of the SCM. EMG was monitored through the EMG monitoring device to ensure an equal amount of muscle contraction from all the participants.

- Estimation of the measurable characteristics of cVEMP; P1 latency, N1 latency and P1-N1 amplitude in patients with Diabetes Mellitus-2 (PwDM-2)
- Estimation of measurable characteristics of cVEMP; P1 latency, N1 latency and P1-N1 amplitude in Age matched Control (AmC).
- There is no reliability of P1, N1 latency and P1, N1 amplitude inPwDM-2 and AmC.
- There is no validity of P1, N1 latency and P1, N1 amplitude in PwDM-2 and AmC.

Table 1:-Mean and standard Deviation value of AmC(Control Group).

AmC	LaRP1R1&R2	LaRN1R1&2	LaLP1R1&R2	LaLN1R1&2	ARR1&R2	ALR1&R2
Mean	13.9 , 14.0	22.9,22.9	13.8,14.0	22.7,23.1	31.0,30.9	36.6,37.2
SD	0.5,0.5	0.6,0.6	0.7,0.7	0.9,0.7	14.6,14.4	15.1,14.7
Min value	13.0,13.0	21.8,22.0	12.3,12.3	20.2,21.4	14.6,14.6	18.0,18.1
Max Value	14.7,14.8	24.3,24.4	15.6,15.64	24.67,24.3	55.6,52.6	69.1

Table 2:-Mean and standard deviation value of PwDM-2(experimental group)

PwDM-2	LaRP1R1&R2	LaRN1R1&R2	LaLP1R1&R2	LaLN1R1&R2	ARR1&R2	ALR1&R2
Mean	16.0,16.0	25.0	15.8,15.9	24.2,24.3	20.2,19.7	22.422.9
SD	1.7,1.8	1.2,1.2	1.5,1.4	1.4,1.4	6.6, 6.1	6.9,7.0
Min value	13.6,13.4	23.1	13.1,13.2	22.3,22.2	12.1,12.5	12.1
Max Value	19.3,19.3	27.4,27.6	17.8	26.9,26.6	30.4,30.5	35.3

DISCUSSION

- This study was undertaken to check validity and reliability of cVEMP in PwDM-2. Participants were 20 PwDM-2 and 20 AmC. P1 latency, N1 latency and P1-N1 amplitude of cVEMP were estimated in all the participants expect 3 PWDM-2 in whom cVEMP was absent. cVEMP recordings were done two times in each participant to examine the reliability of the measures of P1 latency, N1 latency and P1-N1 amplitude. Henceforth, following the data collection statistical tests were performed on 17 PwDM-2 and 20 AmC.
- This analysis was undertaken to validate the results of previous studies investigating cVEMP in patients with Diabetes mellitus-2. Results of paired T-test and independent T-test showed significantly different P1 latency in PwDM-2 which compared to AmC for both right and left ears.
- Pearson correlation coefficient tests were done separately in PwDM-2 and AmC for recording-1 and recording-2 of P1 latency, N1 latency, and P1-N1 amplitude to check the reliability of these measures. Pearson correlation coefficient showed good reliability.

Table 3:-Correlation

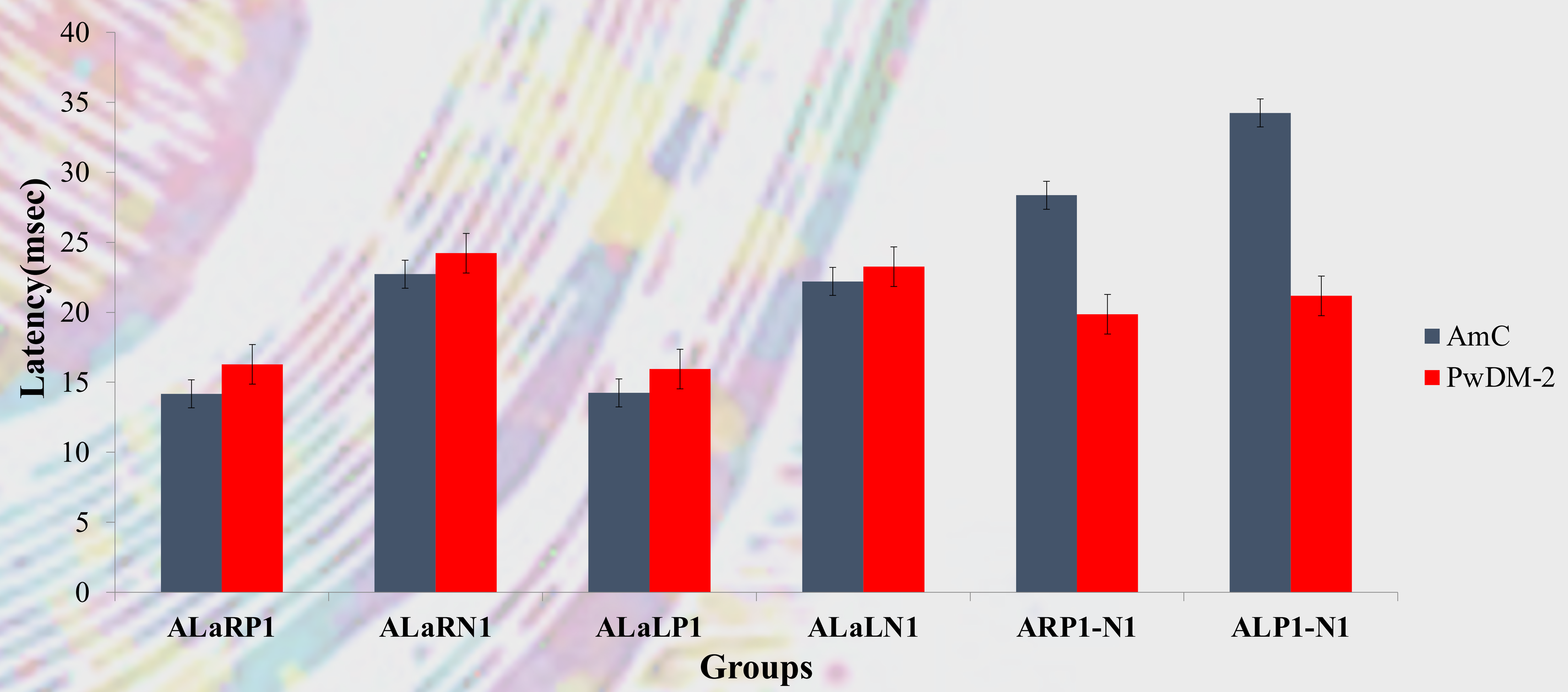
Right ear(AmC)		Left ear(AmC)		Right ear(PwDM-2)		Left ear(PwDM-2)	
Coefficient	p value	Coefficient	p value	Coefficient	p value	Coefficient	p value
0.863	≤0.05	0.907	≤0.05	0.927	≤0.05	0.895	≤0.05
0.844	≤0.05	0.820	≤0.05	0.862	≤0.05	0.886	≤0.05
0.879	≤0.05	0.861	≤0.05	0.949	≤0.05	0.879	≤0.05

Table:-4 Mean and standard deviation for averaged data

	AmC			PwDM-2			
	Mean	SD	P value	Mean	SD	p value	t value
LaRP1	14.17	0.6	≤0.05	16.28	1.8	≤0.05	55.847
LaRN1	22.72	0.8	≤0.05	24.22	2.05	≤0.05	85.773
LaLP1	14.24	0.8	≤0.05	15.94	1.6	≤0.05	58.923
LaLN1	22.20	0.9	≤0.05	23.25	1.1	≤0.05	119.017
ARP1-N1	28.36	15.05	≤0.05	19.86	9.03	≤0.05	11.742
ALP1-N1	34.24	14.39	≤0.05	21.17	6.61	≤0.05	13.084

RESULTS:

Study was undertaken to check validity and reliability of cVEMP in PWDM-2 . Participants were 20 PDM-2 and 20 AmC P1 latency, N1 latency and P1-N1 amplitude of cVEMP were estimated in all the participants expect 3 PWDM-2 in whom cVEMP was absent. cVEMP recordings were done two times in each participant to examine reliability measures of P1 latency, N1 latency and P1-N1 amplitude. Henceforth, following the data collection statistical tests were performed on 17 PWDM-2 and 20 AMC. Right and left ear's mean, standard deviation, minimum value and maximum value of P1 latency, N1 latency and P1-N1 amplitude for AmC & PWDM-2 in recording 1 & 2 shown prolonged latencies and reduced amplitude. Pearson correlation coefficient tests were done separately and shows good reliability in PWDM-2 and AmC for recording-1 and recording-2 of P1 latency, N1 latency and P1-N1 amplitude to check the reliability of these measures. Independent t-tests were done for comparison of P1 latency, N1 latency and P1-N1 amplitude between PWDM-2 and AmC.



CONCLUSION:

- Diabetes is a long standing disorder of glucose metabolism that affects various systems of the body, auditory vestibular system being one among them. Persons with diabetes mellitus are found to show a number of symptoms related to vestibular dysfunction such as dizziness, vertigo and instability. This study was planned to study validity and reliability of latency and amplitude cVEMP in persons with AmC and PwDM-2 across two groups for recording 1 and 2.
- 20 participants with the age range of 30 to 55 years with DM-2 and 20 participants in the age range of 30-55 years without diabetes participated in the study. A detailed case history was taken prior to the testing. It was followed by a series of audiological test battery that included Pure tone audiometry, Immittance, acoustic reflex, cVEMP.
- By this present study, we found the effect of diabetes on cVEMP. Diabetes can affect different vestibular structures. The site of lesion in individuals with diabetes can be confined to end organs only. Most of the time subjects with diabetes remain asymptomatic probably because of bilateral distribution of disorder. This study also showed vestibular system dysfunction due to diabetes mellitus.

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Does the configuration of a mild hearing loss effect the benefit received by adults fitted with bilateral hearing aids?

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Introduction

- Mild hearing loss is the most prevalent of all degrees of hearing loss[1].
- People report negative effects of mild hearing loss, such as feeling excluded from group situations, however, hearing aid uptake is low for this population. Moreover, PTA is not necessarily a good predictor of hearing aid satisfaction.
- There is limited evidence as to the benefit of hearing aids for this population, and it is not known whether the benefit of hearing aids is affected by the configuration of mild hearing loss.

Objective:

To investigate whether the configuration of a mild hearing loss has an effect on the benefit received from hearing aids using the International Outcome Inventory for Hearing Aids (IOI-HA)[2] as the outcome measure.

Methods

- A retrospective review was carried out at Mid and South Essex NHS trust of adults fitted with hearing aids with a mild hearing loss.
- 205 adults (49% male; 51% female) met the inclusion criteria set.
- Audiograms were classified into four different configurations of hearing loss[3] (figure 1).
- Total score and individual question scores on the IOI-HA were analysed.

Figure 1: configurations of mild hearing loss. Grey scale lines represent individual data. Bold red lines indicate mean thresholds

Results

There were no significant differences in the benefit received from hearing aids regardless of the configuration of hearing loss, $H(3) = 4.250$, $p = 0.236$ (figure 2). However, the scores for all configurations of hearing loss exceeded the norms of the IOI-HA considerably (figure 3).

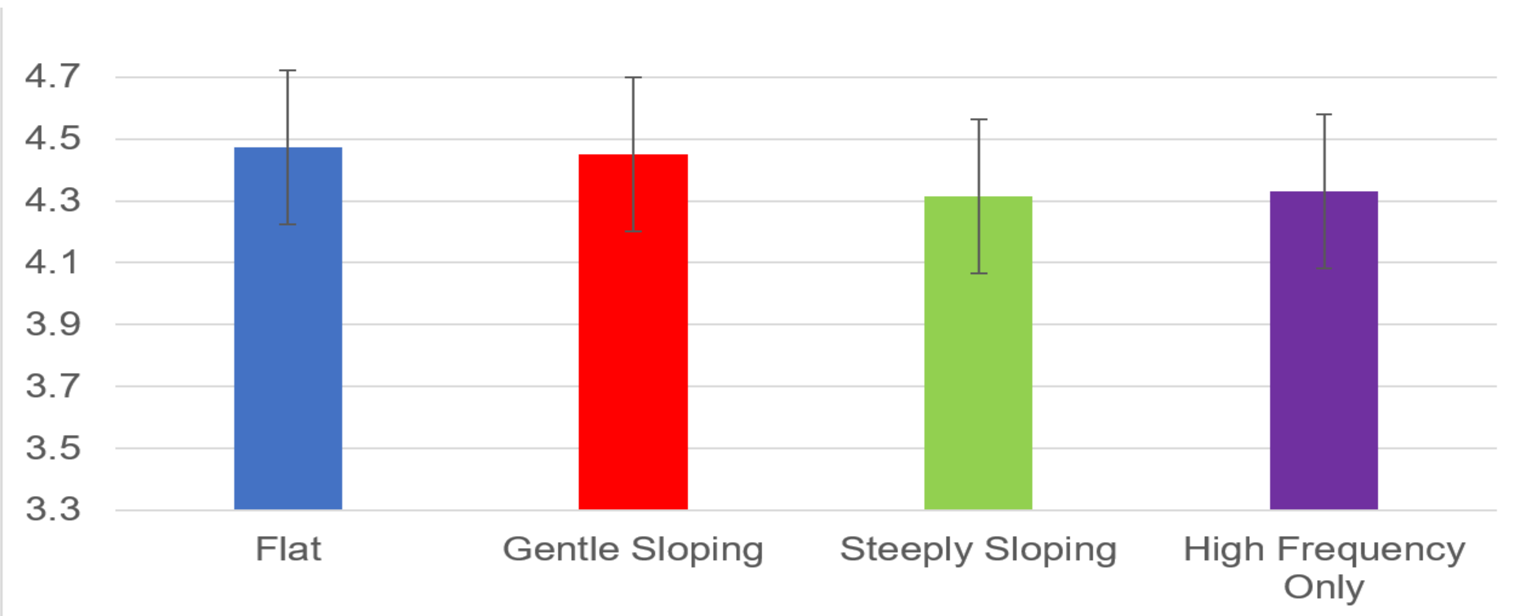

Figure 2: benefit received from hearing aids for different configurations of mild hearing loss

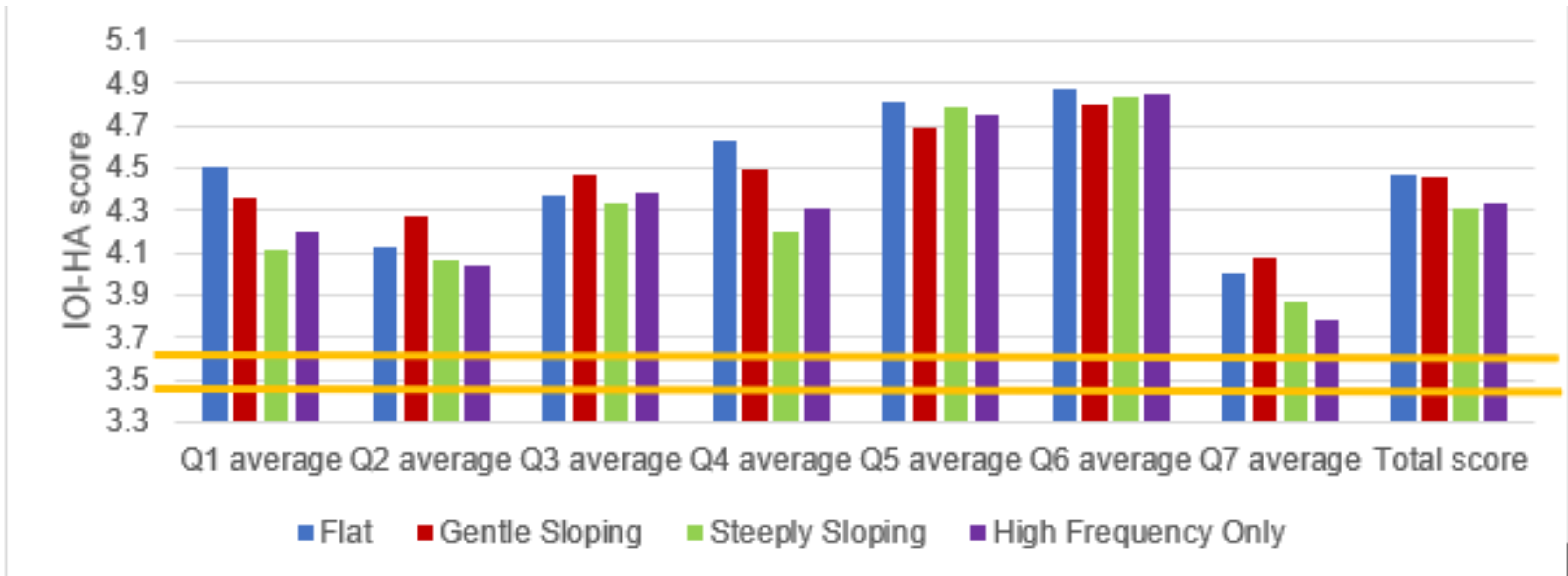

Figure 3: IOI-HA questions scores for each configuration of mild hearing loss. The yellow lines indicate normative data for the IOI-HA.

Conclusions

- **Hearing aids can provide benefit to adults with a mild hearing loss regardless of the configuration of hearing loss.**
- **Audiologists and patients alike should feel confident that benefit can be achieved from hearing aids with a mild hearing loss.**

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Music-listening Level Preferences in Musicians and Non-Musicians

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Background

- Previous studies have indicated that the vestibular system contributes to hearing (Todd & Cody, 2000; Todd et al., 2014), and the connection between these systems could be influenced by musicianship i.e. musical experience (Trainor et al., 2009).
- Musicians differ from non-musicians on both behavioural and electrophysiological measures (e.g. auditory evoked potentials), which may reflect superior auditory and vestibular function in musicians (Schneider et al., 2002).
- Musicians may prefer to listen to loud music to activate the limbic system (the reward centres of the brain) via activation of the vestibular system (Todd & Lee, 2015). Additionally, increased vestibular function helps musicians to better attend to musical rhythm, therefore they prefer to listen to music louder so that they can follow the rhythm via activation of the vestibular system (Trainor et al., 2009).

Aim

- This study aims to investigate the differences in preferred music-listening levels between musicians and non-musicians, and whether the vestibular function contributes to these differences.

Methods

Participants

Inclusion Criteria:

Musicians: Having at least six years of musical experience

Non-musicians: No experience of formal musical training and not actively playing an instrument

Exclusion criteria:

For both groups: Ear malformations and disorders, history of neurological or systemic disease, Any vestibular disorders, ototoxic / vestibulotoxic drug use, hearing loss.

Study design: This study consist of two parts: (1) online questionnaires and tests and (2) laboratory-based tests. For the online part of the study, 92 musicians and 96 non musicians (46F/45M/1 non-specified) with self-reported normal hearing completed online questionnaires. Subsequently, 28 musicians and 41 non-musicians completed online music-listening test (MLP).

For the second part of the study, 76 musicians and 74 non-musicians (87F/63M) were assessed using a lab-based MLP test and the cervical vestibular evoked myogenic potentials test (c-VEMPs).

All participants in both groups were aged between 19 and 45 (mean+sd=25.2±5.8) years. Musicians had an average of 15.1 ± 6.3 years of musical experience (ranging from 0 to 37 years).

Data Collection Procedure

1) Online Questionnaires and Tests:
- A series of online questionnaires
- Online Music-Listening Level Preference Test (onlineMLP)

- **Online Questionnaires:** The online questionnaires consisted of seven questionnaires referring to general health conditions, musicianship, audiological and balance evaluations. The questionnaires were created using REDCap platform.
- **OnlineMLP**: For this test, 6 music pieces each of a different genre (e.g., rock, metal, jazz, etc.) were chosen. Participants adjusted the level of each of the six pieces of music to their preferred by moving the position of the on-screen slider only.
- Participants who completed the online questionnaires and test were invited to participate in the second section of the study (lab-based MLP and c-VEMPs).

2) Lab-based Tests:
- Music Listening Level Preference Test (Lab-based)
- Cervical Vestibular Myogenic Potentials (c-VEMPs) Test

- **Lab-based MLP:** Music-listening preference (MLP) test allows participants to adjust volume levels manually via audiometer. The same 6 pieces of music with onlineMLP test, were presented through headphones from the CD player. The music pieces was adjusted to centre at an octave frequency of 500 Hz.
- **c-VEMPs:** The c-VEMPs amplitudes were recorded at 95 dB nHL at a 500 Hz frequency range. Two active electrodes were placed at the 1/3 upper part of the right and left SCM muscles, while the negative electrode was on the sternoclavicular junction, and the ground electrode was placed at the forehead.

Statistics

- All data analyses were conducted using Rstudio (Version 1.3.1093). Linear regression analyses used musicianship as a predictor variable on the outcome variable (onlineMLP) for all tests.
- A pre-registration for the study is published on the Open Science Framework website (https://osf.io/4vuxs).

Results

1) Online Music-listening test (onlineMLP)

➢ The regression equation was non-significant [F (5, 63) = 1.448, R^2 = 0.103, ***p* =0.915**]. This suggests that musicianship was not a significant predictor of online MLP .

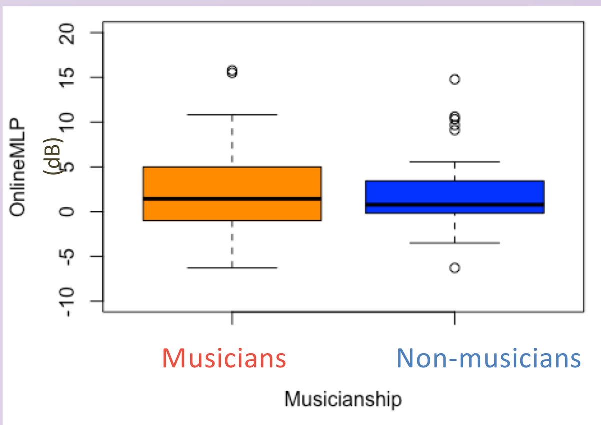

Fig. 1.Boxplots of the mean values for online music-listening levels in dB in both groups

➢ Figure 1 indicates that musicians (mean±sd= 1.98±7.16 dB) had slightly higher music-listening levels in dB than non-musicians (mean±sd=1.52±7.07 dB).

2) Music-listening test (Lab-based)

➢ The regression equation was significant [F (3, 149) = 14.38, R^2 = 0.209, ***p* <0.001**]. This suggests that musicianship was a significant predictor of MLP.

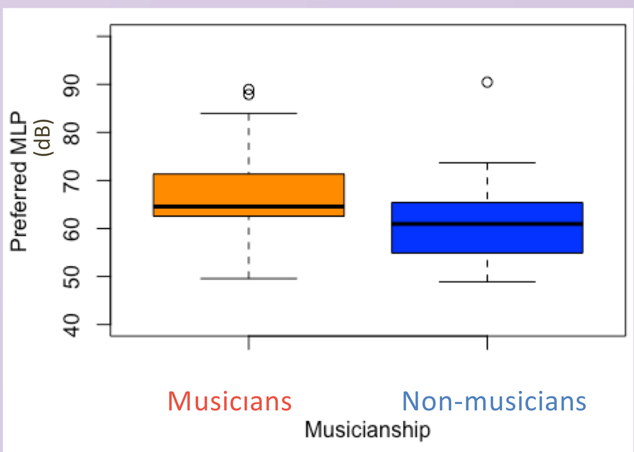

Fig. 2. Boxplots of the mean values for preferred music-listening levels in dB in both groups

➢ Figure 2 shows that musicians (mean±sd= 67.7±7.67 dB) had higher music-listening levels in dB than non-musicians (mean±sd=60.69±7.01 dB).

3) Cervical Vestibular Evoked Myogenic Potentials (c-VEMPs) Test

Coefficients				
	β value	Std. Error	*t*-value	*p* value
(Intercept)	162.1378	20.9709	7.732	<0.001
Musicianship	-36.7575	9.0386	-4.067	<0.001
Sex	5.9042	9.1248	0.647	0.519
Age	-0.1083	0.7949	-0.136	0.892

Table 2. Beta, t and p values and standard errors are presented for P1-N1 amplitude and covariates

➢ Table 2 indicates that the regression equation was significant [F (3, 149) = 6.57, R^2 = 0.099, ***p* <0.001**]. This suggests that musicianship was a significant predictor of c-VEMPs P1-N1 amplitude.

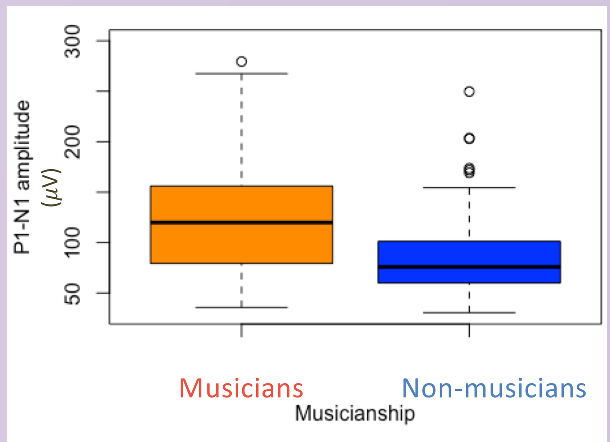

Fig. 3. Boxplots of the mean values for P1-N1 amplitudes in μV in both groups

➢ Figure 3 revealed that the P1-N1 amplitude was significantly higher in musicians (mean±sd= 126.0±60.6 μV) compared to non-musicians (mean±sd= 87.8±43.7 μV).

Conclusions

- The results of the laboratory-based music-listening test suggest that musicians prefer to listen to music at higher levels compared with non-musicians.
- Our findings also showed that musicians have greater vestibular function than non-musicians, assessed by c-VEMPs.
- Further, we aim to assess whether the relationship exists between music-listening level preferences and c-VEMPs amplitudes.
- We also intend to measure loudness perception via a loudness matching test to observe the potential effect of vestibular function on loudness perception.

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Developing Strategic Directions for Inclusive Research about Co-existing Dementia and Hearing Loss in Consultation with Key Stakeholders.

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1. Introduction

Hearing loss and dementia often co-exist, which can impair their assessment and management.[1]

Hearing loss is one of the largest potentially modifiable risk factors for dementia from midlife onwards.[2]

However, further research is needed to understand the specific mechanisms underlying this association, as well as optimal interventions for patients and carers.[1-3]

Therefore, the aims of this research were to:

1) Develop a strategic agenda for future dementia and hearing studies.

2) Co-design a toolkit of strategies and resources to improve the inclusion of under-served groups in dementia and hearing research.[4]

2. Methods

Funder: The NIHR via its Clinical Research Network, Research for Patient Benefit programme, and Nottingham Biomedical Research Centre.

Patient and Public Involvement (PPI): Embedded throughout the research, including the formation of a new PPI advisory group.

Participants: A range of stakeholders, including people living with dementia and/or hearing loss, carers, clinicians, researchers, and members of under-served groups (e.g. ethnic minorities).

Study 1: Focus groups with 24 stakeholders to develop strategic directions for future dementia and hearing research.

Study 2: Experienced-based co-design process[5] with ~30 stakeholders to co-create a toolkit to widen participation in dementia and hearing research (see Figure 1).

Analysis: Reflexive thematic analysis and peer debriefing were used. [6,7]

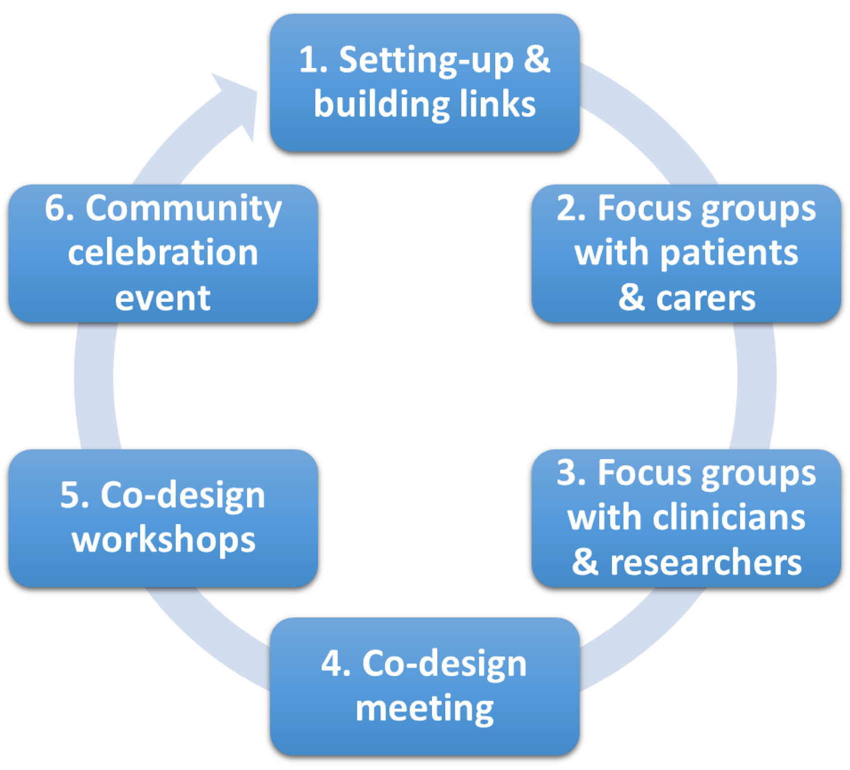

Figure 1. Experience-based Co-design Process

3. Results

Preliminary analysis of the Study 1 focus groups produced the following priority areas for future dementia and hearing research:

- Examine the prevalence, onset, and progression of various hearing conditions and auditory symptoms in people living with dementia.
- Identify appropriate means of screening and assessing hearing and cognition for people who may have both hearing loss and dementia.
- Improve post-diagnostic support for people with dementia and their families, including assessing their hearing and communication needs.
- Develop hearing and dementia training for health and social care professionals and facilitate interdisciplinary approaches to care.
- Develop and evaluate appropriate aural rehabilitation interventions and practices for people living with dementia and their families.
- Design and assess interventions to improve social participation and psychological wellbeing for people living with these conditions.
- Design hospitals, clinics, and care homes that are both dementia-friendly and hearing-friendly.

4. Discussion

This research will produce strategic priorities for future studies in the area of dementia and hearing research that are valued by key stakeholder groups.

This research will also produce a toolkit of strategies to improve the representation of under-served groups in dementia and hearing research, such as appropriate recruitment, data collection, and dissemination practices.

Consequently, this research will provide a foundation for high-quality, inclusive research and practice in this field in the future.

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BEARS Both Ears

Using the qualitative pre-test interview to develop a questionnaire for children with hearing loss

The York-Binaural-Hearing-Related-Quality-of-Life-Youth (YBHRQL-Y)

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Background

In hearing research there are numerous measures for adults with hearing loss. There are fewer measures for children with hearing loss e.g. PEACH, LittlEars etc. Many of these are designed for proxy completion by a parent / guardian / clinician. However, when asking quality of life questions, it is important for the child to be able to self-complete a questionnaire. As adults we have a different world view to children and our priorities differ. A hearing person has different lived experiences to a person with hearing loss.

To truly understand their experience and assess their quality of life there is a need for a questionnaire that is founded in their world view, and which uses language relatable to them. Here, we demonstrate how the qualitative pre-test interview (QPI)[1] can be applied to questionnaire development.

Method

Two sets of interviews with children aged 8 to 16 years with severe-to-profound hearing loss. Interviews based on domains taken from existing questionnaire in adults[2].

Interview 1	Interview 2
Open ended questions	QPI approach
Based on YBHRQL domains	Equal partners
Everyday situations where domains were a challenge	Language use, structure, relatability, presentation, understanding
Analysed inductively using theme analysis	Analysed deductively using the response process model

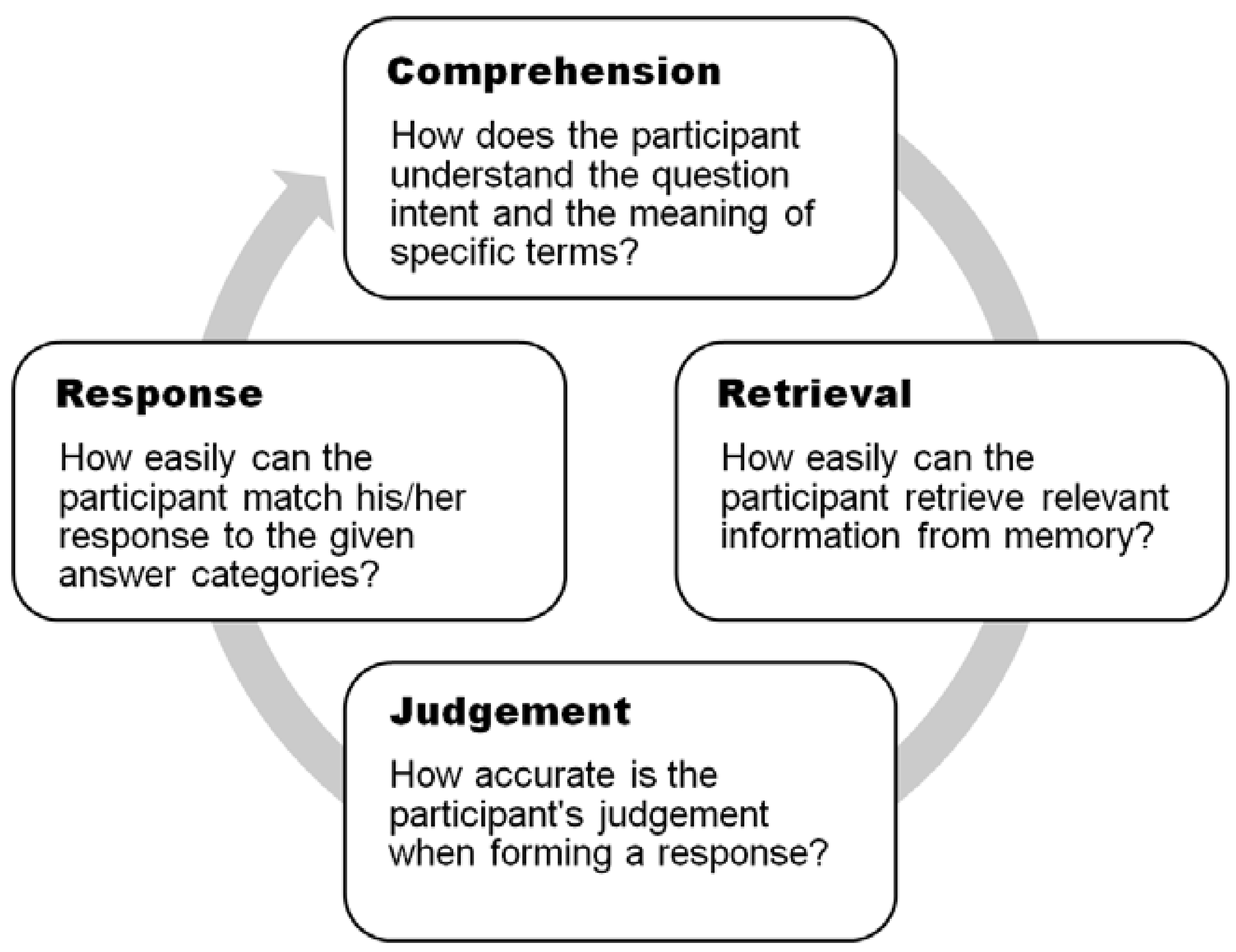

Image taken from Sopromadze 2016

Results

We recruited 12 children (3 male, 9 female) aged 8 to 16 years with a severe to profound hearing loss. Children attended primary (n=5) and secondary schools (n=7) with some having a severe loss (n=8) and others having a profound loss (n=4).

Interview 1	Interview 2
YBHRQL too complex	Language now relatable
Language difficult and not relevant, e.g. preference for understand rather than hear	Some change of response options and structure
Scenarios relatable to participants include; with friends in dining hall, in school classroom, sports clubs, home activities etc.	Short and specific setting of the scene before asking a question. Participants then relating to the scenario more readily.

Understanding speech when there is background noise

☐ 1. When a friend speaks to you while the TV is on or other people are chatting in the same room, you can hear your friend speaking easily, usually picking up all of the words they say.

☐ 2. Between 1 and 3.

☐ 3. When a friend speaks to you while the TV is on or other people are chatting in the same room, you can hear your friend speaking, but you can only pick out some of the words they say. This can lead to confusion if you miss an important word. Sometimes you need them to repeat themselves or to turn the volume down for you to understand them.

☐ 4. Between 3 and 5.

☐ 5. When a friend speaks to you while the TV is on or other people are chatting in the same room, you find it very difficult to hear your friend speaking. You are usually unable to pick out the words they say. This regularly leads to misunderstanding and confusion. The room needs to be completely quiet for you to understand them.

Adult version (original)

Child version (adapted)

Understanding speech when there is background noise

It is lunch time, and you are in the place where you eat food. Imagine the noises that are here, people chatting, cutlery and plates being used. You are sat around a table with your friends. One of them speaks to you but you cannot see their face. Can you understand what they are saying?

I can understand **most** of the words	☐
	☐
I can understand **some** of the words	☐
	☐
I can understand **none** of the words	☐

Conclusion

The QPI approach is a useful way to design and adapt questionnaires for use in children with hearing loss. It would also have beneficial applications in the wider field including translation of questionnaires into other languages.

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BEARS Both Ears

DEVELOPING A PREFERENCE-BASED-MEASURE FOR CHILDREN WITH HEARING LOSS.

The York-Binaural-Hearing-Related-Quality-of-Life-Youth (YBHRQL-Y)

Sarah Somerset[1], Adam Pedley[1] & Pádraig T. Kitterick[2]

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Background

As part of the development for the 'Both Ears Training Package' (BEARS), we need a Quality-of-Life measure that is:

1. Designed for children
2. Specific to hearing loss
3. A preference-based-measure (PBM)

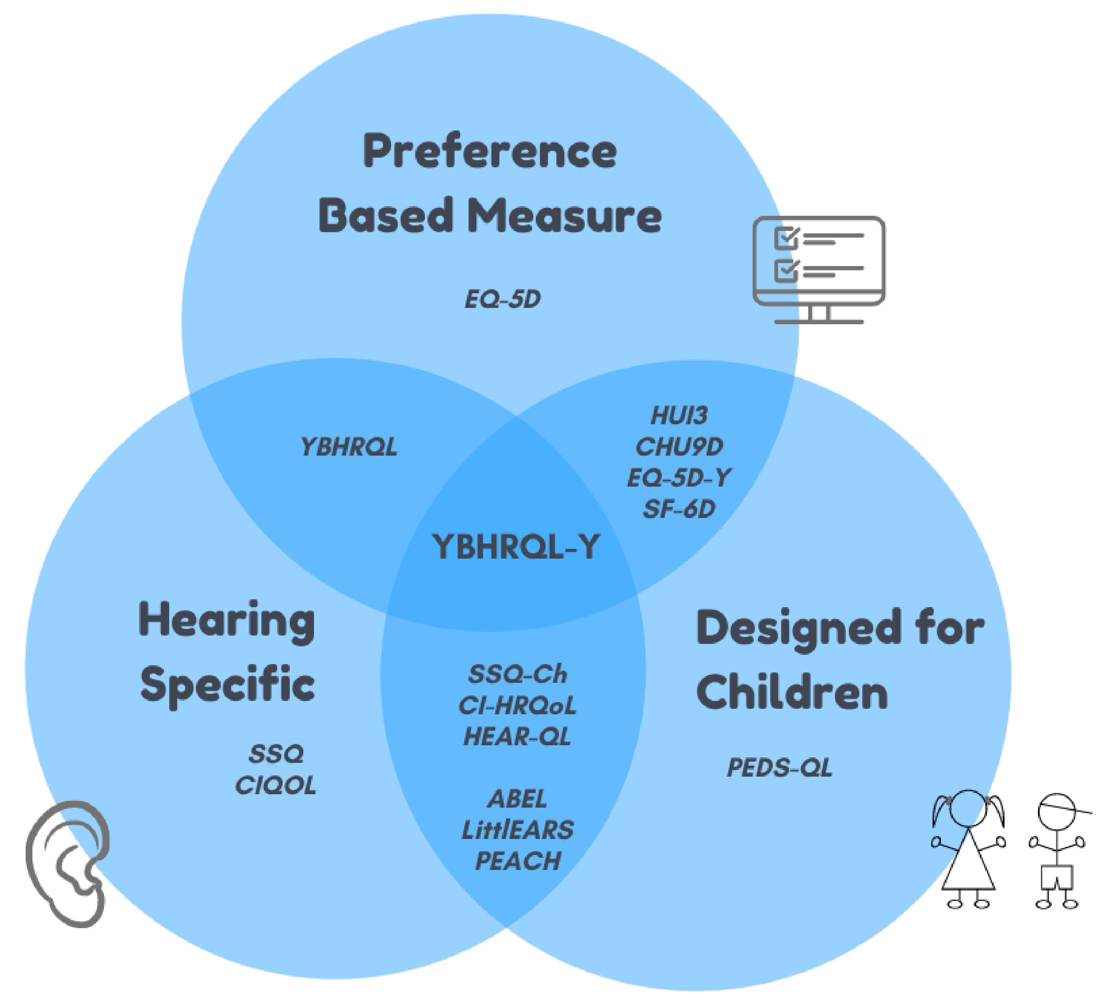
A PBM enables health economists to assess if health care is cost-effective.

<u>No such measure currently exists.</u>

The York-Binaural-Hearing-Related-Quality-of-Life (YBHRQL) by Summerfield, Kitterick and Goman (2022)[1], is a hearing specific PBM for adults. The YBHRQL has three domains, each measured with a single item: speech-perception-in-noise, localization and effort-and-fatigue.

The YBHRQL will be adapted for children to create the York-Binaural-Hearing-Related-Quality-of-Life-Youth (YBHRQL-Y).

Existing Measures



Developing the YBHRQL-Y in 3 stages

1. Adaptation

Two rounds of interviews with 12 young people aged 8 to 16 who have a severe-to-profound hearing loss.

Interview 1: Asked about participant's experience of: speech-perception-in-noise localization and effort-and-fatigue.

Thematic Analysis was used to develop questions for young people based on existing YBHRQL domains.

Interview 2: Participants provided feedback on questions to refine the YBHRQL-Y. Proxy version for parents/guardians also created.

2. Validation and Reproducibility

Reproducibility is assessed by administering the YBHRQL-Y at two time-points to 60 young people (age 8 to 16) who have a severe-to-profound hearing loss.

Validation of the YBHRQL-Y is assessed by administering the following outcome measures to participants; HUI3[2], CHU9D[3],SSQ-Ch[4] and VFS-Peds[5].

Statistical analysis of responses will assess validity and reproducibility.

3. Health-Utility Calculation

To develop health-utility values, the Time-Trade-Off method is used with 150 young adults (aged 18 to 24).

This method asks participants to imagine themselves with the hearing loss described in the YBHRQL-Y and 10 years left of life. Participants then indicate how many years of life they would trade to obtain perfect hearing.

These responses are converted to health-utility values for use in economic evaluation.

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HUSH
HEARING AIDS FOR TINNITUS WITH HEARING LOSS

Barriers and facilitators to conducting tinnitus trials in the UK audiology departments: an example of the HUSH trial

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Introduction

- As yet, there have been relatively few large-scale randomised control trails (RCTs) engaging UK audiology clinics, resulting in a gap in research capacity within NHS hearing services.
- In order to build capacity within the NHS hearing services to support research and RCTs, it is important to understand what are the barriers and facilitators to conducting these trials in the UK.
- The HUSH trial aim was to determine the feasibility of conducting a definitive randomised controlled trial (RCT) of the effectiveness and cost-effectiveness of hearing aids for adults with tinnitus and hearing loss.
- A nested interview study conducted alongside the feasibility trial [1] investigated the feasibility and acceptability of trial processes from the perspective of clinical staff.

Secondary data analysis of these interviews was carried out to explore barriers and facilitators to conducting trials of tinnitus interventions in the UK audiology setting

Methods

- After trial recruitment activities have ceased, ten clinical staff from five trial sites were interviewed to review their experience of the trial.
- Those included Principal Investigators at trial sites and staff conducting the trial (audiologists, research support staff).

5 NHS audiology departments → Multi-centre feasibility RCT → Nested interview study

- Secondary analysis of the interview data was conducted, utilising a Framework approach [2,3].
- The data was mapped to two analytic matrices: (1) Challenges and barriers and (2) Facilitators.

Results

- Preliminary data analysis identified five main themes that reflect the barriers and facilitators (Figure 1).
- There was large variability of usual clinical pathways between and within different audiology departments.
- This variability influenced the experiences of the trial by clinical staff and the identified themes.

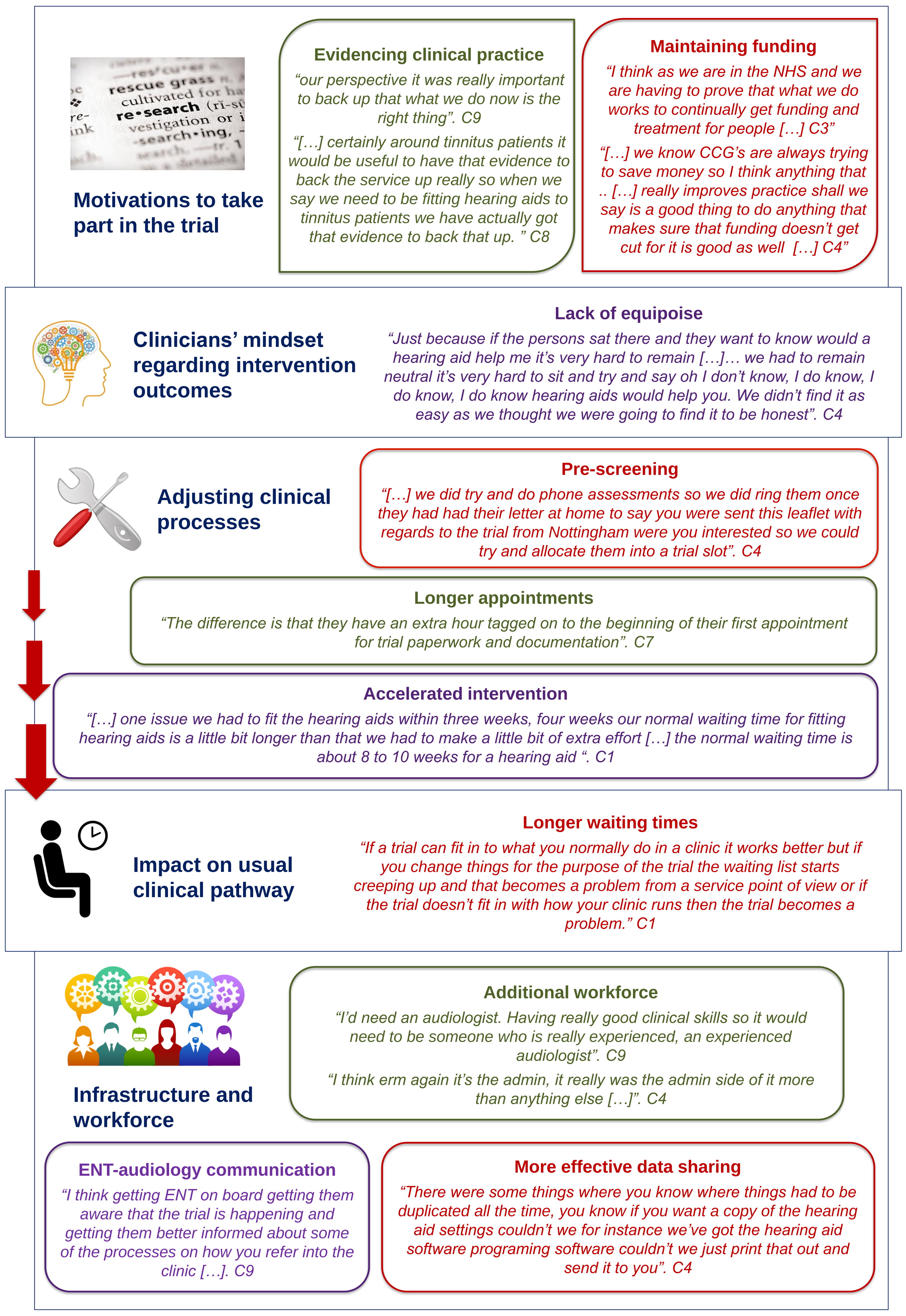

Figure 1. Themes and sub-themes with example quotes.

Conclusions

- Work still needs to be undertaken to help embed high quality trials alongside clinical practice.
- Clinicians are motivated to take part in trials and want build research experience, an evidence base for devices and maintain funding.
- Having a dedicated clinical time and staff, building communications across departments and making data sharing more efficient and effective was seen as key to reducing barriers to conducting trials.

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Establishing a Core Domain Set for early-phase clinical trials of electrical stimulation interventions for tinnitus in adults: an online Delphi study

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Introduction

Tinnitus is the awareness of a sound in the ear or head in the absence of an external source. It affects around 10-15% of people. About 20% of people with tinnitus also experience symptoms such as depression or anxiety that negatively affect their quality of life. Currently, no treatment exists that eliminates tinnitus but many interventions are being trialled. One such group of interventions is electrical stimulation, defined for the purposes of this study as **treatment that aims to improve tinnitus or its symptoms by electrical stimulation of the brain or other parts of the nervous system**. Across trials, there is variability in what outcomes are being measured, making it difficult to synthesise evidence. Core Outcome Sets, a set of outcome domains and instruments that has been agreed upon for a health condition, addresses this issue. Building on previous work [1], the Core Outcome Measures in Tinnitus – Electrical Stimulation (COMiT-ES) study [2] established a Core Outcome Domain Set for electrical stimulation interventions for tinnitus.

Round 1 of the survey
↓
Analysis conducted by the research team
↓
Round 2 of the survey
↓
Analysis conducted by the research team
↓
Online group meeting (optional)

Methods

STAKEHOLDERS: Two groups of stakeholders were recruited: healthcare users with tinnitus who had either undergone electrical stimulation for tinnitus or would consider undergoing this treatment and relevant professionals including clinicians, researchers, funders and commercial partners

THE DELPHI PROCESS: in Round 1 participants rated previously identified outcomes by their importance on a 1-9 scale. In Round 2 participants could view their own ratings, as well as overviews of the ratings of participants in each stakeholder group. Participants were given the opportunity to change their ratings. In the consensus meeting, the final list of outcome domains was determined via discussion and voting

CONSENSUS CRITERIA: Consensus recommendations were made according to the following definition: Include domain in Core Domain Set: 70% or more of the participants in each stakeholder groups score 7-9, and fewer than 15% score 1-3. Exclude outcome domains in Core Domain Set: 50% or fewer participants in each stakeholder group score 7-9. Consensus from the meeting is defined as 70% or more of the participants agreeing on including one or more outcome domains in the Core Domain Set.

Results

Outcome domain	Definition
Ability to ignore	Ability to continue as normal as if tinnitus were not there
Concentration	The ability to continue as if tinnitus were not there
Treatment satisfaction	How the treatment meets your expectations or how pleased you are after receiving the treatment
Helplessness (lack of control)	Feeling despair about being unable to control or manage tinnitus
Tinnitus intrusiveness	The extent to which tinnitus invades your life, stresses you in daily situations and prevents you from doing things you want to do. The unacceptable and unwelcome interference of internal head and body noise heard only by the individual Being acutely aware of the sounds of tinnitus, feeling that it is invading your life or your personal space, changing your thoughts or actions and negatively impacting on your life

Conclusions

1) This Delphi study established a Core Domain Set -a list of outcomes that should inform the choice of measurements used when trialling electrical stimulation-based interventions for tinnitus.
2) Two groups of participants were recruited: healthcare users and professional stakeholders.
3) Standardised reporting will facilitate meta-analysis and Grading of Recommendations Assessment, Development and Evaluations (GRADE) assessment, improving the clarity on the knowledge produced, leading to improvement in treatments for tinnitus.

[1] Hall et al (2018) The COMiT'ID study: Developing core outcome domains sets for clinical trials of sound-, psychology-, and pharmacology-based interventions for chronic subjective tinnitus in adults. Trends in hearing. 22:2331216518814384 [2] Labree et al.(under review) Establishing a Core Domain Set for early-phase clinical trials of electrical stimulation interventions for tinnitus in adults: Protocol for an online Delphi study

Bas Labree bas.labree@nottingham.ac.uk

This research was funded by the NIHR Nottingham Biomedical Research Centre. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

The NIHR Nottingham Biomedical Research Centre is a partnership between Nottingham University Hospitals NHS Trust and the University of Nottingham, supported by Nottinghamshire Healthcare NHS Foundation Trust and Sherwood Forest Hospitals NHS Foundation Trust. We are hosted by Nottingham University Hospitals.

Hearing aid outcomes assessed using Ecological Momentary Assessment (EMA)

Helen Whiston[1], Melanie Lough[1], Johanne Rumley[2], Jeppe Høy Christensen[3], Gabrielle H Saunders[1]

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Introduction

The capacity to connect today's hearing aids to the cloud via a mobile phone opens up the possibility of collecting and storing large quantities of data. This can include information about the soundscapes in which the hearing aid (HA) is used and the HA settings at the time. By combining this information with real-time self-reported outcomes collected via Ecological Momentary Assessment (EMA) - a method in which questions are answered in real-time using mobile technology – we can obtain a detailed understanding of a user's listening difficulties.

In this poster we present data collected via both EMA and datalogging to illustrate the necessity of combining data from both sources if we are obtain a good understanding of real-world listening challenges.

Aim

To examine associations between EMA survey responses and HA soundscape data logged via a mobile phone.

Method

Participants: 41 experienced HA users aged 26-79 years (M=64.8; SD=12).

Study hearing aids: Oticon Opn-S and Oticon More. Ambient sound pressure levels (SPLs) and signal-to-noise ratios (SNRs) detected by the HAs were logged and timestamped every 20 seconds. The HAs also categorised relative usage time as follows: <0.5 hr., 0.5-2 hr., 2-4 hr., 4-8 hr., 8-12 hr., 12-20 hr., 20+ hr.

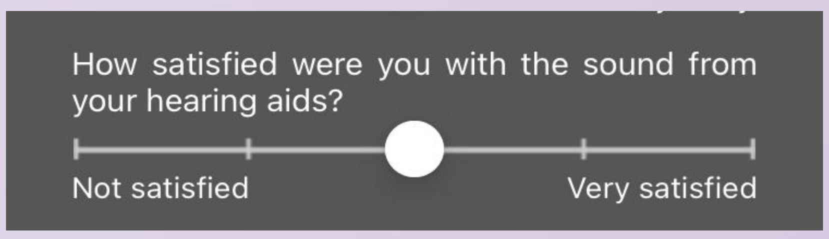
Protocol: Participants wore both pairs of HAs for two weeks each. Order of wear was counterbalanced across participants. Data from both HAs were combined for analyses.

Participants completed several EMA surveys each day using a mobile phone app. The app also stored the most common soundscape category derived over a 5-minute interval prior to the survey prompt/initiation. Surveys were self-initiated or initiated via a phone prompt.

The EMA survey asked about the listening situation (a pull down list), whether the situation was still happening at the time of survey completion, and for 6 ratings (see Fig 1 for response format).

Ratings and *slider anchors*: Noisiness: *Quiet-Very noisy;* Satisfaction: *Not-Very;* Ability to focus, Ability to ignore surroundings, and Ability to localise sound sources: *Difficult-Easy;* Ability to hear surroundings: *Not very well-Very well.*

Fig 1. Screenshot of app response format



Results

On average, relative use time fell into the 12-20 hr. category and participants completed a median of 86 EMA surveys over their four-week trial. This demonstrates good study compliance.

Listening activities assessed by EMA

Figure 2 shows the listening activities reported at the time an EMA survey was completed by time of day.

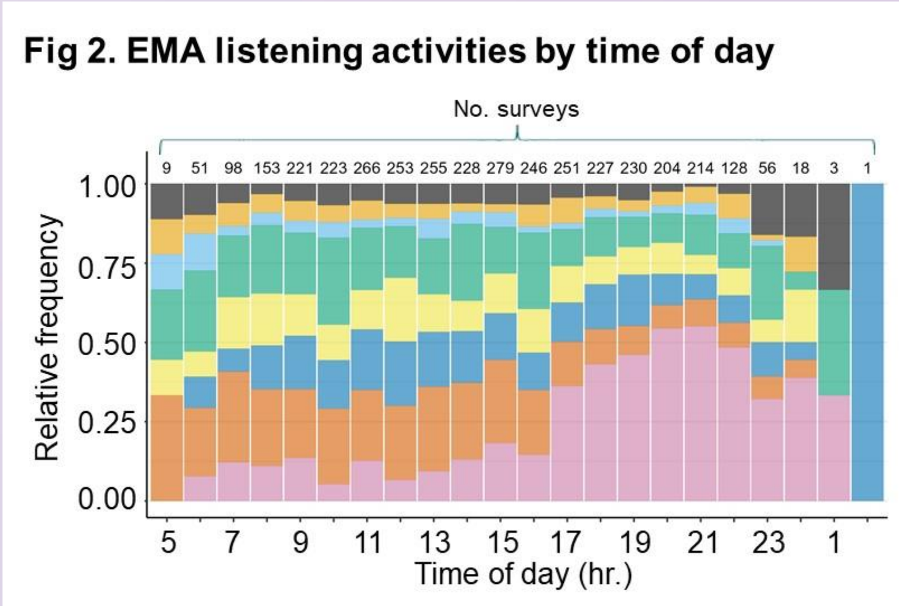
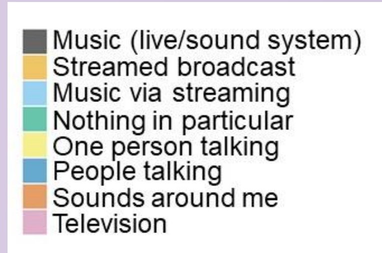


Fig 2. EMA listening activities by time of day



- Television and music are most commonly listened to in the evening/at night.
- Listening to the surrounding environment and nothing in particular are common.

Listening environment extracted from datalogging

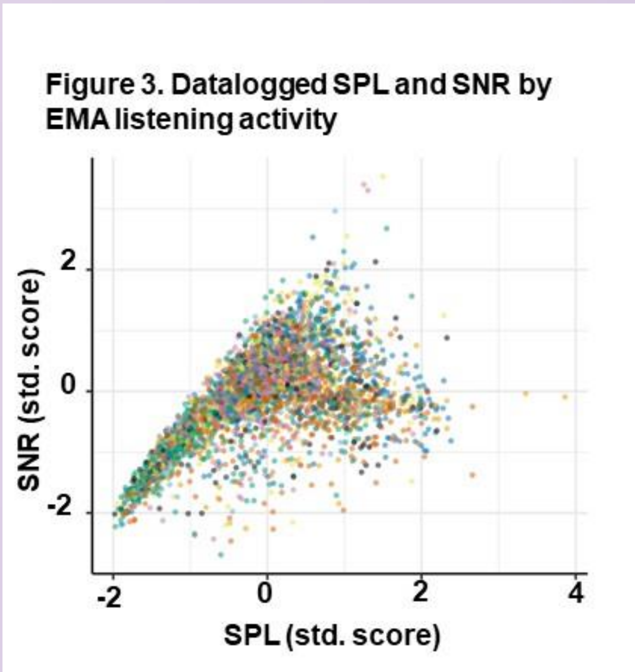


Figure 3. Datalogged SPL and SNR by EMA listening activity

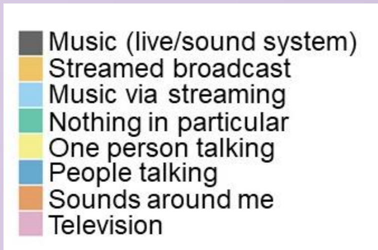


Figure 3 shows the SPL and SNR recorded by the hearing aids for each listening activity recorded by EMA. It illustrates just how variable the sound environment can be for each activity and thus that the datalogged soundscape does not reflect listening intent.

Listening environment relative to EMA ratings

Figure 4 contrasts data for two selected participants (orange vs blue dots) - the datalogged SNR relative to satisfaction ratings for 3 listening EMA-reported activities. It highlights the individual differences in sound environments for the same listening activity, and illustrates how they interact to impact satisfaction.

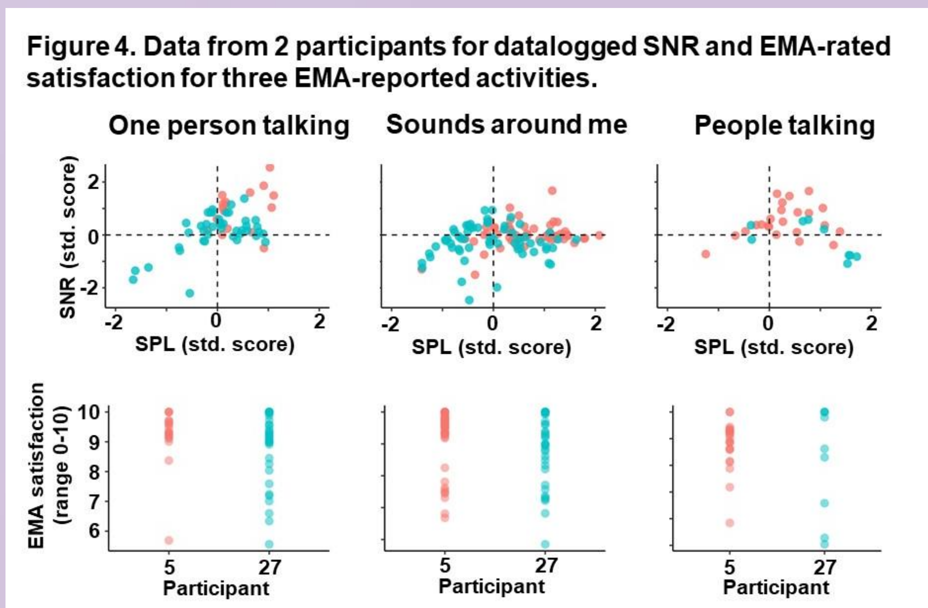


Figure 4. Data from 2 participants for datalogged SNR and EMA-rated satisfaction for three EMA-reported activities.

Discussion

Participants were willing to complete EMA surveys. They did this for a variety of listening activities and in varying sound environments. The data illustrates the importance of combining data from EMA with that obtained through soundscape datalogging when trying to understand variation in reported hearing aid outcomes.

Acknowledgements

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Manchester Centre for Audiology and Deafness

SUPPORTED BY NIHR | National Institute for Health Research

NIHR | Nottingham Biomedical Research Centre

University of Nottingham UK | CHINA | MALAYSIA

Gain

How should we define and measure hearing aid use success? Perspectives of adults who have hearing aids and hearing healthcare professionals.

Sian Calvert[1,2], Emma Broome[1,2], Ashika Shah[3], Jean Straus[4], Helen Henshaw[1,2]

1. NIHR Nottingham Biomedical Research Centre; 2. Hearing Sciences, Mental Health & Clinical Neurosciences, School of Medicine, University of Nottingham; 3. INSPIRE Summer Research Internship Programme (INSRIP), School of Medicine, University of Nottingham; 4. Patient Research Partner

NIHR Nottingham Biomedical Research Centre

1. Background

Hearing Loss, affecting one in five adults in the UK, can be managed using hearing aids. However, the number of adults using hearing aids is far lower than the number who could benefit from them[1].

Previous measures of hearing aid use, for example, the number of hours hearing aids are switched on, may not align with patient perspectives of what 'successful' use means. Consequently, clinical trials focused on improving hearing aid use may not be patient-centred. Defining 'successful' use is key to ensuring that future research and policy reflects patients' priorities.

Objectives:
To define and rank the most important aspects of successful hearing aid use by consensus, from the perspectives of:
a) Hearing aid users
b) Hearing healthcare professionals

2. Methods

Two separate **3-stage prioritisation processes** were used to reach a consensus on what successful hearing aid use meant to a) hearing aid users and b) hearing healthcare professionals.

Participants were recruited via UK National Health Service (NHS) audiology and ENT clinics, social media, professional networks, and a leaflet distributed at the British Academy of Audiology annual conference in November 2021.

1) Survey 1

a) ***"Describe what successful hearing aid use means to you"*** (adults with hearing aids)
b) ***"Describe what successful hearing aid use looks like for adults who have them"*** (hearing healthcare professionals)

Responses from *survey 1* were collated, summarised, and then carried forward to *survey 2* for ranking.

2) Survey 2

Participants were asked to read through all indicative statements and **select their 10 most important**, in ranked order.

3) Consensus workshop

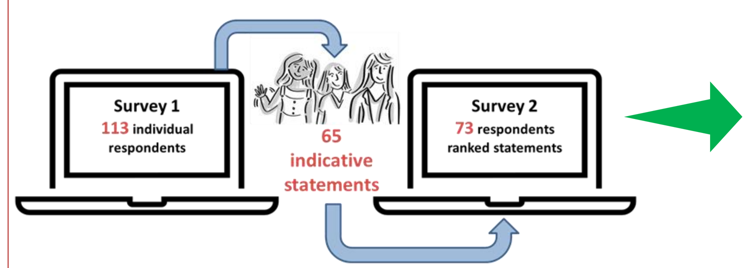
Top-ranked statements were taken to an online consensus workshop, where Nominal Group Technique[2] was used to achieve consensus on the **top 5 priority statements** to define hearing aid use success.

3. Results: Hearing aid users

Participants:

Participants	Survey 1	Survey 2	Workshop
Number of participants	n=113	n=73	n=21
Mean age in years *(SD, range)*	65.9 *(12.5, 21-91)*	66.5 *(12.8, 33-91)*	66.7 *(14.1, 21-91)*
Males:Females	59:54	34:39	11:10

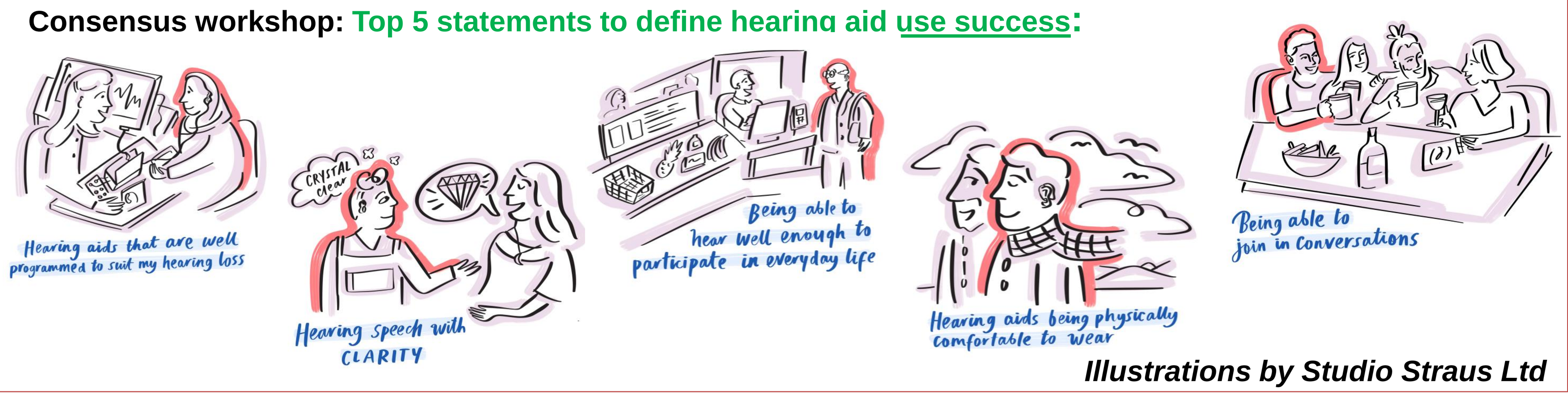
Survey responses:



Survey 2: Top 15 ranked statements

Q: Describe what successful hearing aid use means to you…
1. Hearing speech with clarity
2. Being able to join in conversations
3. Being able to understand what is being said in conversations and respond appropriately
4. Being able to hear well enough to participate in normal everyday life
5. Being able to hear conversations over background noise
6. Being able to hear other people clearly when they are speaking to me
7. Being able to hear as well (or almost as well) as someone who does not have a hearing loss
8. Being able to hear people speak on the telephone
9. Being able to live an active social life
10. Hearing aid(s) that help my tinnitus
11. Improved hearing, although not restored
12. My hearing aid(s) being physically comfortable to wear
13. Hearing aids(s) that are well programmed to suit my hearing loss
14. Being able to hear well enough to participate in my hobbies and interests
15. Being able to hear and communicate with different groups of people

Consensus workshop: Top 5 statements to define hearing aid use success:



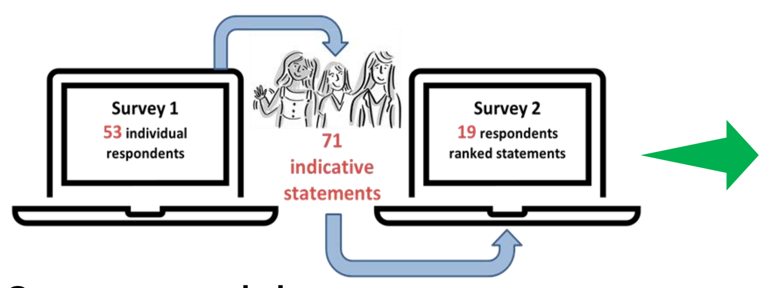
Illustrations by Studio Straus Ltd

4. Interim results: Hearing healthcare professionals

Participants:

Participants	Survey 1	Survey 2	Workshop
Number of participants	n=53	n=19	*Pending*
Mean age in years *(SD, range)*	35.2 *(8.9, 24-58)*	35.4 *(7.8, 25-55)*	
Males:Females	3:49 n=1 prefer not to say	1:17 n=1 prefer not to say	
Profession	Audiologist (24), Clinical Scientist (13), Other (10)*	Audiologist (5), Clinical Scientist (7), Other (n=3)*	
Years work experience *(SD, range)*	10.1 *(8.2, 0-36)*	10.2 *(8.1, 1-35)*	

Survey responses:



Survey 2: Top 16 ranked statements

Q: Describe what successful hearing aid use looks like for adults who have them…
1. Improved quality of life
2. Improved ability to communicate
3. Feeling less isolated
4. Being able to participate in normal everyday life
5. Being able to participate in normal everyday life effortlessly
6. Being able to achieve daily life goals
7. Improved hearing
8. Meeting individual's needs
9. Improved patient reported outcomes
10. Being able to hear and understand speech
11. Hearing speech with clarity
12. Being able to live an active social life
13. Hearing aid(s) help to achieve listening goals
14. Hearing aid(s) that fit well and are correctly positioned in the ear
15. Being able to use and maintain hearing aid(s)
16. Being satisfied with hearing aid(s)

Consensus workshop:

Will be held online **November 1st 2022** to register interest please email emma.broome1@nottingham.ac.uk

Other – **Survey 1: Trainee clinical scientist (6), Paediatric audiologist (4), Trainee audiologist (2), Practice Education Coordinator MSc in Audiology (1), Audiology assistant (1), Audiovestibular Physician (1), Specialist audiologist (1). **Survey 2:** Trainee clinical scientist (4), Practice Education Coordinator MSc in Audiology (1), Audiology assistant (1).*

5. Conclusion and next steps

The findings indicate for hearing aid users, successful use of hearing aids was associated with effective listening communication, as well as device factors such as comfort.

For hearing healthcare professionals (provisional results), the top-ranked statements have a wider focus on improved quality of life, maintaining an active social life and reducing isolation, meeting individuals needs, and attaining listening/life goals.

Next, we plan to use these results to inform the most appropriate outcome domains and specific measures, that can be used to better assess hearing aid use in future research and clinical trials.

5. References

1. Hearing Link (2021). Facts about deafness and hearing loss. Hearing Link. https://www.hearinglink.org/your-hearing/about-hearing/facts-about-deafness-hearing-loss/.

2. Jones, J., & Hunter, D. (1995). Qualitative Research: Consensus methods for medical and health services research. BMJ, 311(7001), 376.

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Investigating the influence of hearing loss and hearing aid use on emotional states in everyday listening situations using ecological momentary assessment

University of Nottingham UK | CHINA | MALAYSIA

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Design

Research Questions

1: In what situations, and for what specific emotions, do hearing aids have systematic positive or negative effects?

2: Are there general differences between reported emotional states of people with and without hearing loss, or are there particular listening situations where the groups diverge?

RQ1: Impact of Hearing Aids	RQ2: Impact of Hearing Loss
Group of hearing aid users	Control group with normal hearing
Hearing and trait emotion questionnaires	Hearing and trait emotion questionnaires
10 days of EMA	10 days of EMA
Wear and don't wear hearing aids on alternate days	Continue life as normal

Participant Characteristics

	Study participants: N=46	
	Hearing loss group	**Normal hearing group**
N	26	20
Age (average years)	69.15	61.15
Age (st dev)	6.3	8.2
Gender		
Male	10	3
Female	16	17
Baseline positive affect	17.6 (3.5)	18.3 (2.9)
Baseline negative affect	11 (4.6)	9.65 (2.6)

Smartphone survey questions

Morning survey (9am)

- How are you feeling this morning? → What is your outlook for the day ahead? → Were you wearing your hearing aid(s) yesterday?

Daytime surveys (x6 randomly)

- Are you currently, or have you recently been listening to someone or something? → What was the listening situation? → What was the background noise level? → Where were you? → How positive or negative did you feel? → How intense was the emotion? → What was the main emotion that you felt? → To what extent do you think that your ability to hear had an impact on your emotions? → Were you wearing your hearing aid(s) during the listening situation?

End of day survey (9pm)

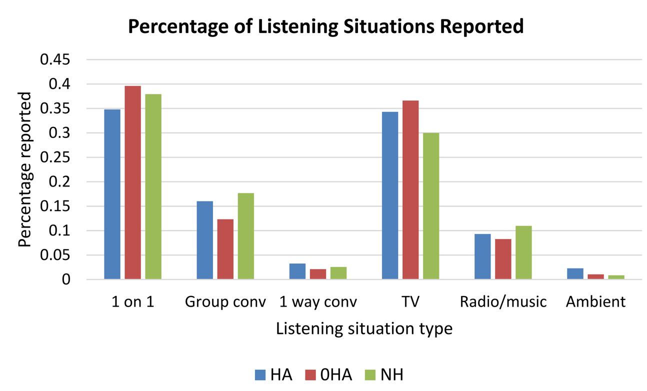
- How positive or negative have you felt today in general? → To what extent do you think your ability to hear had an impact on your emotions today? → How socially connected have you felt today? → How pleasant have your interactions with others been today?

Baseline questionnaires:

Social activity level (SAL), Social participation restrictions (SPaRQ), Hearing handicap (HHIE/A), Trait emotion (PANAS), Single item hearing ability question

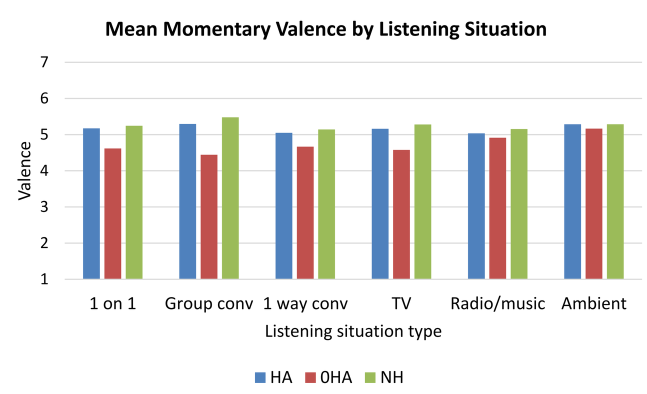
Results: Valence & arousal

Situations



Participants with and without hearing loss, and when wearing and not wearing hearing aids, report similar patterns of listening situations. Hearing aids used less for group conversations than one on one.

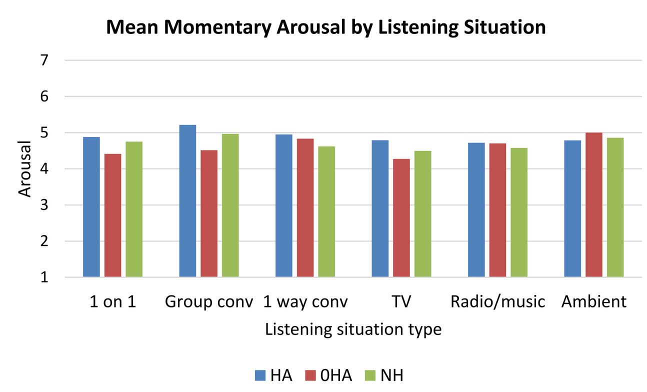
Valence



Effects of predictors on valence (HL group)

CONSTRUCT	B	SE	T
SITUATION TYPE	-0.008	0.019	-0.42
HEARING AID USE	0.59	0.22	2.67**
DAY OF THE STUDY	-0.027	0.009	-3.02**
BACKGROUND NOISE	-0.28	0.04	-6.56***
LOCATION	0.022	0.015	1.4
HEARING LOSS	-0.02	0.15	-0.16
HEARING HANDICAP	-0.02	0.007	-2.9*
SSQ12	-0.012	0.006	-1.7
SPARQ-SB	0.012	0.009	1.34
SPARQ-SP	-0.005	0.009	-0.52
SOCIAL ACTIVITY	0.33	0.007	-2.6*
AGE	0.007	0.017	-0.43
GENDER	-0.015	0.17	-0.08
POSITIVE AFFECT	0.034	0.03	1.1
NEGATIVE AFFECT	-0.01	0.03	-0.38

Arousal

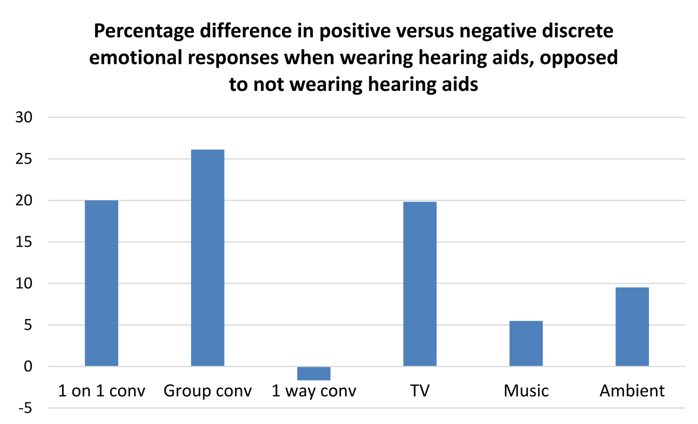


Effects of predictors on arousal (HL group)

CONSTRUCT	B	SE	T
SITUATION TYPE	-0.014	0.018	-0.75
HEARING AID USE	0.45	0.19	2.4*
DAY OF THE STUDY	0.03	0.009	3.53***
BACKGROUND NOISE	0.014	0.042	0.34
LOCATION	-0.003	0.015	-0.22
HEARING LOSS	0.33	0.15	2.17*
HEARING HANDICAP	-0.027	0.007	-3.95**
SSQ12	-0.007	0.007	-1.12
SPARQ-SB	0.015	0.009	1.63
SPARQ-SP	0.003	0.009	0.43
SOCIAL ACTIVITY	0.051	0.1	0.5
AGE	-0.035	0.016	-2.2*
GENDER	-0.55	0.17	-3.2**
POSITIVE AFFECT	0.14	0.029	4.85***
NEGATIVE AFFECT	-0.004	0.028	-0.16

- **No significant difference between people wearing hearing aids and normal hearing group.**
- **Wearing a hearing aid significantly related to higher valence and arousal ratings.**
- **Varying relationships of different variables to valence/arousal (e.g. women lower arousal).**

Other key results

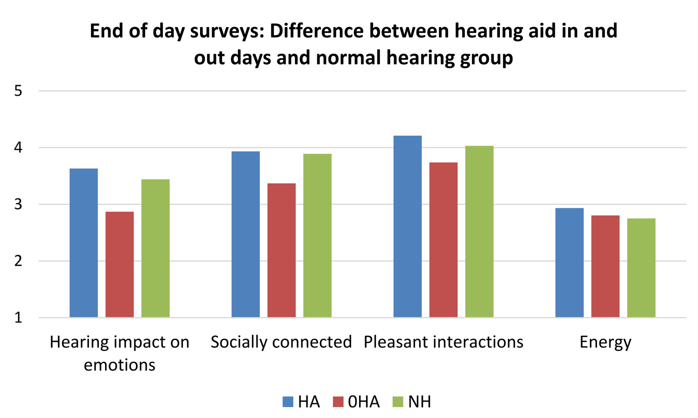


Discrete emotions

When not wearing hearing aids there were large numbers of negative discrete emotions given.

When wearing hearing aids there was a noticeable change towards more positive discrete emotions.

16 choices (8 positive 8 negative)



End-of-day variables

No significant difference between days wearing hearing aid(s) and normal hearing group.

Wearing hearing aid(s), compared to not wearing, results in significantly higher social connection, pleasant interactions and perceived impact of hearing ability on emotions. There was no effect on energy.

	How have your feelings towards your hearing aids changed during this study
A lot more negative	0
More Negative	0
No change	12
More positive	7
A lot more positive	7

Changing feelings towards hearing aid(s)

When asked how people's feelings had changed towards their hearing aids after the study nobody felt worse, 12 experienced no change, and 14 felt better about their hearing aids.

Conclusions

Valence & Arousal

- Hearing loss without amplification is linked to worse reported valence and arousal.
- No significant effect of situation type.
- Significant link to hearing handicap (↑HH = ↓V&A).
- Hearing aid(s) restore valence/arousal to "normal" levels

Discrete emotions

- Choice of 16 discrete emotions (half positive/negative).
- When wearing hearing aids the proportion of positive emotions increased by up to 26%.
- This was most evident for traditionally challenging listening situations.

Psychosocial variables

- Hearing loss without amplification is linked to worse daily social connection and pleasant interactions. Also more negative perceived impact of hearing ability on emotions.
- No difference between people with and without hearing loss for trait positive and negative affect.

Next: EMA before and after first hearing aid fitting

Research Questions

1: What effect does first ever hearing aid fitting have on the affective experience of everyday life?

2: Is greater affective benefit associated with continued use of hearing aid(s) after one year?

- 35 people with hearing loss
- Hearing and trait emotion questionnaires
- 10 days of EMA
- First ever hearing aid(s) fitted
- 3 month gap
- 10 days of EMA
- 9 month gap
- Follow-up of hearing aid use

QR code for digital copy of poster

Work funded by the Hearing Industry Research Consortium

@UoNHearSci

Barriers and Facilitators to Providing Hearing Healthcare to People with Dementia Living in Long-Term Care: Interviews with Care Staff

Hannah Cross[1], Christopher Armitage[1], Piers Dawes[1,2], Iracema Leroi[3] & Rebecca Millman[1]
[1]University of Manchester, UK [2]University of Queensland, Australia [3]Trinity College Dublin, Ireland

1. Background

- 70% of residents living in long-term care (LTC) have dementia[1] and 75% have hearing loss.[2]
- The symptoms can overlap and interact, including communication difficulties, loneliness, poorer quality of life and exacerbated dementia-related behavioural symptoms.[3-5]
- Providing support for hearing loss can improve outcomes for residents with dementia and their caregivers.[6]
- Most residents with dementia rely on LTC staff to support their hearing needs.
- However, hearing care provision within LTC homes is inconsistent (low hearing aid use, loud communal areas etc.) and requires improvement[7].

2. Study Aim

- To understand the barriers and facilitators faced by LTC staff when providing hearing care to residents with dementia.
- To inform the development of a hearing-related intervention suitable for a LTC setting using the Behaviour Change Wheel[8].

3. Methods

- Remote semi-structured interviews with LTC staff (N= 10).

Gender	Women (n= 7); Men (n= 3)
Ethnicity	White British (n= 8); Asian/ Asian British (n= 2)
Mean years in profession (*SD*)	13 (*7.70*)
Job role	Care assistant (n= 3); Senior carer (n= 2); Nurse (n= 2); Therapy assistant (n= 1); Deputy manager (n= 1); Home manager (n= 1)
LTC home registration	Residential home (n= 4); Nursing home (n= 4); Dementia Specialist (n= 1); Unknown (n= 1)

- Interviews informed by the Theoretical Domains Framework (TDF)[9] and the Capability, Opportunity, Motivation-Behaviour (COM-B) model.[8]
- The TDF and COM-B model are part of the Behaviour Change Wheel[8] which aids theory-driven intervention development.
- Two level coding of interviews by two independent researchers:

Deductive coding of instances of the TDF domains based on frequency and emphasis, and mapping these TDF domains to the COM-B domains.

Generating themes to explain barriers and facilitators, in line with identified domains.

4. Results

- Five TDF domains identified, exploring the barriers or facilitators to LTC staffs' provision of hearing care to residents with dementia.

- **Social/ Professional Role and Identity** – Reflective Motivation

Lack Of Personal Accountability for Hearing Care (Barrier)

"I think staff need to take more of an onus on the responsibility for the hearing aids and who's job role it is, rather than just letting the resident try and find their own hearing aids" – Therapy Assistant

- **Knowledge** - Psychological Capability

Lack of Knowledge of Hearing Loss and Hearing Care (Barrier)

"we're just winging it and hoping that what we're doing is the best. But if a CQC inspector came in and said 'why are you doing that?' we'd be like 'because we think it works … we've had to try and find a way to communicate'" – Care Assistant 1

- **Beliefs about Consequences** – Reflective Motivation

Recognition That Providing Hearing Care is Beneficial to Residents with Dementia (Facilitator)

"their [resident] quality of life will improve. She'll be able to engage with people, she wouldn't get angry with other residents because she can't hear what they're saying and she gets frustrated because she can't understand what you're saying properly." – Care Assistant 1

- **Environmental Context & Resources** - Physical Opportunity

Poor Collaborations Between LTC Homes and Audiology Services (Barrier)

"they [audiology] always want the resident to go to the hospital to have the hearing test. And that's not always possible, especially if you've got someone that has got dementia who doesn't do well with going outside in new environments, a noisy environment … they don't always take that into consideration, it always seems to be quite a fight" – Home Manager

- **Optimism** - Reflective Motivation

Despondency about Audiology Services (Barrier)

"She [audiologist] wasn't prepared to listen to where this man was with his dementia and some of the difficulties associated with that … it wasn't the best experience." – Nurse 2

The Practicalities of Conventional Hearing Aids for Residents with Dementia (Barrier)

"we've had residents eating their hearing aids. That was a bit of a worry. Finding the battery after that had been chewed you think 'oh no' if they swallow a battery that could obviously be quite serious." – Nurse 1

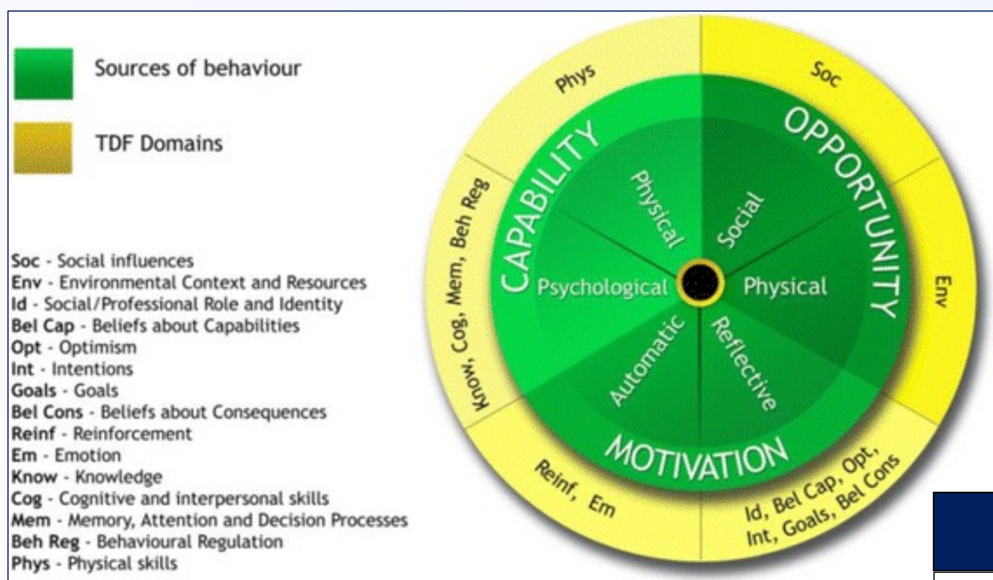


Figure 1. Mapping of the COM-B and TDF domains.[9]

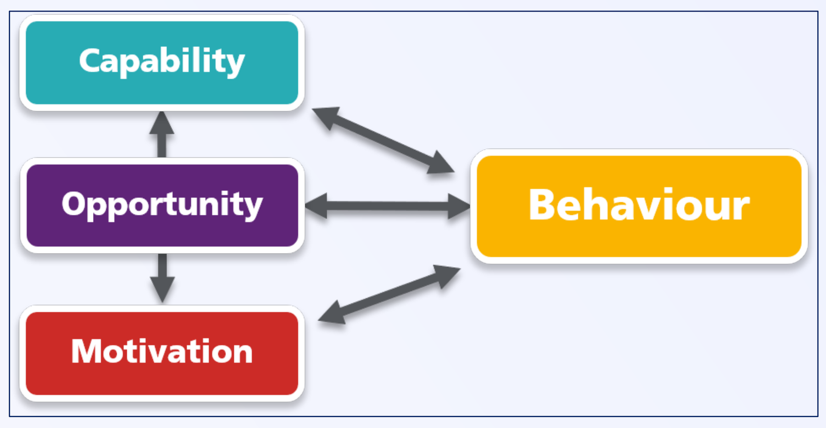


Figure 2. The COM-B model.[8]

5. Conclusions & Recommendations

- LTC staff must be better equipped to provide hearing care to residents with dementia. But, the barriers are wide ranging, complex and require multi-component intervention.
- Study limitations: the potential for social desirability bias regarding participants' professionalism and competence.
- Recommendations for Intervention targeting Capability, Opportunity and Motivation:

Appointing a paid Hearing Loss Champion to take ownership of hearing care.

Providing training to staff on hearing loss and hearing care.

Providing dementia-friendly adaptations to hearing devices.

Improving relationships between audiology and LTC homes.

E-mail: hannah.cross-3@postgrad.manchester.ac.uk

References

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Coproduction of text message content to support NHS audiology patients when they are first prescribed hearing aids

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NIHR Nottingham Biomedical Research Centre

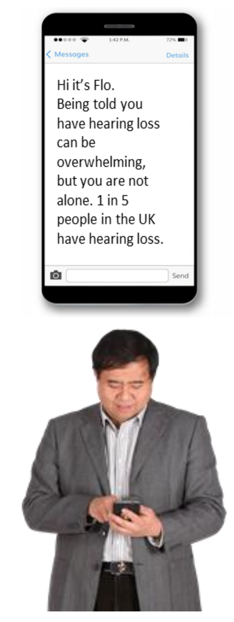
1. Introduction

The problem

- 12 million people have significant long term hearing loss [1]
- 355,000 adults are fitted with hearing aids each year via the NHS at a cost of £131 million.
- The non-use and infrequent use of NHS-prescribed hearing aids is high.

The solution

- An NHS-approved text-messaging service. Implemented in over 100 NHS organisations.
- Text-messages are simple, convenient, requiring little effort to engage.
- Florence responds to patients in real time, providing information required to overcome common barriers exactly when they need it.



Research aims:

1. To co-create and refine text-message content with patients and audiologists
2. To gather in-depth feedback on usability, message content, language and framing.

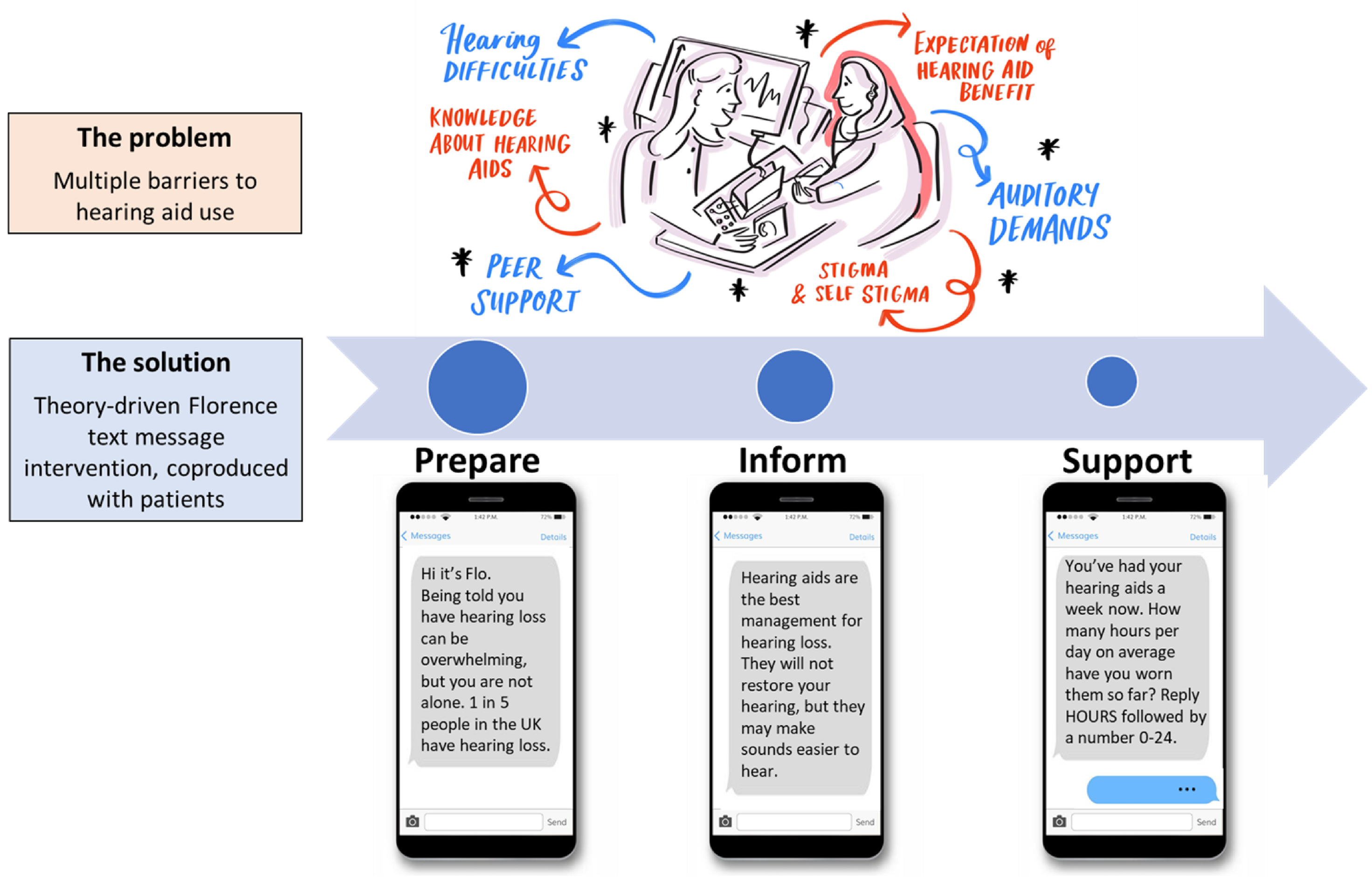
florence
Intelligent Health Messaging

2. Intervention planning and optimisation

Although Florence has been used to help NHS patients self-manage many long-term conditions, it has not yet been used by people to help manage hearing loss. We worked in partnership with patients to coproduce a Florence intervention protocol for new hearing aid users, using:

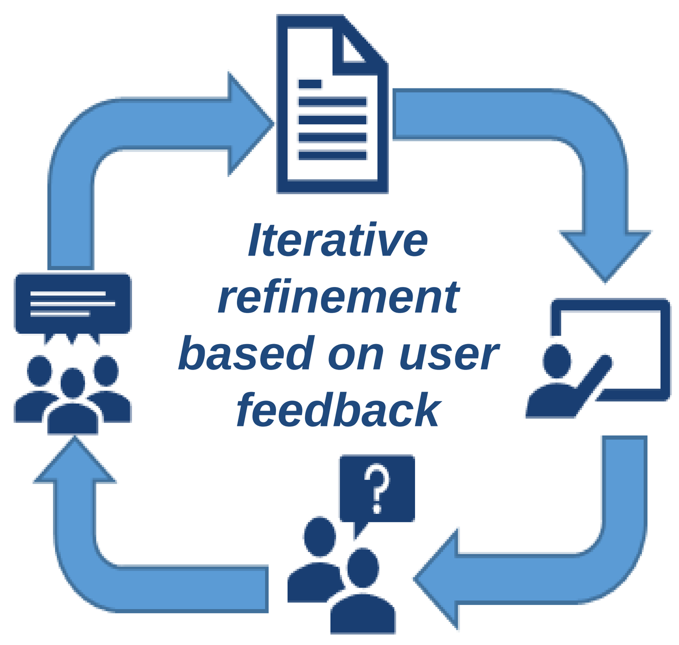
- ✓ qualitative participatory techniques
- ✓ the Medical Research Council guidance for the development and evaluation of complex interventions [2]
- ✓ health behaviour theory [3]

The intervention is designed to address key barriers to hearing aid use by improving patients' **capability**, **opportunity** and **motivation** to use hearing aid(s) when they are first prescribed.



- Florence uses behaviour change techniques to address key barriers to hearing aid use.
- Promotes self-management of hearing loss in NHS audiology patients.
- If effective, result in better use of NHS resources.

3. Co-development and usability testing



Adults with hearing aids

- 15 participants, 3 workshops (2 online, 1 face-to-face)
- Aged between 37-74 years (mean = 61.75 years)
- Owned hearing aids between 3-58 years (mean = 13.78)

Audiologists

- 6 participants from across the UK
- 1 workshop (online)
- Professional experience = 3-20 years, (mean 12.6 years)

Usability testing

- Florence piloted with patients (n=5) to gather feedback on text-message content, language and framing via semi-structure interviews.

4. Next steps

Feasibility Study

- ➢ 16 month feasibility study with 90 new NHS hearing aid users across three NHS audiology sites
- ➢ Assessing recruitment and attrition rates
- ➢ Exploring the acceptability of study procedures by patients and clinicians

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Aston University
BIRMINGHAM UK

Hearing Loss and Patient Reported Experience (HELP): Using patient experience to improve audiology

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SCAN ME

Introduction & Background

One in two of us will have a significant hearing loss in older life, and this can affect every aspect of communication and daily life. There is no cure, but people with hearing loss are offered a hearing aid. Little is known about the patient experience of using hearing aids so there is a risk they are prescribed to people who do not use them. People may stop using hearing aids because they find practical management and adapting to new sound difficult. For some, managing the aids is more difficult than managing hearing loss without hearing aids.

Patient Reported Experience Measures (PREMs) are simple questionnaires about specific conditions. An audiology PREM could be used to understand patients' experiences of hearing loss and using hearing health services, and the efforts they make to manage their hearing. Audiology services vary throughout the UK and a PREM would provide us with more information about the experience of audiology patients.

HeLP study logo

Aim: **To improve knowledge of adult patient experience of hearing loss and hearing services (audiology).**

Methods

This research consists of three linked studies called work packages (WP). These WPs will run at parallel time points over the 3 years e.g. WP 3 implementation interviews will begin in year 1 alongside WP 1 and continue into year 2.

WP1
- Develop a conceptual model to explain how work of coping with hearing loss (including hearing aids) is experienced.
- Conduct a systematic review using narrative synthesis.
- Conduct a qualitative interview study (n=54).

WP2
- Develop a PREM tool based on themes arising in WP1.
- PREM reliability and validity testing (n=300).
- Evaluation of contrasting clinical help-seeking and non-help-seeking participants with hearing loss.

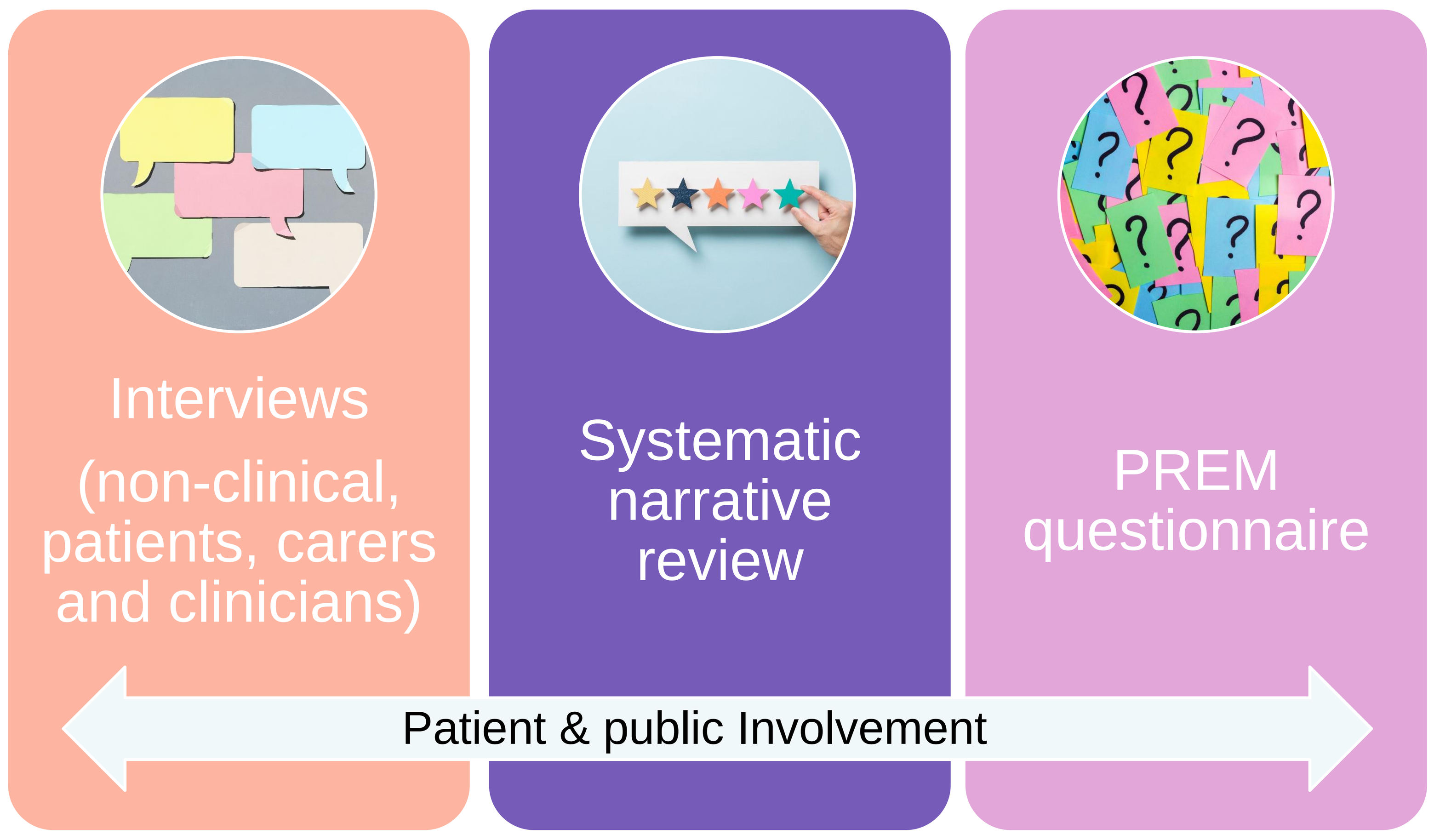
WP3
- Implement the PREM in contrasting clinical locations.
- Examine potential for the PREM to lead to service changes.

The Sample is stratified to ensure we learn about the experience of hearing loss and using hearing aids (or not) throughout the life course. To do this, we have included:

- Young adults: transitioning from paediatric to adult services
- 30s-40s: those managing a career and family life
- 50s-70s: Noticing hearing loss symptoms for the first time
- 80s - end of life: Most likely to have hearing loss.

Progress to date

- Start date: 1st July 2022
- Interviews have been conducted with:
  - People with hearing loss (accessed via audiology sites and non-clinical routes (n= 15; ongoing)
  - Relatives/carers of people living with hearing loss
  - Clinicians.
- Coding of the data gathers has begun
- Narrative review
  - search strategy developed, search conducted, and full-text screening underway.
- PREM
  - Interviews with clincians to get their opinions on implementing a PREM in practice. Tool to be developed once WP1 is completed.
- Patient and public involvement contributors will continue to contribute advice, guidance and steering at every stage of the research process.



Next Steps…

- Complete the narrative review and continue conducting interviews
- Analyse interview data & develop conceptual model to understand the work of coping with hearing loss
- Continue working with PPI contributors
- Develop PREM to complement existing outcome measures in practice
- Continue interviews with clinicians about PREM implementation.

Acknowledgements

We would like to thank all of those who have show interest and contributed to this research to date, your input has been invaluable.

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What is the burden of tinnitus?

Helen Pryce [1]; Nicolas Dauman [2]; Georgina Burns-O'Connell* [1]

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Introduction & Background

Living with tinnitus creates work for the person. Not only is there the experience of the tinnitus sound and the distraction it can cause, people also have to cope with the emotional distress associated with hearing the tinnitus sound. In addition to work relating to experiencing tinnitus, patients are also expected to undertake treatment work.

The efforts patients make are referred to as the **'burden of treatment'** theory (May et al., 2014). This theory describes how health services transfer accountability and work to patients to manage long-term conditions. For example, tinnitus patients are expected to undertake help-seeking activities, and to learn about tinnitus and the different management techniques.

As with most chronic health conditions, most of the **workload of tinnitus treatment is assigned to the patient**. Even though patients are doing burdensome work, it is often not acknowledged due to the clinical focus being aimed at the outcome measures, rather than the efforts by patients to achieve those outcomes. This work is important because clinicians negotiate the work that patients are given for tinnitus treatment, but they may be unaware of the burden being experienced by the patient.

Aim: To **understand** the **cumulative burdens** of tinnitus, including experiencing **the sound** of tinnitus and the **treatments** undertaken by people living with tinnitus.

Methods

Approach:	qualitative
Method:	semi-structured, in-depth interviews
Participants:	38 adults recruited via UK clinical services
Data analysis:	reflexive thematic analysis

- A qualitative approach was used to explore how illness and treatment burden is experienced by tinnitus patients
- Interviews were conducted with 38 participants who had sought help in a variety of UK clinical services. These data were collected with the purpose to understand the experience of help-seeking (see Pryce et al., 2018)
- The procedures described in Braun and Clarke's reflexive thematic analysis (Braun & Clarke, 2006, 2021) were followed to explore the interview data and develop insights into the cumulative burdens relating to the experience of tinnitus.

Results

The burden of tinnitus, and the work it requires, is twofold:

1. Coping with the interference of tinnitus in their daily life (illness burden)
2. Seeking help, making sense of tinnitus, and the prescribed interventions (treatment burden).

There was an overarching theme of negative self-talk and 3 main subordinate themes relating to this:
uncertainty, abandonment, and sense of agency.

Results (cont'd) & Discussion

Negative self-talk

Uncertainty arises from the process of help-seeking for tinnitus	Dealing with tinnitus on their own results in a sense of abandonment in patients	A sense of agency mediates patients' capacity to silence negative self-talk about having tinnitus
'You read things on the internet and you hear people's opinions, like, "I've been suffering with this," it's just like lots of scattered information.'	'So it's partly about educating clinicians.'	'But the main thing with tinnitus, I find, one word... acceptance.'

Applying the burden of care theory

Key aspects of work incurred by tinnitus and the efforts required to mediate it were identified. Our analysis involved comparing burden of care theory descriptions with the themes and categorizing them as forms of illness or treatment work (see figure 1).

	BURDENS	RESOURCES
ILLNESS WORK	- Lack of sleep and fatigue - Lack of control over self-perception - Distress and confusion - Concentration efforts - Sense-making of tinnitus	- Accountability in decision making - Self discovery and self-growth - Sense of control over hearing - Acceptance of tinnitus - Resilience
TREATMENT WORK	- Health uncertainty - Sense-making of dissonante or vague information - Uncertainty in treatment opportunities - Abandonment in decision making - Search for knowledgeable clinicians	- Gathering reliable information - Acknowledge limitations of care - Agency in the therapeutic alliance - Use of technical devices - Social support

Figure 1. Application of burden of care theory to the thematic analysis

Considerations:

- Agency and capacity to use resources varies and is dependent on factors such as social privilege, having multiple health conditions, and increased treatment demands
- The experience of tinnitus is heterogeneous (Beukes et al., 2021; Cederroth et al., 2019)
- Variation is inevitable given the burden of self-treatment is devolved to the patient.

Conclusion

We hope that this research illustrates the need to broaden models to fully consider contextual burdens of illness and treatment in tinnitus.

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NIHR Nottingham Biomedical Research Centre

Practice Listening and Understanding Speech (PLUS): Feasibility of providing auditory-cognitive training alongside hearing aids in the NHS

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NIHR Nottingham Biomedical Research Centre

1. Background

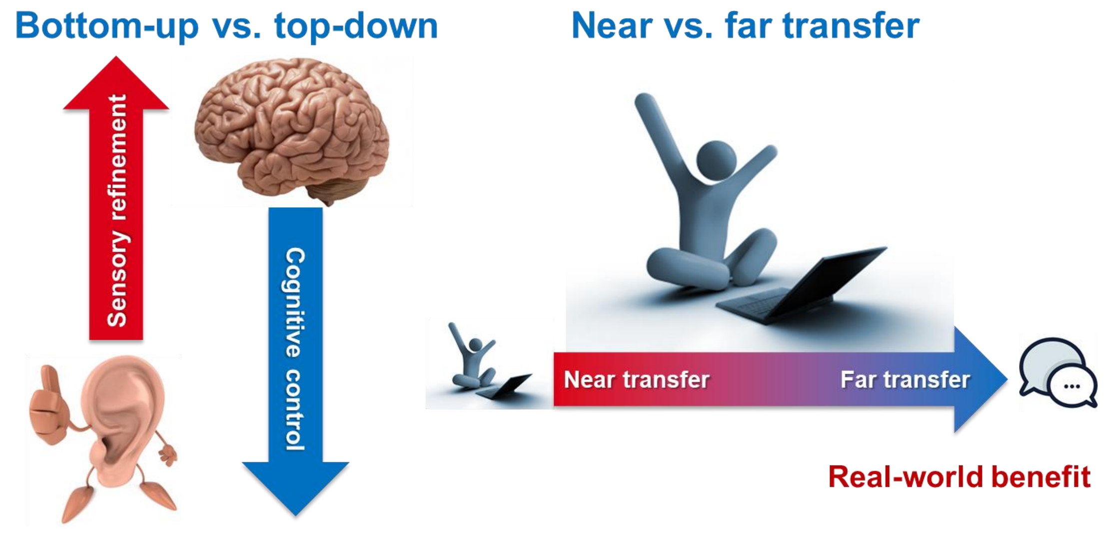
Auditory training (AT): *teaching the brain to listen through active engagement with sounds.*

Cognitive training (CT): *mental exercises designed to improve core cognitive abilities.*

For people with hearing loss (PHL) and hearing aid (HA) users, AT & CT interventions aim to improve real-world listening through the development of auditory and cognitive skills.

Evidence from literature and our own research shows that for PHL:

- AT results in on-task learning, but evidence for transfer is mixed[1].
- Phoneme discrimination AT transfers to complex, but not simple outcomes that tax top-down cognitive control (executive functions)[2,3].
- CT that targets improvements in working memory capacity (Cogmed RM) does not transfer to improvements in untrained outcomes[4,5].
- A combined auditory-cognitive training approach may offer the greatest benefits to real-world listening[5,6].

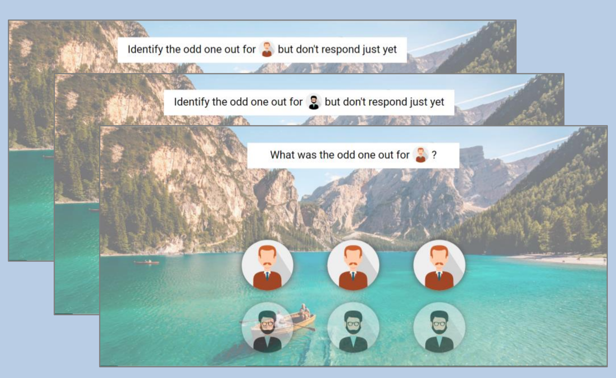


Research Aim

To assess whether a multicentre randomised controlled trial of intervention effectiveness and cost-effectiveness is feasible.

2. Auditory-cognitive training (ACT)

Phoneme discrimination *n*-back training



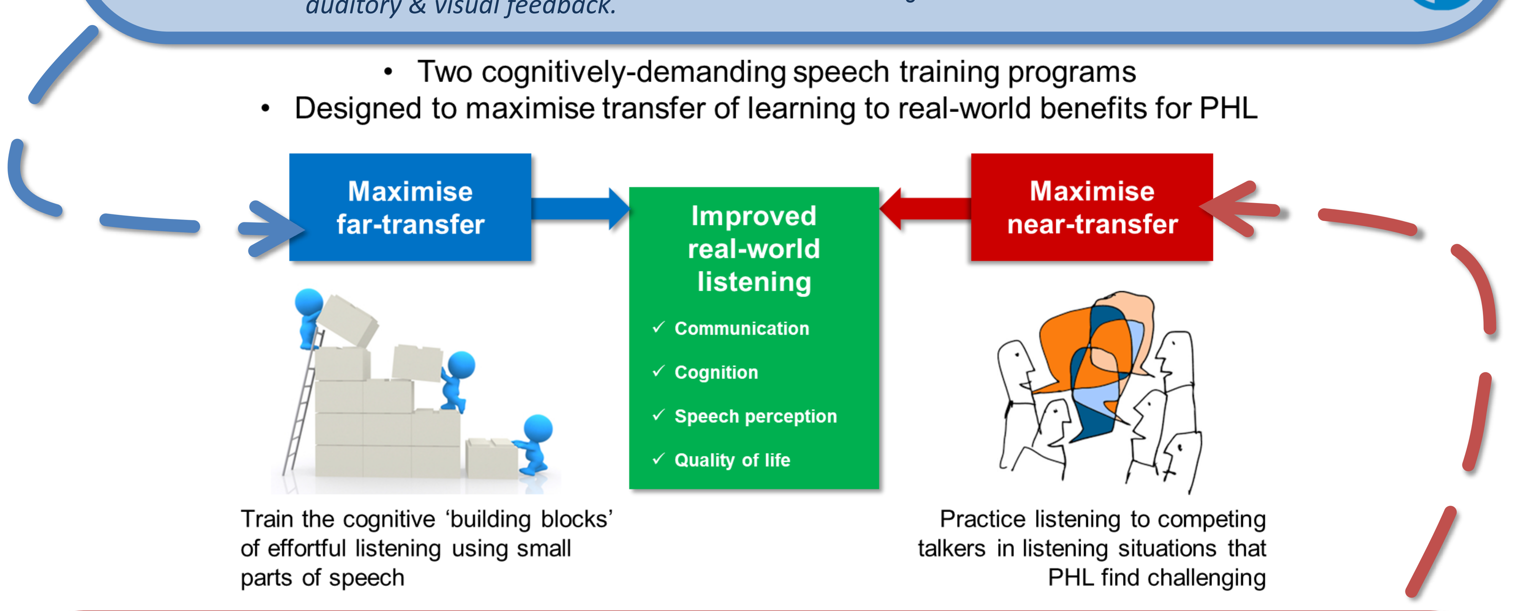
Adaptive based on individual performance; 1-back & 2-back versions; auditory & visual feedback.

- 'Tried and tested' phoneme discrimination training approach with a greater demand on executive functions
- n-back previously shown to result in near- & far-transfer of learning[7,8].

n-back *Basic phoneme discrimination task developed into n-back training paradigm*

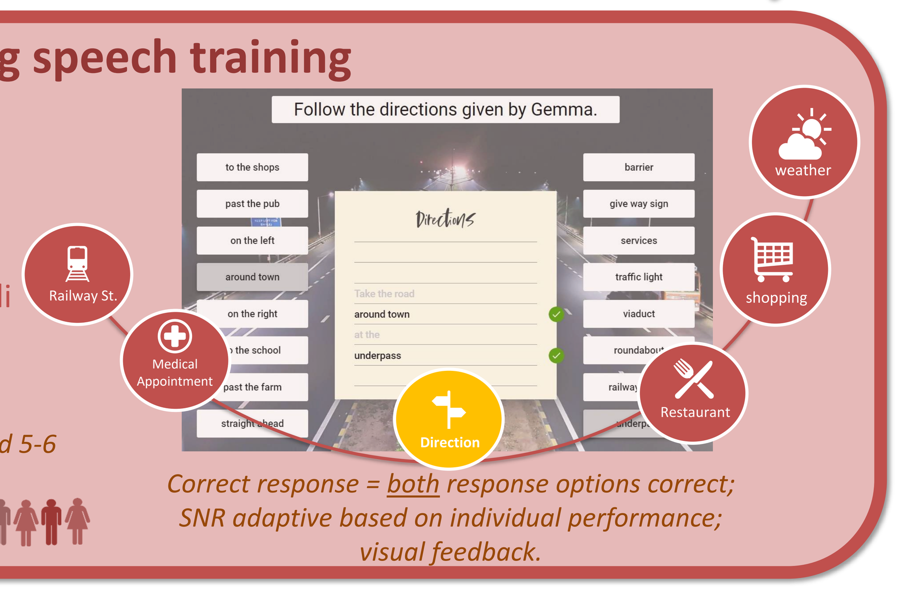
Patient & public involvement (PPI) team members generated n-back training task instructions

- Two cognitively-demanding speech training programs
- Designed to maximise transfer of learning to real-world benefits for PHL



Competing speech training

- Cognitively-demanding competing speech task and one of the most common complaints of PHL
- Based on the Coordinate Response Measure[9], with ecologically valid stimuli that reflect the real-world listening challenges of PHL.



Photovoice[10]: 10 adult hearing-aid users provided 5-6 photographs of challenging listening situations

Sentences for 6x situations recorded by 4x talkers

Correct response = both response options correct; SNR adaptive based on individual performance; visual feedback.

3. Feasibility Study of 105 new adult HA users

The feasibility study has been designed to assess:

- What is the best way to provide ACT interventions to NHS audiology patients, and what does it cost?
  - To collect quality of life data and identify any resources or costs associated with the delivery of the training interventions from a health (NHS) and social care perspective, from which to calculate cost-utility of the interventions in the anticipated randomised controlled trial.
- What are the important rates required to inform a future pragmatic randomised controlled trial of ACT efficacy?
  - Patient recruitment & attrition rates; patient attrition rates at a 12-week post-intervention outcome assessment; the completeness of all outcome measures at all assessment timepoints.
- What do patients and clinicians think about the ACT interventions and the trial processes?
  - Semi-structure interviews with patients and audiologists about recruitment procedures, study burden, and acceptability of outcome measures (patient only).
- How long does data collection take?
  - Time taken to achieve the required numbers of patients per group ; time taken to collect all study and outcome measure data.

Clinical Pathway | **Feasibility Study** | **Timeline**

- **Hearing Assessment** (Audiologist) — **Week 0** Hearing Assessment
  - ~ 2-4 weeks
  - **Information pack sent to patients booked to hearing aid fitting clinic** (Administrator/CRN audiologist)
  - Reply slip returned to CRN audiologist & screened for eligibility
- **Hearing-aid Fitting** (Audiologist) — **Week 4** HA fitting
  - **Outcome Assessment** (Study Coordinator) **Patients randomised to study arms** (CRN audiologist/ Chief Investigator) — **Week 5** Pre-training outcome assessment (within 10 days of HA fitting)
  - ~ 8-12 weeks
  - **Group 1** Treatment as usual (TAU); **Group 2** TAU + Phoneme training; **Group 3** TAU + Sentence training — **Week 6-9** Auditory-cognitive training intervention
  - **Outcome Assessment** (Study Coordinator) — **Week 10** Post-training outcome assessment
- **Clinical Service Standard follow-up**
  - **Outcome Assessment** (Study Coordinator) — **Week 22** Follow-up outcome assessment

Study Setting

Nottingham University Hospitals NHS Trust will be the study recruitment site. All in-person assessments will take place on NUH premises in facilities suitable for the assessment of hearing and cognition. Participants will also be informed of the study via Sherwood Forest Hospitals NHS Foundation Trust (Audiology department), who will act as a Participant Identification Centre.

Inclusion criteria

√ Are 18 years of age or over
√ Recommended 1 or 2 hearing aid(s) for the first time
√ Have good understanding of written and spoken English
√ Internet access at home (training interventions will be home-delivered via the internet)

Next Step

If feasible, apply for funds to conduct a full-scale randomised controlled trial.

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VERBAL AND NON-VERBAL AUDITORY SEQUENTIAL MEMORY TEST: PERFORMANCE OF AN *APP*

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Evollu
sensing evolution

INTRODUCTION

The development of innovations in digital services has currently been a bet for health technology manufacturers. The field of Audiology also benefits from the digital evolution that facilitates access to information for the public, but also for the audiologist himself. *Evollu - Sensing Evolution, SA* is a company that, together with the academy in Coimbra (Project A4A: Audiology for All), is developing apps that can be used both for self-care and by the audiologist as a counseling aid or even as information collection tools (Luengen et al., 2021; Murdin et al., 2022).

OBJECTIVE

Compare if the performance of tests of verbal and non-verbal sequential auditory memory performed with an *app* is identical to the performance of the same tests by the clinical method.

METHODS

- Normal hearing subjects of different age groups performed the verbal and non-verbal sequential auditory memory tests – subjects were evaluated using the clinical method (Pereira & Schochat, 2011) and/or the *app Evollu Hear*;
- **5 years old group**: were tested with 3 sequences of 3 verbal stimulus (pa, ta, ca) and 3 non-verbal (rattles, maracas, bell);
- **9 years old group** and **18-22 years old group (Young Adults)**: were tested with 3 sequences of 4 verbal stimulus (pa, ta, ca, fa) and 4 non-verbal (rattles, drum, bell and maracas).

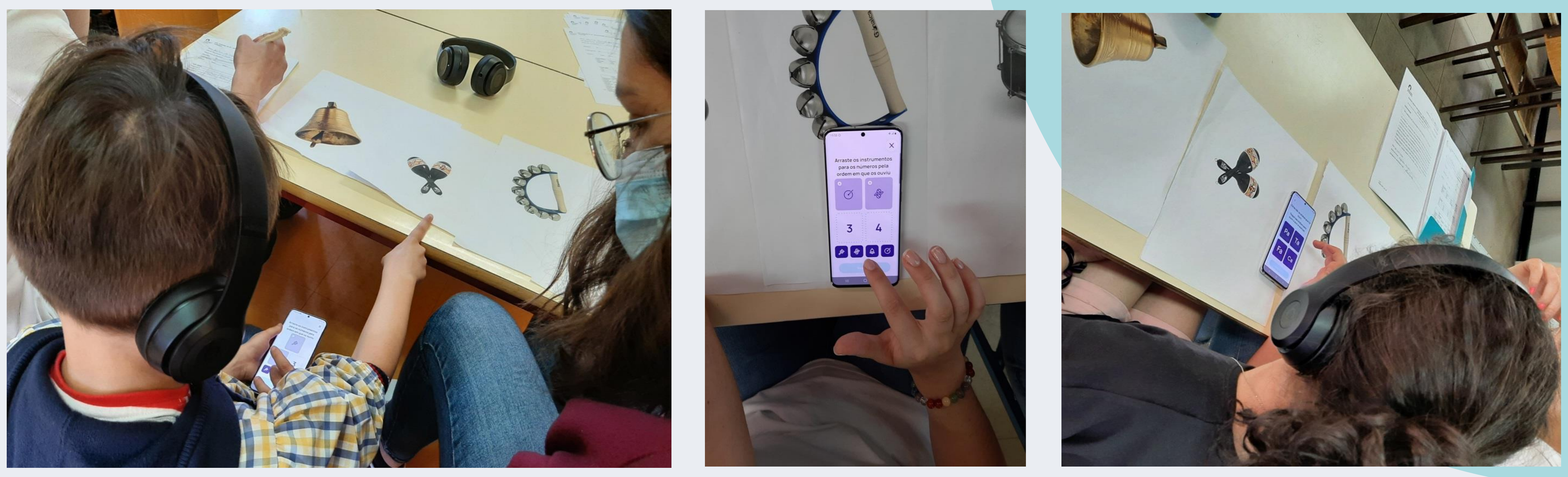

Fig. 1. Non-verbal and verbal sequential auditory memory tests

RESULTS

Table 1 and Table 2. Descriptive statistics of the performance of different age groups in non-verbal and verbal sequential auditory memory tests

Table 1. All subjects evaluated with the clinical method and/or with the app

Age		N	Minimum	Maximum	Mean	Std. Deviation
5 years old	Non Verbal Test	57	,00	3,00	1,9825	,85547
	App-Non Verbal Test	28	,00	3,00	1,3571	,95119
	Verbal Test	52	,00	3,00	,9231	,98710
	App-Verbal Test	27	,00	3,00	,5556	,93370
9 years old	Non Verbal Test	27	,00	3,00	2,0741	,87380
	App-Non Verbal Test	27	1,00	3,00	2,2593	,85901
	Verbal Test	27	,00	3,00	1,5185	1,01414
	App-Verbal Test	27	,00	3,00	1,6296	1,14852
Young Adults	Non Verbal Test	26	2,00	3,00	2,8462	,36795
	App-Non Verbal Test	26	,00	3,00	2,4231	,85665
	Verbal Test	26	1,00	3,00	2,5000	,76158
	App-Verbal Test	26	,00	3,00	2,3077	,88405

Table 2. Groups of subjects evaluated with the clinical method and with the app

Age		Mean	N	Std. Deviation	Std. Error Mean
5 years old	Non Verbal Test	2,0000	10	,81650	,25820
	App-Non Verbal Test	1,6000	10	,84327	,26667
	Verbal Test	1,0588	17	1,08804	,26389
	App-Verbal Test	,8235	17	1,07444	,26059
9 years old	Non Verbal Test	1,9375	16	,99791	,24948
	App-Non Verbal Test	2,5000	16	,81650	,20412
	Verbal Test	1,3750	16	1,02470	,25617
	App-Verbal Test	1,3750	16	1,20416	,30104
Young Adults	Non Verbal Test	2,8182	11	,40452	,12197
	App-Non Verbal Test	2,6364	11	,50452	,15212
	Verbal Test	2,5455	11	,82020	,24730
	App-Verbal Test	2,3636	11	,80904	,24393

There were identical results between the tests performed by the app and those performed by the clinical method, in the three age groups, and in both tests.
No significant differences were found between methods.

Table 3. Paired difference test for groups of subjects evaluated with the clinical method and with the app

		Paired Differences			
Age		Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
5 years old	Non Verbal Test - App Non Verbal Test	,40000	,69921	,22111	,102
	Verbal Test - App Verbal Test	,23529	,75245	,18250	,206
9 years old	Non Verbal Test - App Non Verbal Test	-,56250	1,20934	,30233	,075
	Verbal Test - App Verbal Test	,00000	1,41421	,35355	,917
Young Adults	Non Verbal Test - App Non Verbal Test	,18182	,40452	,12197	,157
	Verbal Test - App Verbal Test	,18182	,87386	,26348	,480

DISCUSSION

This app proved to be valid for performing verbal and non-verbal sequential auditory memory tests in the age groups studied. The apps can be a reliable method of self-care and referral to the health professional and can also facilitate the clinical intervention by audiologists.

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