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University of Southampton

Listening for better hearing

Dr Kate Hough
Research Fellow, PPIE Lead
@DrKateHough

Science Discovery Group,
Emsworth Community Centre
16th October 2023 7:30 pm

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Definitions

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Research	Finding out **new knowledge** by addressing clearly defined questions with systematic and rigorous methods that could lead to changes to treatments, policies or care.
Patient and public involvement	**Research** being carried out '**with' or 'by**' members of the public **rather than 'to', 'about', or 'for'** them.
Public engagement	Public engagement focuses on **distributing** the research findings and knowledge to members of the public through different **activities** and **events**.
Community engagement	Going out into the community and building relationships and **partnership** between the **university** and the **community**. It is work that provides **mutual benefit** to the community and the university.

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Lifelong hearing

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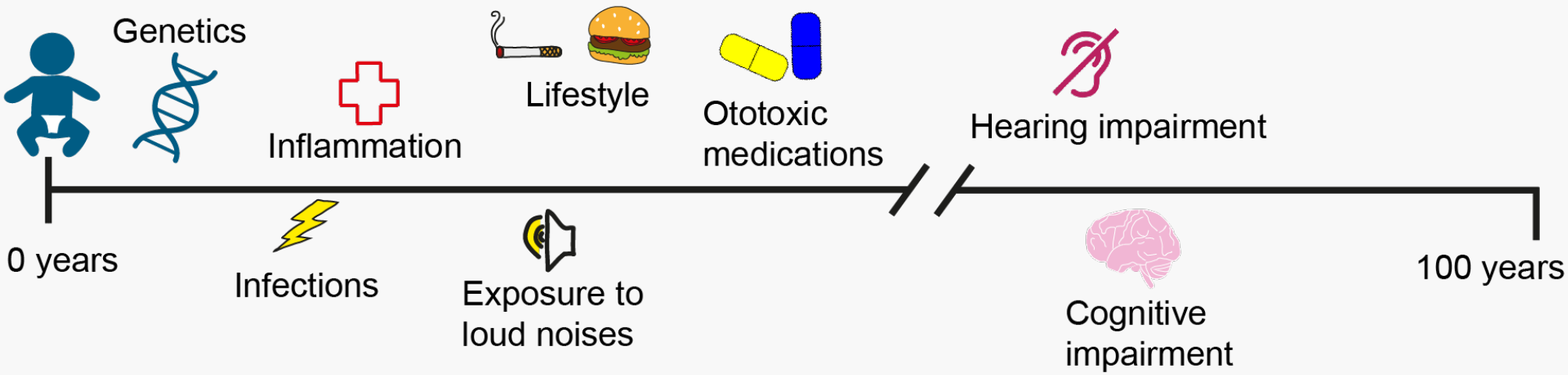

- We all have a **unique hearing trajectory** as we go through life.
- How we live our lives can influence this trajectory.

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Age-related hearing loss (Presbycusis)

Over 65% of adults **above 60** years of age experience some degree of **hearing loss**.

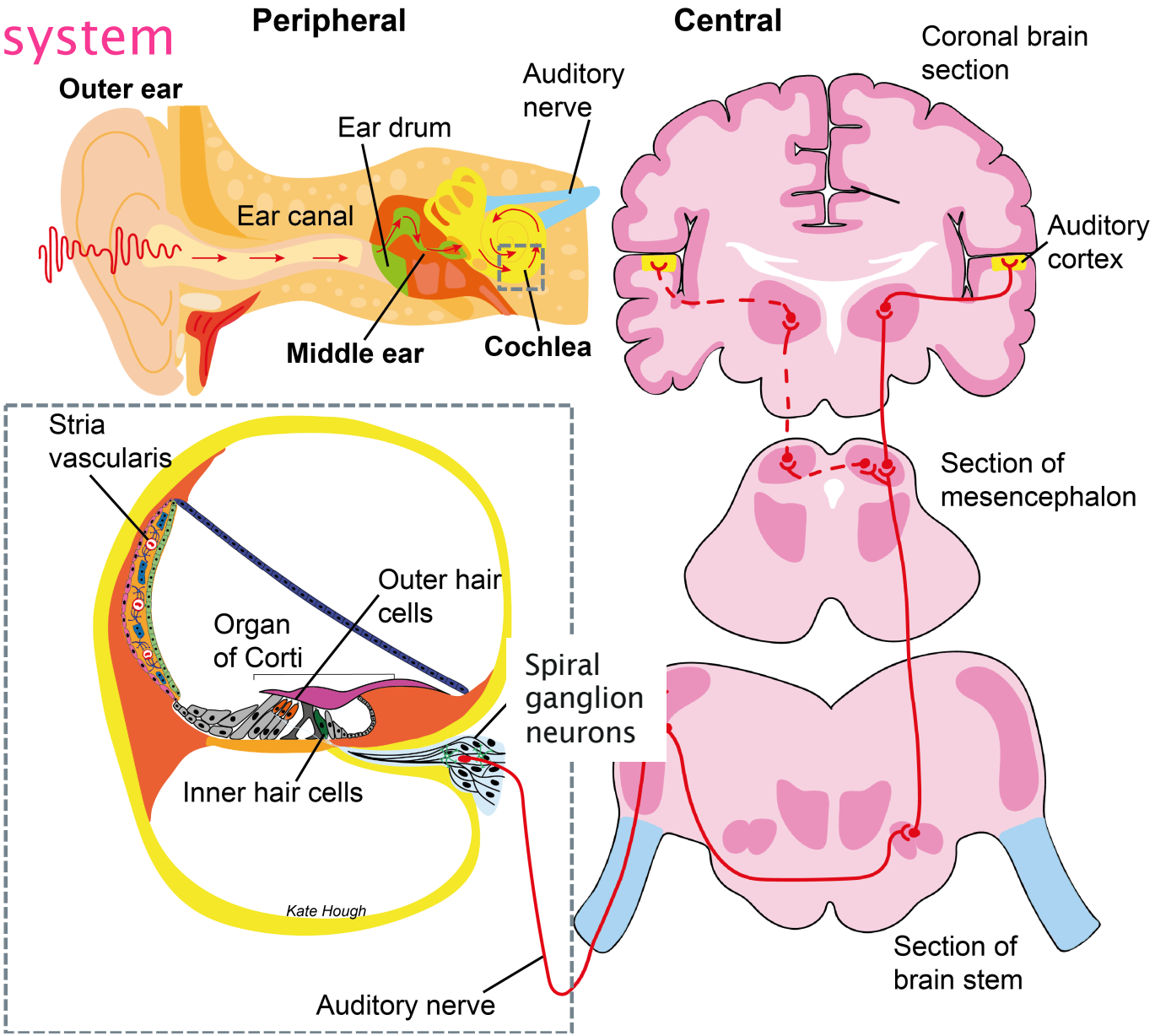
Moderate or **higher grade** hearing loss occurs in around:

11 - 18 % of 60 - 69 year olds
42 – 52 % of 80 – 89 year olds
53 – 65 % of 90 and above years

Globally

(Word Health Organisation, 2021b)

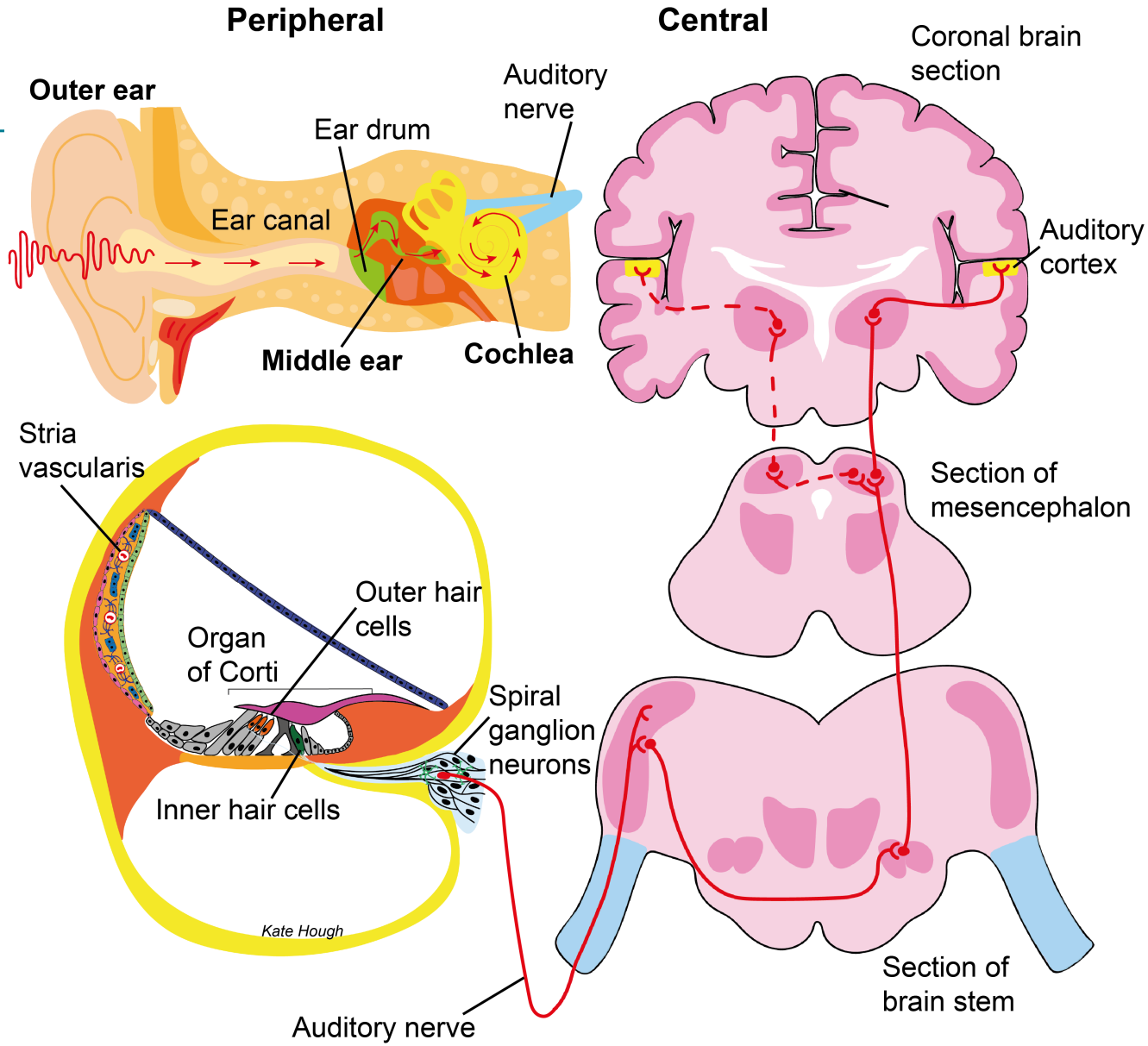
The auditory system



Age-related hearing loss (Presbycusis)

Pathologies of ARHL:

- Loss or damage to sensory hair cells
- Loss of spiral ganglion neurons
- Atrophy of the stria vascularis
- Degeneration of the auditory nerve
- Changes to central auditory pathways



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Age-related hearing loss (ARHL)

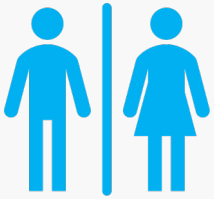
University of Southampton

Factors that influence the development of ARHL:

- Cochlear aging
- Noise exposure
- Environment
- Genes
- Hypertension
- Other health comorbidities such as Type 2 diabetes
- Gender
- Race
- Inflammation/inflammaging







Inflammation and hearing loss

Inflammaging/ Chronic inflammation: Describes low grade inflammation that can occur in aging tissues and that worsens with aging.

Original Article

Inflammation is associated with a worsening of presbycusis: Evidence from the MRC national study of hearing

Carl Verschuur*, Akosua Agyemang-Prempeh* & Tracey A. Newman†

*Hearing and Balance Centre, Institute of Sound and Vibration Research, University of Southampton, Highfield, Southampton, UK, and †Faculty of Medicine, University of Southampton, Highfield, Southampton, UK

Received: 27 May 2021 | Revised: 8 September 2021 | Accepted: 9 September 2021

DOI: 10.1002/glia.24095

GLIA

WILEY

REVIEW ARTICLE

Macrophages in the cochlea; an immunological link between risk factors and progressive hearing loss

Kate Hough[1] | Carl A. Verschuur[2] | Colm Cunningham[3] | Tracey A. Newman[4]

An association between WBC count and hearing threshold was identified in a different cohort of aging people. This became greater in individuals over 75-years-old → inflammatory status continues to increase with age (inflammaging).

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Untreated or undiagnosed hearing impairment may lead to:

- Social isolation → loneliness
- Reduced independence
- Anxiety
- Increased burden on carer/ family members
- Depression
- Reduced access to health services and information

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A link between hearing and brain health

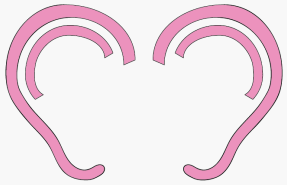
University of Southampton

Unaddressed hearing loss is associated with:

- Increased risk of cognitive impairment and dementia
- Increased risk of poor mental health and lower quality of life

8% of **dementia** cases are **linked** to hearing loss.

ARHL is the **biggest modifiable risk factor** for dementia.



(Livingston et al., 2020; Lin et al., 2011; Deal et al., 2017)

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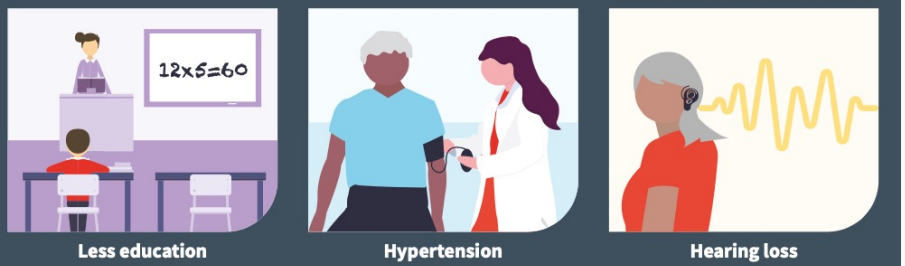
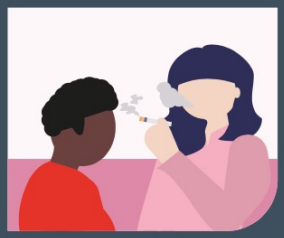
The 12 modifiable risk factors for dementia according to The Lancet



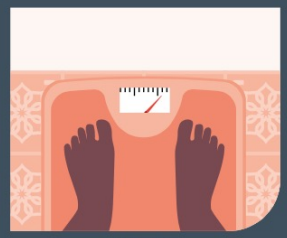
Less education

Hypertension

Hearing loss



Smoking

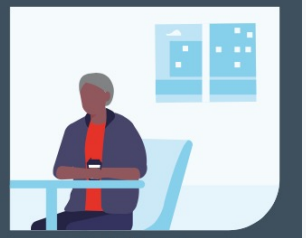


Obesity

Depression

Physical inactivity

Diabetes



Social isolation

Excessive alcohol consumption

Head injury

Air pollution

WORLD ALZHEIMER REPORT 2023

ALZHEIMER'S DISEASE INTERNATIONAL

It is important to have your hearing tested.

Similar symptoms and signs of **hearing problems** and **dementia.**

- Repeating questions 
- Disorientation 
- Find it hard to keep up with conversations 
- Lack of motivation 

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Link between hearing and brain health

University of Southampton

Hearing aids could help cut the risk of dementia, study finds

Study provides best evidence yet to suggest hearing aids could mitigate potential impact of hearing loss on dementia

Hearing aids may lower risk of dementia by more than 40 PERCENT, Lancet study suggests

- **People with hearing loss without aids had a 42 percent higher risk of dementia**
- **It forces the brain to work harder in other regions at memory system's expense**
- **Wearing a hearing aid could significantly slash the risk of developing dementia**

By CASSIDY MORRISON SENIOR HEALTH REPORTER FOR DAILYMAIL.COM
UPDATED: 23:39, 13 April 2023

For Better Brain Health, Preserve Your Hearing

Hearing loss is the largest modifiable risk factor for developing dementia, exceeding that of smoking, high blood pressure, lack of exercise and social isolation.

Science News *from research organizations*

New study links hearing loss with dementia in older adults

Findings highlight potential benefit of hearing aid

Date: January 10, 2023

Source: Johns Hopkins Bloomberg School of Public Health

Summary: A new study has found that older adults with greater severity of hearing loss were more likely to have dementia, but the likelihood of dementia was lower among hearing aid users compared to non-users

Health > News Health

TAKE THE TEST Urgent warning to Brits skipping hearing tests which could prevent deadly illness

Terri-Ann Williams | Isabel Shaw
Published: 0:01, 6 Jan 2023 | **Updated**: 0:42, 6 Jan 2023

BRITS have been urged to get their hearing tested in order to prevent deadly illness.

Fewer people have their hearing checked than their eyes, teeth and blood pressure, data shows.

Hearing Aids Might Help Lower Risk for Dementia

By HealthDay | April 14, 2023, at 2:05 p.m.

Save

Possible mechanisms for the relationship between ARHL and AD

Not been able to establish causation

1. **Common cause**

2. **Sensory deprivation**

3. **Occupation of cognitive resources**

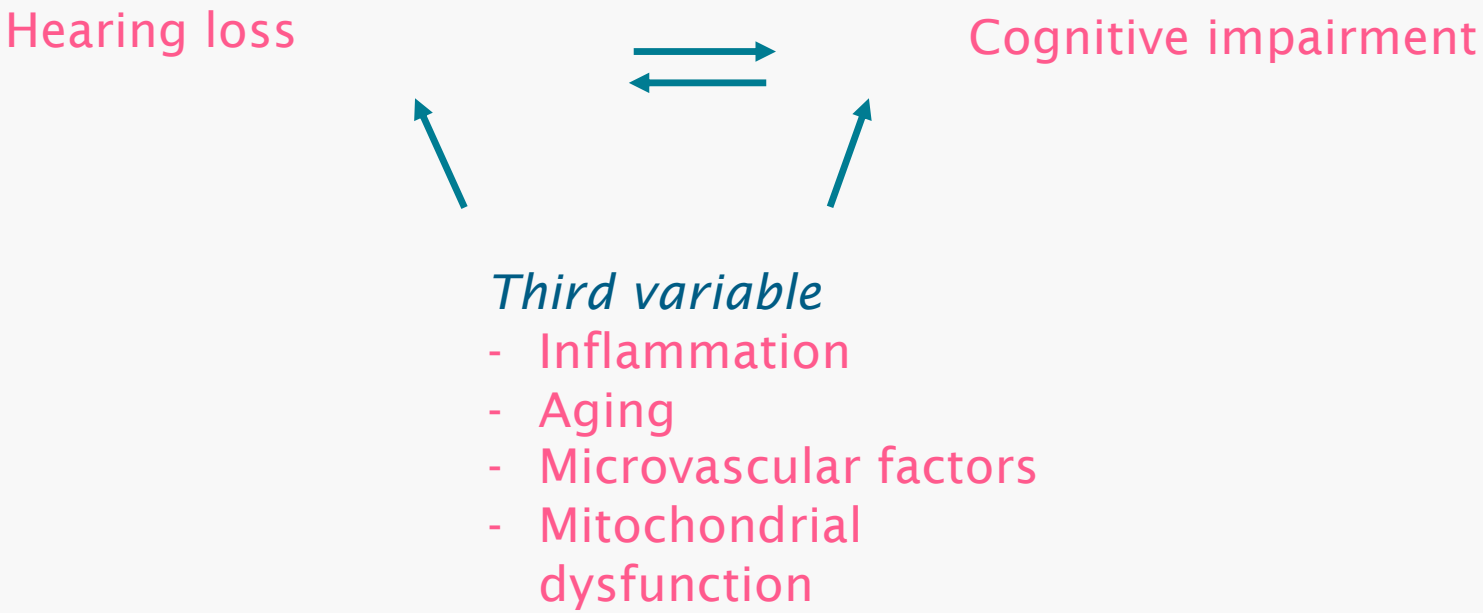
4. **Function and structure-Pathology**

(Powell et al., 2021; Tarawneh et al., 2022)

Theory 1

1. Common cause

Common factors that influence hearing function and cognitive function could explain the correlation e.g. aging, inflammation, microvascular factors, mitochondrial dysfunction.



Theory 2

2. Sensory deprivation

Hearing loss leads to loss of sensory input to the cortex.

Less stimulation

Less social interactions

Withdrawal

Over time = changes in the **structure** and **function** of auditory and cognitive systems in the brain. Leads to cognitive impairment.

Theory 3

3. **Occupation of cognitive resources for listening**

When auditory input is degraded, higher cognitive processing is needed to compensate → less resources available for higher cognitive processing in retaining and retrieving memories.

(depletion of cognitive reserve)

Theory 4

4. Interaction between brain activity related to cognitive/hearing loss and Alzheimer's Disease (AD) pathology (**function and structure)**

Hearing loss modifies cortical activity in the medial temporal lobe (MTL), resulting in altered neuronal activity which can cause or increase Alzheimer's Disease neuropathology.

Increased activity in MTL caused by demands of listening

+

Pathological markers of AD – tau and AB induce altered synaptic activity (potential role of NMDA receptor)

→

Neuronal degeneration due to excitotoxicity

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Hearing Interventions

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Hearing aids

- Potential **to improve cognition** and **reduce risk** of **dementia**
- Improve **quality** of **life**

Cochlear implants

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Are hearing interventions protective against cognitive decline?

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Hearing aids do protect against cognitive decline/ improve cognition.

Bucholc et al., 2020
Sarant et al., 2020
Maharani et al., 2018
Amieva et al., 2015
Deal et al., 2015

No association between hearing aid use and rate of cognitive decline/incident dementia.

Dawes et al., 2015
Lin et al., 2013

Hearing aid use reduces risk of all-cause dementia.
Jiang et al., 2023

Do cochlear implants protect against cognitive decline?

Jayakody et al., 2017
Mosnier et al., 2018
Volter et al., 2022

Limitations of current study methodology

Main limitation of hearing intervention studies = **short duration**.

To investigate incident dementia- need **large cohort sizes.**

Self-reporting of hearing loss and/or hearing aid use can be problematic

Adherence to hearing interventions can be an issue – many hearing aid owners don't use their HA or use them infrequently.

Ethical considerations – ideally would use randomised controlled design.

As the benefits of hearing interventions are well established – **ethically problematic** to withhold them from the people in the control group, whilst giving them to them in the intervention group – especially over the long duration.

Hearing intervention versus health education control to reduce cognitive decline in older adults with hearing loss in the USA (ACHIEVE): a multicentre, randomised controlled trial

*Frank R Lin, James R Pike, Marilyn S Albert, Michelle Arnold, Sheila Burgard, Theresa Chisolm, David Couper, Jennifer A Deal, Adele M Goman, Nancy W Glynn, Theresa Gmelin, Lisa Gravens-Mueller, Kathleen M Hayden, Alison R Huang, David Knopman, Christine M Mitchell, Thomas Mosley, James S Pankow, Nicholas S Reed, Victoria Sanchez, Jennifer A Schrack, B Gwen Windham, Josef Coresh, for the ACHIEVE Collaborative Research Group**

Objective: Determine the **efficacy** of **hearing rehab intervention** vs a successful aging health **education control**.

"Hearing loss is very treatable in later life, which makes it an important public health target to reduce risk of cognitive decline and dementia," Lin says.

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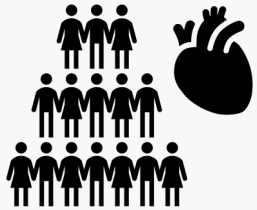
Older adults participating in a long-standing observational study of cardiovascular health (ARIC study)



Healthy de novo community volunteers

Recruited from two study populations

Randomised 1:1

Hearing intervention

Health education control

Participants from ARIC were older, had more risk factors for cognitive decline, and had lower baseline cognitive scores than those in the de novo cohort.

Primary outcome measure = 3-year change in global cognitive function

Randomised controlled trial – ACHIEVE

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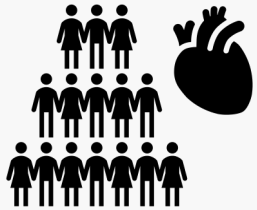

Healthy de novo community volunteers

Randomised 1:1

Hearing intervention

Health education control

Participants from ARIC were older, had more risk factors for cognitive decline, and had lower baseline cognitive scores than those in the de novo cohort.

Findings: When combined the data from both cohorts, found no significant difference in 3-year cognitive change between hearing intervention and control.

Randomised controlled trial – ACHIEVE

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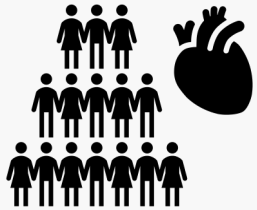

Healthy de novo community volunteers

Randomised 1:1

Hearing intervention

Health education control

Participants from ARIC were older, had more risk factors for cognitive decline, and had lower baseline cognitive scores than those in the de novo cohort.

Findings: A prescribed sensitivity analysis **statistically significant difference** in the effect of hearing intervention on 3-year cognitive change between the ARIC and de novo cohorts.

Randomised controlled trial – ACHIEVE

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Conclusion: Hearing aids might reduce cognitive decline in those who are at increased risk for cognitive decline but not in those at decreased risk of cognitive decline.

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Hearing Interventions

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Hearing aids

- Low uptake
- Need **better public awareness** of the potential benefits

Cochlear implants

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Our approach

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Research

Patient and public involvement

Public engagement

Community engagement

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Through research

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Quality improvement project: Tackling hearing loss in dementia services

Aims: To improve services

1. Screen for hearing impairment.
2. Use modified cognitive test if hearing impairment is identified.
3. Signpost patients to audiology services.

How?

1. **Staff education**
2. **Patient education**
3. **Service improvement**

Chloe Taylor, Bethan Impey, Kate Hough, Callum Findlay, Gemma Smith, Tracey Newman.

Through research

Evaluating access to cochlear implant services: motivators and barriers to implantation in older adults

Aim:

- Evaluate cochlear implant access at the University of Southampton Auditory Implant Service (USAIS)
- Explore the motivators and barriers to implantation in older adults with hearing loss may experience at USAIS

Outcomes:

People from lower socioeconomic groups are less likely to access USAIS.

There may be problems in the referral pathway as certain services and areas are more likely to refer patients than others.

Motivators: patient struggles with hearing loss, support/reassurance.
Barriers: Fears and concerns, denial of hearing loss, lack of clinical knowledge.

Alisha Giby, Kate Hough, Mary Grasmeder, Callum Findlay, Tracey Newman.

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Through community engagement

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What is community engagement?

Community - University Partnership

Work that provides **mutual benefit** to the community and the university.

Dynamic and **relational**

Something that should be **embedded** and **embraced** in the teaching, learning and research that takes place at a university.

(Hart et al., 2011; Sunderland and Parsons 2004)

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How **valuable** is community engagement?

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For research…

Improve the **quality** and **relevance** of **research**.

Increase the **diversity** of people involved in research.

For members of the community …

Make a **positive difference.**

More informed about **health.**

The chance to have their **voices heard**.

For the individual …

Learn new **skills**.

Provide **new opportunities**.

For the wider society…

Bridge the **gap** between researchers and members of the community.

(Staley et al., 2009; NIHR, 2021; Islam et al., 2021; Rahman et al., 2022)

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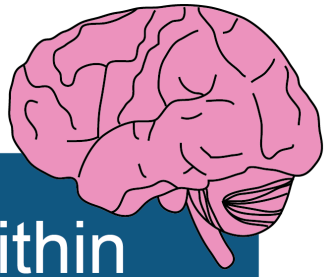
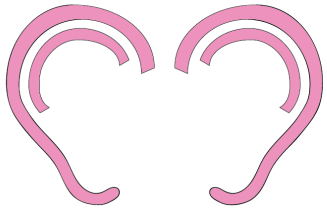


SO-Together Health: Working together within Southampton for better hearing and brain health

2022/2023



We are aiming to:

- start a **conversation** about **hearing loss** in our local **community**

- bring older members of the community together, to share their **experience**, knowledge and **fears** around hearing loss and brain aging

- **raise awareness** of hearing loss and the **positive impact** that making hearing health a priority, can have on **overall health** and **wellbeing**

Funding: University of Southampton Public and Community Development Fund 2022/2023

For more information about the project, please email Kate Hough at K.L.hough@soton.ac.uk

Project plan

1. Build relationships/ connections with community groups

2. Co-design activities to take into the community to raise awareness of hearing and brain health

3. Run activities in community groups

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Building relationships with community groups

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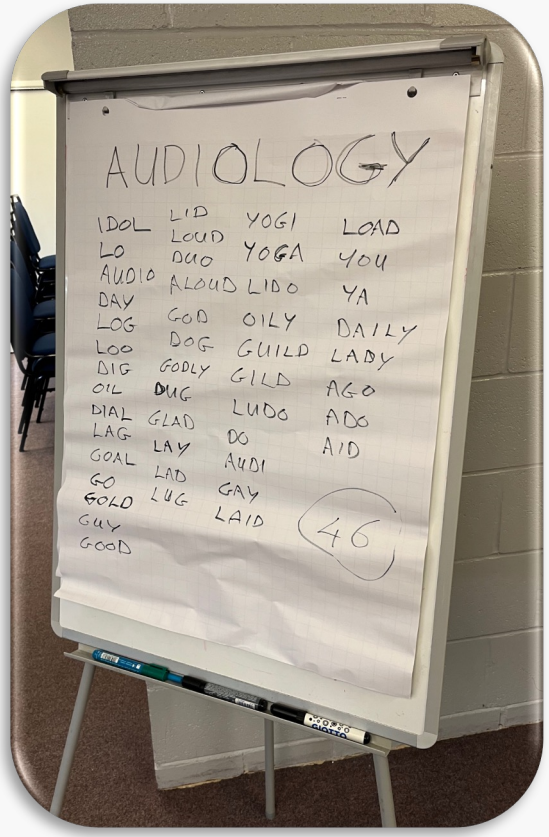

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Let’s Communicate Hard of Hearing Group

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Co-design activities

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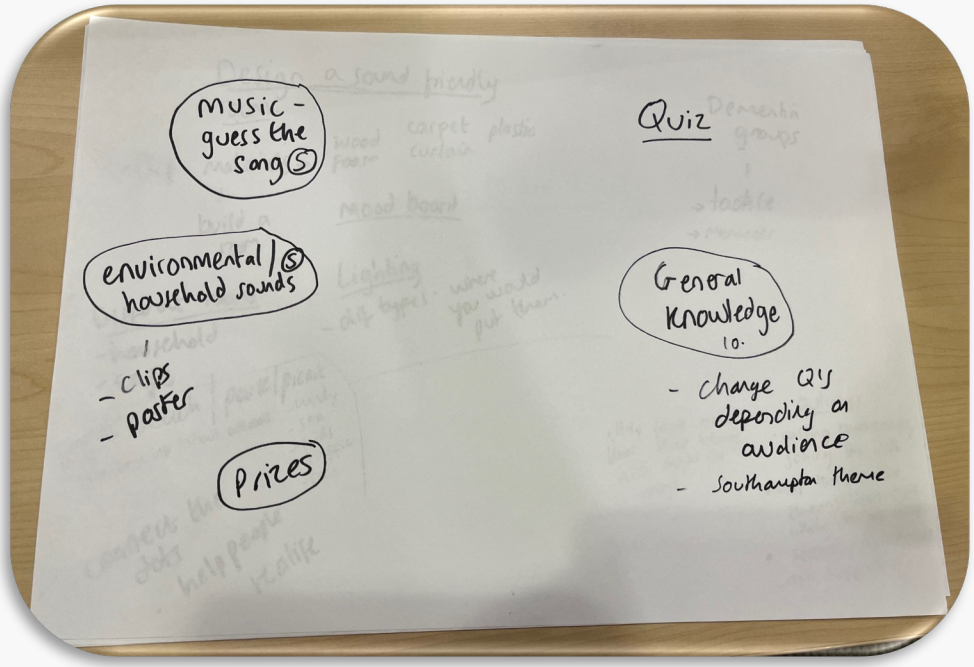

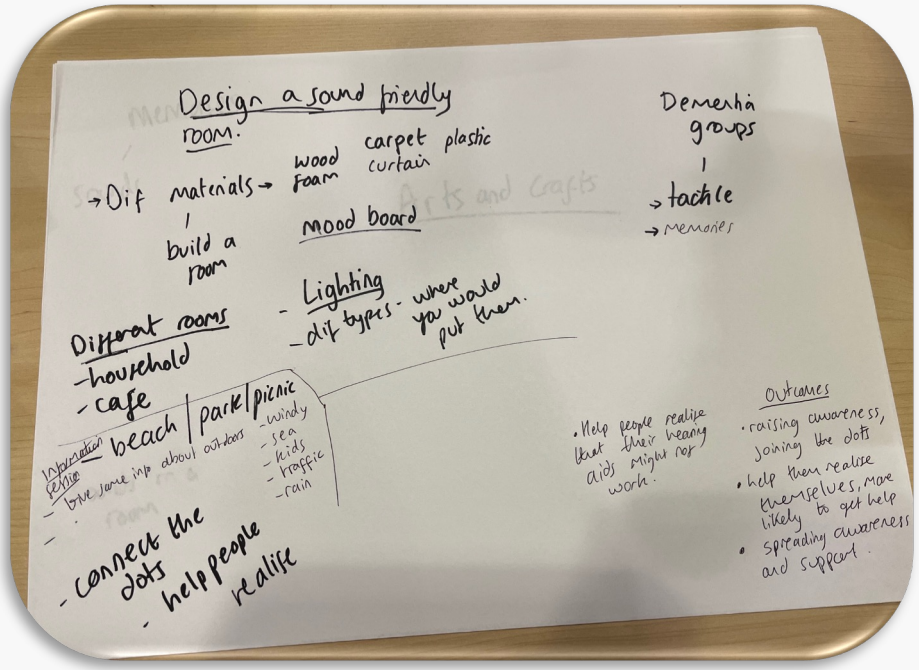

With community group leads and members of patient and public involvement and engagement (PPIE) group (ALL_EARS@UoS)

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Running the activities

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Achievements...

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Building new partnerships

Bridging gap between the university and the local community

Sparking conversations

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Challenges…

Time

Funding and support

Reluctance or lack of trust

THE Dementia careHUB
Living with dementia is tough, getting support shouldn't be

ALL_EARS@UoS

Let's Communicate
Hard of Hearing Group

Dementia Friendly Hampshire

SOUTHAMPTON LIVING WELL

Southampton Community
Independence Service
Sensory Services

PERu

SO:Linked
Supporting Southampton People & Communities

Impact

HEALTH AND WELLBEING COMMUNITY HUB

Dementia Friends

Dementia Friendly
Steering Group

Caraway

Shirley Memory Café

Bitterne Memory Café

University of Southampton

Southampton Voluntary Services

PRIORY ROAD
COMMUNITY GROUP

St Denys Friendlies

St Denys Church
The Parish Church of St Denys, Southampton

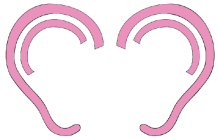
What's next?

Alzheimer's Research UK — Make breakthroughs possible

University of Southampton

Dr Kate Hough | Prof Tracey Newman | Dr Rosalind Willis | Steve Beal

Listening to local communities to understand how to reduce inequities and barriers to risk reduction for better brain health



Our objectives are to:

- bring members of the community together, to share their **experience**, knowledge and **fears** around hearing loss, brain aging and dementia

- **raise awareness, build knowledge** and **inform behaviour change** around **hearing** and **brain health**

- encourage participation in **research**

- evaluate the **effectiveness** of **community engagement**

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For more information, please email Kate Hough at K.L.hough@soton.ac.uk

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Patient and public involvement and engagement (PPIE) in our research

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What is patient and public involvement (PPI)?

Research being carried out '**with' or 'by'** members of the public **rather than 'to', 'about', or 'for'** them.

Develop a long-term partnership between researchers and patients and members of the public to enable lived experience to inform the research process and priorities.

Involvement


Engagement

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ALL_EARS@UoS

A researcher/patient/recipient/supporter group and partnership of people drawn from all walks of life who are involved with, or have lived experience of, hearing loss and/or cochlear implants.

@AllEarsUoS

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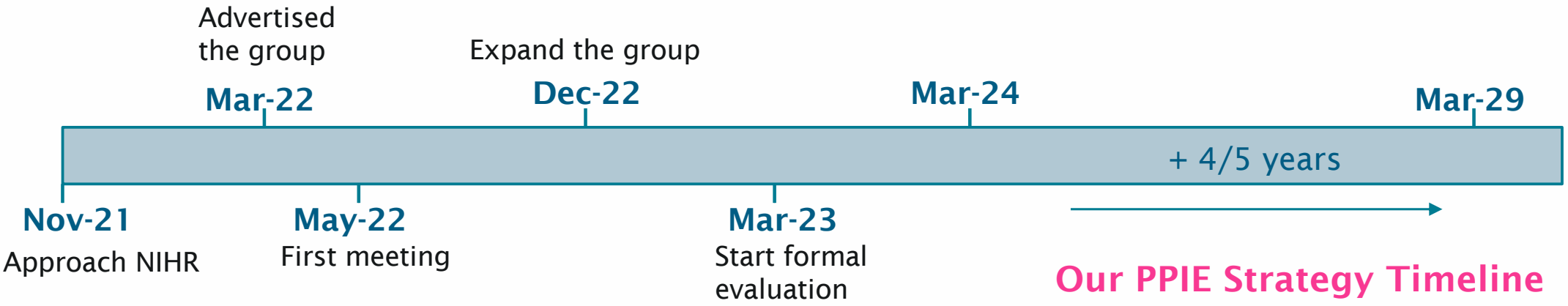
Our website



Our PPIE Strategy Timeline

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What have we been doing to achieve our aims and objectives?

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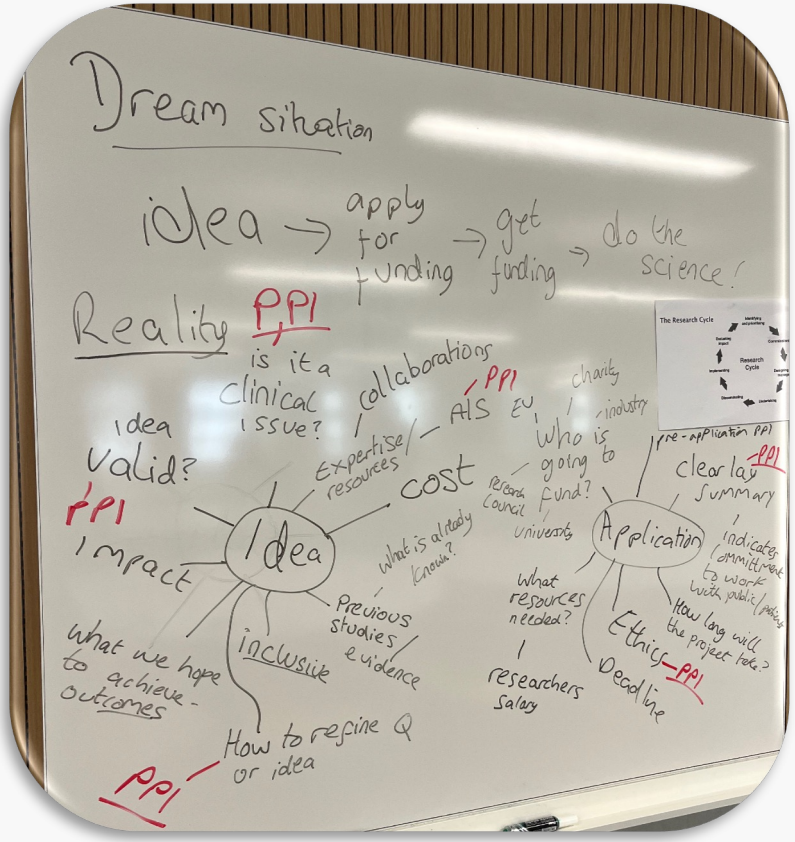
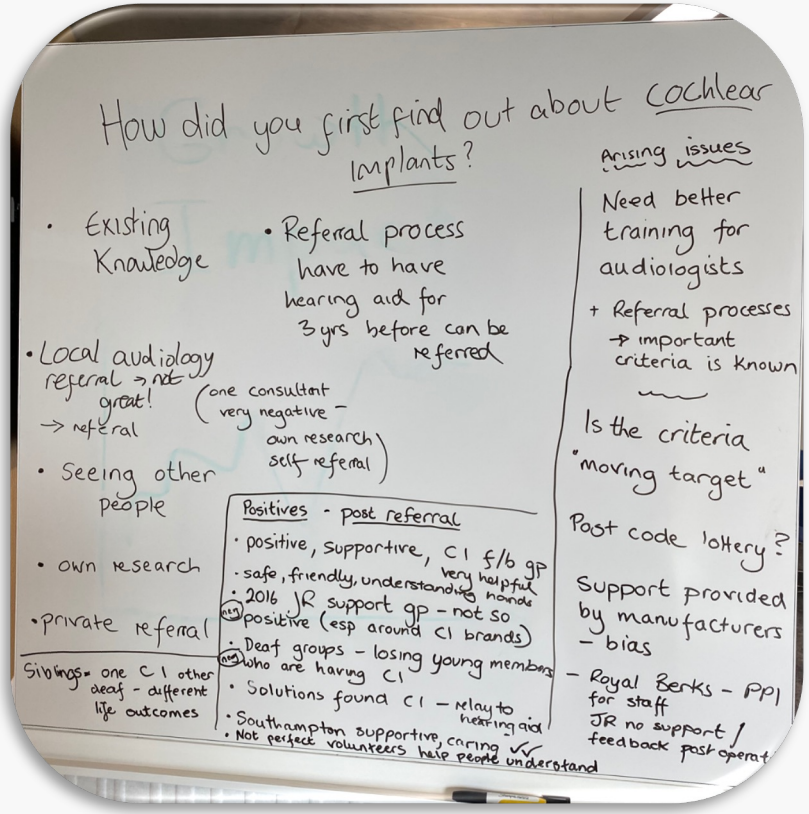


Training about the research process



Learn about people's experiences

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ALL_EARS@UoS PPIE Group

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Our website

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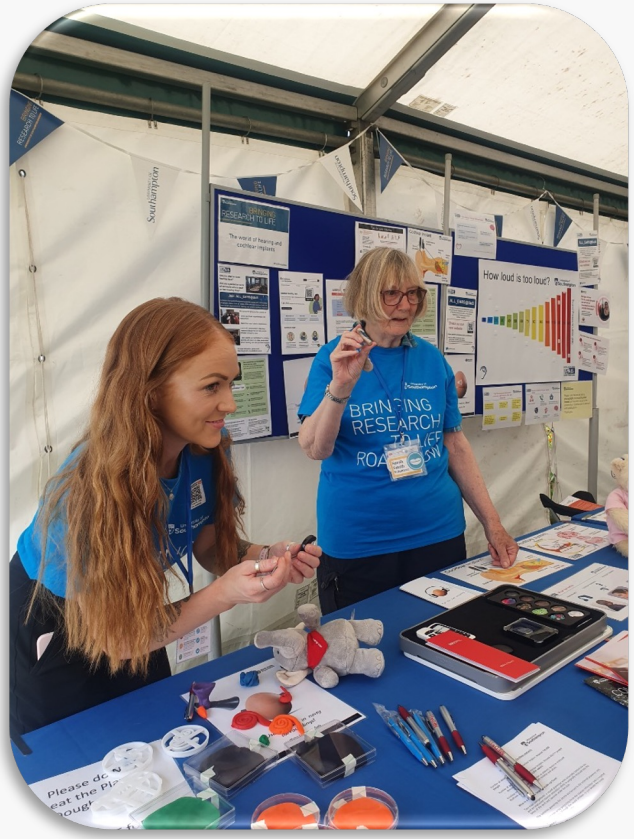
Public engagement

University of Southampton

UoS Science and Engineering Festival



New Forest and Hampshire County Show

Take home messages

- **Hearing** is **valuable**, and we should pay attention to our ears as we go through life.
- Hearing health is linked to our **brain health**.
- Our mission is to tackle the **low awareness** and uptake of hearing interventions such as **hearing aids** and **cochlear implants**.
- We have been doing this through:

Research

Patient and public involvement

Public engagement

Community engagement

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ALL_EARS@UoS PPIE Group

University of Southampton

SCAN ME

Scan QR to see our website!

https://generic.wordpress.soton.ac.uk/all-ears/

Thank you to our whole group!

Dr Kate Hough (Researcher)

Prof Tracey Newman (Researcher)

Heather Parsons (PPI Officer – UHS)

Barney Jones (PPI Officer – Wessex Public Involvement Network)

Dr Mary Grasmeder (Audiologist/ Researcher)

All **community groups** who have welcomed me!

Members of Newman Lab Group

All members of ALL_EARS@UoS group.

Staff and Patients from University of Southampton Auditory Implant Service (USAIS)

@AllEarsUoS

@DrKateHough

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Faculty of Medicine Ethics
Committee reference: 88524

What stops people from wearing their hearing aids?

What is the purpose of this study?
The title of this study is 'Barriers to hearing aid use in people with hearing loss and cognitive impairment/dementia; a perspective from their cohabitees'.
This study aims to investigate the barriers to hearing aid use in individuals who have been prescribed hearing aids for hearing loss, and have confirmed or suspected cognitive impairment/dementia. We are focusing on views from their relatives or friends. Going forward the results will be used to help address these barriers in health and social care.

Who can take part in this study?
- People who have a relative/friend who has been prescribed hearing aids **and** has either been referred to a specialist due to suspected cognitive decline/dementia or has been diagnosed with dementia/cognitive impairment.
- Live in the same household as, or see this relative/friend almost everyday.

Please note - you must meet both of the above conditions to participate.

What does the study involve?
You will be asked to read an information sheet about the study and consent to taking part. Then, you will be asked to spend approximately **15-20 minutes** to completing an **anonymous** questionnaire.
The questionnaire contains a range of multiple choice, ranking and short answer questions.
In exchange for participating you can receive a **£10 Amazon voucher** by following the link provided once you have submitted the questionnaire.

Contact: Ella Woodman
erw2n21@soton.ac.uk
The study will run from October to the end of November 2023.
This student project is sponsored and funded by the University of Southampton.

Please scan the QR code to access the questionnaire or ask for a paper copy from a member of staff.

Support services available to you:
- Age UK Southampton – **call** 023 8036 8636 or **email** info@ageuksouthampton.org.uk
- Carers UK Helpline – **call** 020 7378 4999 or **email** advice@carersuk.org
- Dementia UK Helpline – **call** 0800 888 6678 or **email** helpline@dementiauk.org
- Hearing Link UK Helpdesk – **call** 01844 348111 or **email** helpdesk@hearinglink.org
- RNID Helpline – **call** 0808 808 0123 or **email** contact@rnid.org.uk

If you have concerns about your relative's health, please contact their GP.

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