NIHR National Biomedical Research Unit in Hearing

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Nottingham is the UK’s centre of excellence for hearing

- Today, 10M people in the UK have a hearing loss. By 2031, this will rise to 14.5M. Only about 20% receive a hearing aid.

- Over 5M UK residents experience tinnitus and the incidence is growing. The primary NHS treatments have little or no evidence to support their efficacy.

- Nottingham’s MRC Institute of Hearing Research is one of only a handful of centres around the world that delivers interdisciplinary hearing research. It is the MRC's largest investment in hearing science.

- Nottingham Audiology Services is one of the largest and most comprehensive NHS audiology services in the country. It delivers excellent patient care, receiving an award in 2012 at the Chief Scientific Officers Annual Conference for 'exemplary models of care in audiology services'.


- Nottingham is the largest paediatric implant service in the UK and receives referrals from throughout the UK.

- Nottingham Auditory Implant Programme has carried out over 1300 implant operations. It is one of the leading establishments in the field.
World-leading scientists and clinicians

Trust

University

BRU

MRC
Our research areas

- Tinnitus etiology and management
- Habilitation for hearing loss
- Sensorineural plasticity and rehabilitation
- Cochlear implantation
- Paediatric ENT and Audiology
- Large-scale studies of hearing and hearing health
- Advanced imaging and translational neuroscience
Our facilities

• Comfortable, welcoming and quiet environment for participants.

• 2 large sound-insulated booths, 3 quiet testing rooms and a dedicated, child-friendly room.

• Specialist equipment for assessing many different kinds of hearing (high-frequency audiometry, tympanometry, and otoscopy, tinnitus, selective attention, working memory and cognition).

• fMRI, MEG, EEG and NIRS to acquire physiological measures that capture underlying patterns of brain activity.

• Active collaborations with University of Nottingham Biomaterials-related infection group, Division of Drug Delivery and Tissue Engineering and University of Leicester Department of Cell Physiology and Pharmacology.
Access to patient cohorts

• Active database of >1,000 research participants with different types of hearing-related problems.

• Expertise in analysis of national UK statistics (UK Biobank, Clinical Research Practice Datalink and Hospital Episode Statistics).

• Establishing procedures for patient and public involvement in research with provision of appropriate learning and development for researchers and members of the public.

• Active involvement with charity sector organisations (British Tinnitus Association, The Ear Foundation, Nottinghamshire Deaf Society).

• Representation on professional bodies for Audiology (British Society of Audiology, British Academy of Audiology).
Otitis Media with Effusion (OME)

- Otitis Media with Effusion (OME) (or ‘glue ear’) is a common cause of hearing impairment in children, characterised by the presence of fluid in the middle ear which is caused by persistent bacterial biofilm infection.

- The common surgical treatment with small tubes (grommets) merely removes the fluid, but does not address the underlying infection.

- Over a quarter of children have to have grommet surgery more than once.

- Our goal is to reduce the recurrence of OME requiring repeat grommet insertion by developing novel treatment strategies.

- There has been lots of controversy about the cause of OME. Over the last few years we have come to realise that bacterial biofilms are very important. Of course, knowing what causes the condition is exciting, as it opens up the possibility of better treatments in the future.
The role of biofilms

- Bacterial biofilms are three dimensional communities of bacteria, surrounded by slime, and attached to a surface.

- Images show confocal microscopy of the “glue” fluid from patients with OME.

- Biofilms are seen as green clumps attached to the mucin (red/orange substance).

- The biofilms contrast with planktonic bacteria (circled) that live as single organisms and float about freely.

- Bacterial biofilms are much less sensitive to antibiotics than the planktonic bacteria. This makes them very difficult to eradicate using oral antibiotics.

- We have been developing ways to apply the antibiotic directly to the infection in the middle ear.
Novel drug delivery method

- Biodegradable slow-release antimicrobial biomaterials in a pellet which contains antibiotics, a gel, and a biodegradable scaffold (top image).
- In the laboratory, these pellets are able to eradicate the biofilms.
- Pre-clinical work to assess ototoxicity, in an animal model (currently underway).
- First-in-man clinical trial is being planned.
Non-use of hearing aids

• 2010/11: NHS England n=350,000 first-time users

• Non-use of hearing aids = ~20%
  – Costs of non-hearing aid use
    • To NHS: Annual = ~£25-30m
    • To person with hearing loss = communication difficulties
      → reduced social interaction
      → reduced quality of life

• Hearing-aid use and benefit for many is not optimal
• Hearing-aid fitting occurs too late or not at all

Hearing aids alone are not the only option
Delivery and retention of information

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

(RNID Hear Me Out, 2011)

Study aims
1. To develop a series of interactive video tutorials
   - range of auditory rehabilitation subjects
   - accessible to hearing aid users and their families

2. To evaluate the benefits and cost-effectiveness of the tutorials
What are the benefits to hearing-aid users?

• retained more information (up to 40%)
• showed increased learning on hearing aids and communication
• used their hearing aids on average two hours/day more

• uptake was high; 77% agreed to participate in the study
• compliance was high; 92% watched all RLOs at least once
• self-management was evident; (mean watched =2-3 times, max=7)
• tutorials were useful; mean rating was 9.0 (10=extremely useful).

Patients seemed to like them:

- My wife found this very informative
- I found this reassuring and supportive
- Rather obvious and simplistic so a bit boring
- Good pace, accessible and empowering
- I liked that I could press ‘pause’ to practice inserting aid
Industry relations

- Commercialisation discussions underway
  - UK’s leading supplier of equipment to audiology industry

Potential advantages
- **maximise distribution of tutorials**
  - enable targeting of first-time HA users through NHS system
  - marketing expertise
  - globalisation opportunities (US, Australia + non-English)

- Financial possibilities
  - research funding
  - cost / unit
Further applications

• Flexible learning options
  • Mobile technologies
  • Low-tech booklet

• Addressing patients expectations prior to hearing-aid fitting

• Other groups
  • Specific to family and friends
  • Cochlear implants user (e.g. teenager transition)

• Training other healthcare professionals on basic hearing aid use, communication tactics
  • Nursing homes – training for care assistants
  • Hospitals – training for nurses
  • GPs