National Institute for Health and Care Excellence

Draft

Hearing loss

Hearing loss in adults: assessment and management

NICE guideline

Appendices A – S

November 2017

Draft for consultation

Developed by the National Guideline Centre,
hosted by the Royal College of Physicians

Disclaimer

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and, where appropriate, their carer or guardian.

Local commissioners and providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

NICE guidelines cover health and care in England. Decisions on how they apply in other UK countries are made by ministers in the Welsh Government, Scottish Government, and Northern Ireland Executive. All NICE guidance is subject to regular review and may be updated or withdrawn.

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Contents

Appendices

Appendix A: Scope

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NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Guideline scope

Hearing loss (adult presentation): assessment and management

Topic

The Department of Health in England has asked NICE to produce a guideline on the assessment and management of hearing loss (adult presentation).

This guideline will also be used to develop the NICE quality standard for hearing loss (adult presentation).

The guideline will be developed using the methods and processes outlined in Developing NICE guidelines: the manual.

For more information about why this guideline is being developed, and how the guideline will fit into current practice, see the context section.

Who the guideline is for

- People using services, families and carers and the public
- Healthcare professionals in all settings where NHS care is commissioned or provided
- Social care professionals
- Commissioners of health and social care services.

NICE guidelines cover health and care in England. Decisions on how they apply in other UK countries are made by ministers in the Welsh Government, Scottish Government, and Northern Ireland Executive.

Equality considerations

NICE has carried out an equality impact assessment during scoping. The assessment:

- lists equality issues identified, and how they have been addressed
- explains why any groups are excluded from the scope.

The guideline will look at inequalities relating to disability.

1 What the guideline is about

1.1 Who is the focus?

Groups that will be covered

- Adults (aged 18 years and older) with hearing loss, including those with onset before the age of 18 but presenting in adulthood.
- Special consideration will be given to:
  - young adults (aged 18–25)
  - people with single-sided deafness
  - people with speech and language difficulties.

Groups that will not be covered

- Adults who presented with hearing loss before the age of 18.

1.2 Settings

Settings that will be covered

- All settings where NHS care is commissioned or provided.

1.3 Activities, services or aspects of care

We will look at evidence on the areas listed below when developing the guideline, but it may not be possible to make recommendations on all the areas.

Key areas that will be covered

- Initial assessment (first presentation) and triage.
- Further assessment.
- Management of hearing difficulties.

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Areas that will not be covered

- Tinnitus (without hearing loss).
- Vertigo (without hearing loss).
- Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions.
- Management of disease processes underlying hearing loss.
- Surgical management of hearing loss.
- Screening programmes for hearing loss.

1.4 Economic aspects

We will take economic aspects into account when making recommendations. We will develop an economic plan that states for each review question (or key area in the scope) whether economic considerations are relevant, and if so whether this is an area that should be prioritised for economic modelling and analysis. We will review the economic evidence and carry out economic analyses, using an NHS and personal social services (PSS) perspective, as appropriate.

1.5 Key issues and questions

While writing this scope, we have identified the following key issues, and key questions related to them:

1 Initial assessment (first presentation) and triage
  1.1 In whom should hearing loss be suspected? For example, people with dementia, mild cognitive impairment and learning difficulties.
  1.2 What are the signs and symptoms that allow early recognition of hearing loss needing urgent referral to a specialist?
  1.3 Which causes of hearing difficulty can be identified and treated in primary care?
  1.4 Who should be referred to audiovestibular medicine or ear, nose and throat (ENT) surgery for medical assessment?
  1.5 Which causes of hearing difficulty can be identified and treated by audiology services?
2 Further assessment

2.1 How should hearing and communication needs be assessed? For example, history, examination, pure tone audiometry, tympanometry, speech and hearing in noise tests, needs and goal-setting (individual management plans).

2.2 Which tests and investigations should be used in secondary medical services to assess the underlying cause of hearing loss?

2.3 Which tests and investigations should be used in secondary medical services to determine the cause of sudden-onset sensorineural hearing loss?

3 Management of hearing difficulties

3.1 How should earwax be treated?

3.2 What tools (for example, patient-centred decision aids) help people with hearing difficulty choose between different management strategies, including (combinations of): hearing tactics, lip reading, hearing aids, assistive listening devices, communication training, counselling?

3.3 What are the information, support and advice needs of people with hearing difficulty and their families and carers?

3.4 What is the clinical and cost effectiveness of 1 hearing aid (for 1 ear) compared with 2 (for 2 ears)?

3.5 What is the most clinically and cost effective treatment for idiopathic sudden-onset sensorineural hearing loss?

3.6 How and when should people with hearing-related communication needs (including those with hearing aids) be monitored and followed up?

3.7 What is the clinical and cost effectiveness of different types of hearing aid microphones and digital noise reduction technologies?

3.8 What is the clinical and cost effectiveness of assistive listening devices (such as loops to support use of audiovisual devices)?

3.9 What is the clinical and cost effectiveness of aftercare to support continuing use of devices?

The key questions may be used to develop more detailed review questions, which guide the systematic review of the literature.

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1.6 Main outcomes

The main outcomes that will be considered when searching for and assessing the evidence are:

1 Health-related quality of life.
2 Positive predictive value of signs and symptoms.
3 Diagnostic accuracy of tests.
4 Adverse events.
5 Use of hearing aids.
6 Validated hearing-specific self-report benefit measures.

2 Links with other NICE guidance, NICE quality standards, and NICE Pathways

2.1 NICE guidance

NICE guidance about the experience of people using NHS services

NICE has produced the following guidance on the experience of people using the NHS. This guideline will not include additional recommendations on these topics unless there are specific issues related to hearing loss:

- Patient experience in adult NHS services (2012) NICE guideline CG138
- Service user experience in adult mental health (2011) NICE guideline CG136
- Medicines adherence (2009) NICE guideline CG76

NICE guidance in development that is closely related to this guideline

NICE is currently developing the following guidance that is closely related to this guideline:

- Diagnostic services NICE guideline. Publication expected November 2017.

2.2 NICE quality standards

NICE quality standards that may use this guideline as an evidence source when they are being developed

- Hearing loss NICE quality standard. Publication date to be confirmed

2.3 NICE Pathways

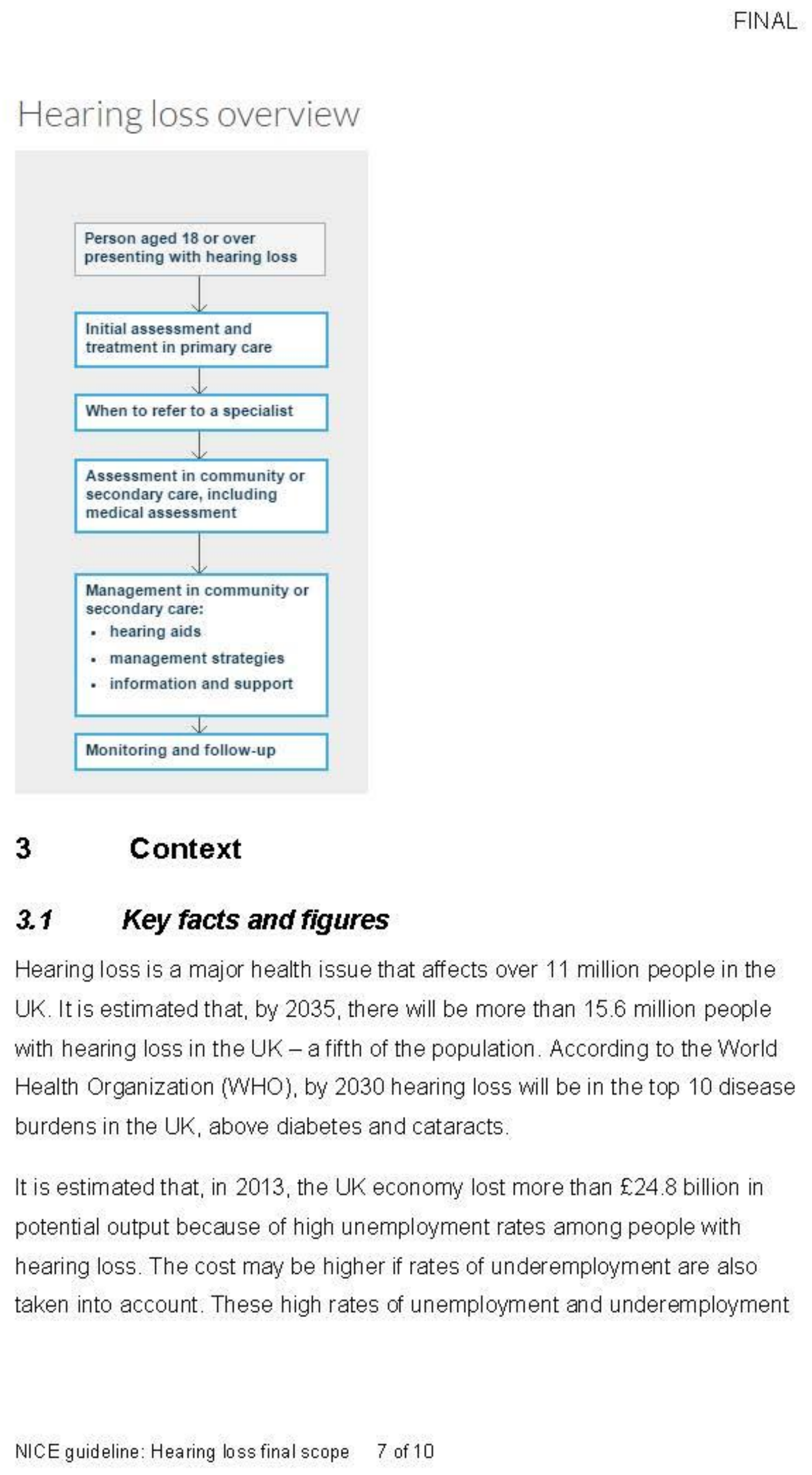
NICE Pathways bring together all NICE guidance and associated products on a topic in an interactive flow chart.

When this guideline is published, the recommendations will be incorporated into a new pathway on hearing loss. Other relevant guidance will also be added to the pathway, including:

Cochlear implants for children and adults with severe to profound deafness (2009) NICE technology appraisal guidance TA166

Auditory brain stem implants (2005) NICE interventional procedure IPG108

An outline of the new pathway, based on the scope, is included below. It will be adapted and more detail added as the recommendations are written during guideline development.



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Hearing loss overview

Person aged 18 or over presenting with hearing loss

Initial assessment and treatment in primary care

When to refer to a specialist

Assessment in community or secondary care, including medical assessment

Management in community or secondary care:
- hearing aids
- management strategies
- information and support

Monitoring and follow-up

3 Context

3.1 Key facts and figures

Hearing loss is a major health issue that affects over 11 million people in the UK. It is estimated that, by 2035, there will be more than 15.6 million people with hearing loss in the UK – a fifth of the population. According to the World Health Organization (WHO), by 2030 hearing loss will be in the top 10 disease burdens in the UK, above diabetes and cataracts.

It is estimated that, in 2013, the UK economy lost more than £24.8 billion in potential output because of high unemployment rates among people with hearing loss. The cost may be higher if rates of underemployment are also taken into account. These high rates of unemployment and underemployment reflect the communication and participation difficulties experienced by people with hearing loss.

Research shows that hearing loss doubles the risk of developing depression and increases the risk of anxiety and other mental health issues. Research also suggests that use of hearing aids reduces these risks. There is also evidence that people with hearing loss have a higher risk of dementia: this risk is 3 times higher in moderate hearing loss and 5 times higher in severe hearing loss.

One study found that on average there is a 10-year delay in people aged 55–74 seeking help for their hearing loss, and 45% of people who do report hearing loss to their GP are not referred to NHS hearing services.

In 2015, the Department of Health and NHS England developed the Action plan on hearing loss to produce and enforce national commissioning guidance, aiming to ensure that consistent, high-quality services are available, and to intervene if services do not improve.

3.2 *Current practice*

The investigation and management pathways for people with hearing loss vary, and many people face delays in treatment and inappropriate management. This is a particular issue in relation to sudden-onset sensorineural hearing loss, which needs urgent treatment.

The main referral pathway for an adult with hearing loss who meets the national 'direct referral' criteria set out by the British Academy of Audiology and the British Society of Hearing Aid Audiologists is direct from GP to audiology services. For those who do not meet these criteria, referral is directly to ENT or audiovestibular medicine.

Difficulties in hearing can arise from simple problems, such as occlusive earwax which can be treated in primary care, through to potentially life-threatening conditions, such as autoimmune disease which needs specialist medical care. Currently in primary care, the identification of treatable causes of hearing loss such as occlusive earwax and infections is not robust, leading

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to some people waiting a long time to see a specialist when they could have been treated successfully in primary care.

Assessment includes taking a history, pure tone audiometry and tympanometry. It may also include clinic-based assessment of ability to understand speech in a noisy environment, and self-report measures related to disability and participation limitations.

Audiology services are provided in a number of NHS settings. In some parts of England this is through the AQP)scheme, which means people have a choice of service providers ranging from traditional audiology services to independent high street providers.

Management pathways vary locally once hearing loss is identified. In general, if hearing aids are recommended, people are offered 1 for each ear unless there are reasons that this is inappropriate. However, in some areas people are not offered NHS hearing aids when they might conceivably benefit, while others are offered 1 hearing aid when they need 2, or given 2 when they have difficulty maintaining the use of 1. Some people are given hearing aids when strategies to improve hearing and listening would be more useful. In some cases hearing aids are tried but discontinued because the person has not had the support they need to use them.

These variations in assessment and management pathways for hearing loss can have a major impact, adversely affecting people's prognosis, and contributing to the overall financial burden of hearing loss. Identifying the correct routes of referral and optimal management pathway for people with hearing loss is therefore very important.

3.3 Policy, legislation, regulation and commissioning

Policy

Any qualified provider (AQP) scheme Some routine and non-complex audiological care is provided by the private and independent sector in England under the 'any qualified provider' scheme, whereby any service can offer hearing testing and provide hearing aids if the provider meets the criteria.

Providers now include high street chains as well as local audiology departments. The guideline will be relevant to all providers of adult hearing services in England.

Legislation, regulation and guidance

Action plan on hearing loss NHS England and Department of Health, 2015

Commissioning Framework on Hearing Services, NHS England, publication expected in May 2016.

4 Further information

This is the final scope, incorporating comments from registered stakeholders during consultation.

The guideline is expected to be published in May 2018.

You can follow progress of the guideline.

Our website has information about how NICE guidelines are developed.

Appendix B: Declarations of interest

The September 2014 version of the NICE code of practice for declaring and dealing with conflicts of interest policy was applied to this guideline.

Graham Easton

Committee meeting	Declaration of interest	Classification	Action taken
On application	Receives payments on a freelance basis as a presenter and contributor on health programmes for the BBC Radio Science Unit.	Personal financial non-specific	Declare and participate unless topic is specific, in which case declare and withdraw
First meeting [23/06/2016]	Apologies received		
Second meeting [18/07/2016]	No change to existing declarations		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	Apologies received		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	Apologies received		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	Apologies received		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

1 Melanie Ferguson

Committee meeting	Declaration of interest	Classification	Action taken
On application	2011: PI for Grant award by NIHR Research for Patient Benefit 2014 – present. A small royalty (licence agreement from hearing aid distributor) for the sale of C2Hear DVD paid to employer (Nottingham University Hospital NHS Trust and University of Nottingham). June 2015. Expenses paid to deliver keynote at conference. USA Hearing Rehabilitation Foundation (charity). Feb 2015: Expenses paid to attend seminar on hearing loss in Denmark. Ida Institute (non-profit organisation, funded by the Oticon Foundation).	Non-personal financial non-specific Non-personal financial non-specific Personal financial specific Personal financial specific	Declare and participate Declare and participate Declare and participate Declare and participate
First meeting [23/06/2016]	No change to existing declarations		
Second meeting [18/07/2016]	No change to existing declarations		
Third meeting [22/09/2016]	Apologies received		
Fourth meeting [27/10/2016]	Lead author of the following study which is included in the Cochrane Review (Barker et al, 2014) on interventions to improve hearing aid use in adult auditory rehabilitation and which is reproduced in this guideline: Ferguson MA, Brandreth M, Leighton P, & Wharrad H. 2016. "A Randomized Controlled Trial to Evaluate the Benefits of a Multimedia Educational Programme for First-time Hearing Aid Users". Ear and Hearing, Mar-Apr; 27(2): 123-136. Principal Investigator for	Personal non-financial specific Non-personal financial	Withdraw from decision-making and formulating recommendations Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	study: Ferguson M, Wharrad H, Brassington W, Coulson N, Maidment D. The development and feasibility of m-health technologies to improve hearing aid use and benefit in first-time hearing aid users. NIHR Research for Patient Benefit, Sept 2016.	specific	
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	Co-author on a registered systematic review of assistive listening devices (submitted for publication). Co-author on a HTA report on screening for hearing loss which included the study presented at the GC	Personal non-financial specific Personal non-financial non-specific	Declare and participate Declare and participate
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	1) Author on papers/research that might be discussed: a) Ferguson M, Maidment DW, Russell N, Gregory M, Nicholson NR. 2016. Motivational engagement in first-time hearing aid users: a feasibility study. International Journal of Audiology. 55:S23-33. b) Ferguson M, Woolley A., & Munro K.J. 2016. The Impact of Self-efficacy, Expectations and Readiness on Hearing Aid Outcomes. International Journal of Audiology; 55:S34-41. c) Ferguson MA, Kitterick PT, Edmondson-Jones AM, Hoare D. Hearing aids for mild to moderate hearing loss in adults (Protocol). The Cochrane Collaboration. 2015(12):1-9. 2) Recent grants – co-applicant Ida Institute Research grants a) David Maidment, Melanie	1a) Personal non-financial specific 1b) Personal non-financial non- specific 1c) Personal non-financial specific 2a) Non-personal financial specific	1a) Declare and withdraw 1b) Declare and participate 1c) Declare and withdraw 2a) Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	Ferguson, Eithne Heffernan, Mel Gregory: Helping patients to make decisions about managing their hearing loss that are right for them b) Helen Henshaw, Melanie A. Ferguson, Melanie Gregory, William Brassington: How do patients with hearing loss prepare for their hearing appointments and how might this help?	2b) Non-personal financial specific	2b) Declare and participate
Ninth meeting [15/06/2017]	No change to existing declarations		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

Julia Garlick

Committee meeting	Declaration of interest	Classification	Action taken
On application	None		
First meeting [23/06/2016]	None		
Second meeting [18/07/2016]	None		
Third meeting [22/09/2016]	Apologies received		
Fourth meeting [27/10/2016]	None		
Fifth meeting [28/11/2016]	Apologies received		
Sixth meeting [06/02/2017]	None		
Seventh meeting [07/02/2017]	None		
Eight meeting	None		

Committee meeting	Declaration of interest	Classification	Action taken
[11/05/2017]			
Ninth meeting [15/06/2017]	None		
Tenth meeting [11/07/2017]	None		
Eleventh meeting [12/07/2017]	None		
Twelfth meeting [07/09/2017]	None		
Thirteenth meeting [08/02/2018]			

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2 **Katherine Harrop-Griffiths (Chair)**

Committee meeting	Declaration of interest	Classification	Action taken
On application	Participates in occasional medico-legal cases privately. These cases draw on current evidence and focus on causation.	Personal financial non-specific	Declare and participate
	Lectured on the Leicester Balance Course up to October 2015 in the subject of balance disorders in children. The course was developed to train clinicians about vestibular disorders and has a strong academic component. It is non-profit making educational course organised by Biosense for, and in conjunction with, the University Hospital of Leicester ENT department. Travel, accommodation and subsistence costs were covered and no other financial benefit was received. The costs of the course are covered by the delegates without any additional sponsorship.	Personal non-financial non-specific	Declare and participate
	Since taking up the chairmanship of this guideline committee KHG		

Committee meeting	Declaration of interest	Classification	Action taken
	has withdrawn from contributing to this course.		
First meeting [23/06/2016]	No change to existing declarations		
Second meeting [18/07/2016]	No change to existing declarations		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	No change to existing declarations		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	No change to existing declarations		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

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2 **Richard Irving**

Committee meeting	Declaration of interest	Classification	Action taken
On application	Principal Investigator for research grants: • 2015 NIHR i4i. A Human Feasibility study of an Implantable Middle Ear Microphone • 2016 MIO Comparison of implantable and external microphones using BKB testing The MIO is a	Non-personal financial non-specific Non-personal financial non-specific	Declare and participate Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	charitable organisation. President elect Royal Society of Medicine (Otology section) from 2018 (unpaid) President British Society of Otology (current [2016]but ends this year [2016]) (unpaid)	Personal non-financial specific Personal non-financial specific	Declare and participate Declare and participate
First meeting [23/06/2016]	Apologies received		
Second meeting [18/07/2016]	Apologies received		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	No change to existing declarations		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	Apologies received		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

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2 **Ted Leverton**

Committee meeting	Declaration of interest	Classification	Action taken
On application	Unpaid volunteer with Action on Hearing Loss	Personal non-financial non-specific	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
First meeting [23/06/2016]	No change to existing declarations		
Second meeting [18/07/2016]	Apologies received		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	No change to existing declarations		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	No change to existing declarations		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

Kevin Munro

Committee meeting	Declaration of interest	Classification	Action taken
On application	Member of the Phonak (Switzerland) paediatric advisory board since around 2004. This involves an annual 1-2 day meeting with Phonak employees (circa 4) and researchers/clinicians (circa 10) who are involved in paediatric audiology. Presents recent paediatric research and contributes to Phonak's clinician support plans, for example suggests	Personal financial non-specific	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	conferences, research updates, summaries etc. Expenses are paid and an honorarium is received for attending and contributing. The next advisory board meeting is June 2016. Current research grants below (nature of involvement is providing intellectual input but not usually involved in day to day data collection).		
	• 2015-16 PI: Medical Research Council proximity to discovery industrial secondment (Implanted device with technical support from Cochlear, the main UK supplier of bone anchored hearing aids)	Non-personal financial non-specific	Declare and participate
	• 2016-18 PI: Hearing device research, Marston Foundation (philanthropic donation to purchase research resources)	Non-personal financial non-specific	Declare and participate
	• 2015-16 Co-I: Genetic and environmental causes of hearing loss and impact on cognitive and emotional well-being in older adults, Manchester Interdisciplinary Collaboration for Research on Ageing	Non-personal financial non-specific	Declare and participate
	• 2015-16 co-PI: New automated tests for early detection of speech listening problems and promotion of healthy aging, Manchester and Monash Collaborative Fund (developing a website for public)	Non-personal financial non-specific	Declare and participate
	• 2015-17 PI: Improving clinical practice in the early care pathway for deaf babies NIHR RfPB	Non-personal financial non-specific	Declare and participate
	• 2014-15 Co-I: Understanding aging: the genetics of immune function and effects on hearing loss and cognition in older adults, Central Manchester Foundation Trust	Non-personal financial non-specific	Declare and participate
	• 2014-15 Co-I: Improving	Non-personal financial non-	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	auditory outcomes using health behavioural approaches, Central Manchester Foundation Trust (investigating reasons for low uptake and use of hearing aids)	specific	
	• 2014-17 Co-PI: Using health behavioural change approaches to predict and encourage hearing aid uptake and adherence in adults, Phonak AG, Switzerland (PhD student funded to continue the above study investigating uptake and use of hearing aids)	Non-personal financial specific	Declare and participate
	• 2014-15 PI: Infant CAEP testing, The Marston Foundation	Non-personal financial non-specific	Declare and participate
	• 2013-15 Co-I: The effect of cochlear implantation on balance in adolescents, Med-El Hearing Implants	Non-personal financial non-specific	Declare and participate
	• 2014-16 PI: Large scale hearing population studies, Central Manchester Foundation Trust (analysis of data in UK Biobank, a database with information on hearing from 500,000 UK residents)	Non-personal financial non-specific	Declare and participate
	• 2014-18 Co-I: The physiological bases and perceptual consequences of 'hidden' noise-induced hearing loss, MRC Programme Grant	Non-personal financial non-specific	Declare and participate
	• 2014-16 PI: Auditory devices and technology, Central Manchester Foundation Trust (preliminary studies to identify way of improving digital signal processing and hearing device technologies for better outcomes)	Non-personal financial specific	Declare and participate
	• 2013-15 PI: Listening effort and fatigue, Castang Foundation	Non-personal financial non-specific	Declare and participate
	• 2013-15 PI: Early intervention for permanent childhood hearing	Non-personal financial non-specific	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	impairment: progress means new challenges, Central Manchester Foundation Trust Strategic Research Fund		
First meeting [23/06/2016]	No change to existing declarations		
Second meeting [18/07/2016]	Apologies received		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	No change to existing declarations		
Fifth meeting [28/11/2016]	Apologies received		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	Ferguson M, Woolley A., & Munro K.J. 2016. The Impact of Self-efficacy, Expectations and Readiness on Hearing Aid Outcomes. International Journal of Audiology; 55:S34-41.	Personal non-financial non-specific	Declare and participate
Tenth meeting [11/07/2017]	Apologies received		
Eleventh meeting [12/07/2017]	Apologies received		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

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2 **Rudrapathy Palaniappan**

Committee meeting	Declaration of interest	Classification	Action taken
On application	Has private practice and shares the premises with a hearing aid dispenser. No	Personal financial non-specific	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	investment or any shareholding with the hearing aid dispenser company. However, refers patients regularly for hearing tests and hearing aid fitting to them.		
First meeting [23/06/2016]	Apologies received		
Second meeting [18/07/2016]	Apologies received		
Third meeting [22/09/2016]	Teaches regularly on MSc Audiology course at UCL Ear Institute. No financial gain.	Personal non-financial non-specific	Declare and participate
Fourth meeting [27/10/2016]	Apologies received		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	No change to existing declarations		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

Linda Parton

Committee meeting	Declaration of interest	Classification	Action taken
On application	None		
First meeting [23/06/2016]	Unpaid Volunteer for Action on Hearing Loss	Personal non-financial non-specific	Declare and participate
Second	No change to existing		

Committee meeting	Declaration of interest	Classification	Action taken
meeting [18/07/2016]	declarations		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	Apologies received		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	No change to existing declarations		
Tenth meeting [11/07/2017]			
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

Neil Pendleton

Committee meeting	Declaration of interest	Classification	Action taken
On application	Investigator in European Commission Horizon 2020 research programme titled SENSE-Cog-Promoting Health for Eyes, Ears and Mind which is funded between 01/01/2016 – 31/12/2020. Leads a work package which will use population representative longitudinal data from England and Europe to model the changes in cognition, vision and hearing in older adults.	Non-personal financial non-specific	Declare and participate
First meeting [23/06/2016]	No change to existing declarations		

Committee meeting	Declaration of interest	Classification	Action taken
Second meeting [18/07/2016]	No change to existing declarations		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	No change to existing declarations		
Fifth meeting [28/11/2016]	Apologies received		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	Apologies received		
Tenth meeting [11/07/2017]	Apologies received		
Eleventh meeting [12/07/2017]	Apologies received		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

Jane Wild

Committee meeting	Declaration of interest	Classification	Action taken
On application	Vice Chair of British Society of Audiology Adult Rehabilitation Interest Group	Personal non-financial specific	Declare and participate
	Member of British Academy of Audiology Service Quality Committee	Personal non-financial specific	Declare and participate
	Co-applicant on a number of clinical research projects in the areas of adult hearing loss and its rehabilitation being undertaken at Betsi Cadwaladr University Health Board. These include the	Non-personal financial non-specific	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	test-retest validation of a new outcome measure, a randomized controlled trial evaluating live voice auditory training and investigation of the incidence of dementia with hearing aid use in the adult population. Co-author of a systematic review of the psychosocial barriers to successful hearing aid use in the adult population that is currently in preparation for submission for publication.	Personal non-financial specific	Declare and participate
First meeting [23/06/2016]	No change to existing declarations		
Second meeting [18/07/2016]	No change to existing declarations		
Third meeting [22/09/2016]	No change to existing declarations		
Fourth meeting [27/10/2016]	No change to existing declarations		
Fifth meeting [28/11/2016]	No change to existing declarations		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	No change to existing declarations		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	No change to existing declarations		
Tenth meeting [11/07/2017]	No change to existing declarations		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	No change to existing declarations		
Thirteenth meeting [08/02/2018]			

Michael Akeroyd (co-opted member)

Committee meeting	Declaration of interest	Classification	Action taken
On application	Trustee & Council Member, British Society of Audiology (BSA) (unpaid). Elected as Trustee in 2013. Term ends in September 2016. President, International Collegium of Rehabilitative Audiology (ICRA) until May 2017 (unpaid).	Personal non-financial specific Personal non-financial specific	Declare and participate Declare and participate
First meeting [23/06/2016]	N/A		
Second meeting [18/07/2016]	N/A		
Third meeting [22/09/2016]	N/A		
Fourth meeting [27/10/2016]	N/A		
Fifth meeting [28/11/2016]	N/A		
Sixth meeting [06/02/2017]	No change to existing declarations		
Seventh meeting [07/02/2017]	N/A		
Eight meeting [11/05/2017]	N/A		
Ninth meeting [15/06/2017]	N/A		
Tenth meeting [11/07/2017]	N/A		
Eleventh meeting [12/07/2017]	N/A		
Twelfth meeting [07/09/2017]	N/A		
Thirteenth meeting [08/02/2018]			

Chris Armitage (co-opted member)

Committee meeting	Declaration of interest	Classification	Action taken
On application	Current research funding		

Committee meeting	Declaration of interest	Classification	Action taken
	includes: • January 2016 to December 2018, funded by The Colt Foundation (Dawes PI, Armitage, Munro, Plack & Moore, University of Manchester; Ginsborg, Royal Northern College of Music), “Time to face the music: Addressing hearing health in future professional musicians”	Non-personal financial non-specific	Declare and participate
	• January 2016 to December 2020, European Commission Horizon 2020 (Leroi PI, Armitage & 36 others, mostly University of Manchester), “Ears, Eyes and Mind: The ‘SENSE-Cog Project’ to improve mental well-being for elderly Europeans with sensory impairment”	Non-personal financial non-specific	Declare and participate
	• May 2014-September 2015, Central Manchester University Hospitals Foundation Trust (Armitage PI, K Munro & M O’Driscoll, University of Manchester), “Improving auditory outcomes using health behavioural approaches”	Non-personal financial non-specific	Declare and participate
	Supervises two PhD students who apply Health Psychology approaches to hearing health. - One studentship is sponsored by Phonak.	Non-personal financial specific	Declare and participate
	Current Chair of the BPS Division of Health Psychology’s Conference Scientific Committee	Personal non-financial non-specific	Declare and participate
	Deputy Director of the Hearing Health Theme in Manchester’s £30M (University of Manchester plus Central Manchester Hospitals Foundation Trust) bid for a NIHR Biomedical Research Centre	Non-personal financial non-specific	Declare and participate
First meeting	N/A		

Committee meeting	Declaration of interest	Classification	Action taken
[23/06/2016]			
Second meeting [18/07/2016]	N/A		
Third meeting [22/09/2016]	N/A		
Fourth meeting [27/10/2016]	N/A		
Fifth meeting [28/11/2016]	N/A		
Sixth meeting [06/02/2017]	N/A		
Seventh meeting [07/02/2017]	N/A		
Eight meeting [11/05/2017]	No change to existing declarations		
Ninth meeting [15/06/2017]	N/A		
Tenth meeting [11/07/2017]	N/A		
Eleventh meeting [12/07/2017]	N/A		
Twelfth meeting [07/09/2017]	N/A		
Thirteenth meeting [08/02/2018]			

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2 **Steve Connor (co-opted member)**

Committee meeting	Declaration of interest	Classification	Action taken
On application	Lead applicant for grant: Response assessment in Head and Neck Cancer using multi-parametric MRI. Funded by Guy's and St Thomas' Charity. Lead applicant for grant: The accuracy of quantitative diffusion weighted MRI and 18F-FDG PET-CT in the prediction of loco-regional residual disease following radiotherapy and chemo-	Non-personal financial non-specific Non-personal financial non-specific	Declare and participate Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	radiotherapy for head and neck cancer. Funded by Kodak radiology fund research Bursary. Given lectures on imaging of the ear (only expenses paid): London, May 2015: Royal Society of Medicine Otology division London, June 2015: London Petrous Temporal Bone course Manchester, June 2015: UK Radiology Congress Sydney, March 2016: Australian and New Zealand Society of Neuroradiology	Personal financial specific	Declare and participate
First meeting [23/06/2016]	N/A		
Second meeting [18/07/2016]	N/A		
Third meeting [22/09/2016]	N/A		
Fourth meeting [27/10/2016]	N/A		
Fifth meeting [28/11/2016]	N/A		
Sixth meeting [06/02/2017]	N/A		
Seventh meeting [07/02/2017]	N/A		
Eight meeting [11/05/2017]	N/A		
Ninth meeting [15/06/2017]	N/A		
Tenth meeting [11/07/2017]	N/A		
Eleventh meeting [12/07/2017]	N/A		
Twelfth meeting [07/09/2017]	N/A		
Thirteenth meeting [08/02/2018]			

Helen Gallacher (co-opted member)

Committee meeting	Declaration of interest	Classification	Action taken
On application	None		
First meeting [23/06/2016]	N/A		
Second meeting [18/07/2016]	N/A		
Third meeting [22/09/2016]	N/A		
Fourth meeting [27/10/2016]	N/A		
Fifth meeting [28/11/2016]	N/A		
Sixth meeting [06/02/2017]	N/A		
Seventh meeting [07/02/2017]	N/A		
Eight meeting [11/05/2017]	N/A		
Ninth meeting [15/06/2017]	N/A		
Tenth meeting [11/07/2017]	N/A		
Eleventh meeting [12/07/2017]	N/A		
Twelfth meeting [07/09/2017]	N/A		
Thirteenth meeting [08/02/2018]			

Padraig Kitterick (co-opted member)

Committee meeting	Declaration of interest	Classification	Action taken
On application	I have been in receipt of research grants and/or support in kind from manufacturers of hearing aids and cochlear implant devices. I was a recipient of research	Non-personal financial specific Non-personal financial non-specific	Declare and participate

Committee meeting	Declaration of interest	Classification	Action taken
	grants from Cochlear Europe Ltd, a manufacturer of cochlear implants, that provided part-funding to conduct a multi-centre study of cochlear implantation in single-sided deafness and a feasibility study of direct acoustic cochlear implantation.		
	I was a co-investigator on a feasibility study funded by the Health Foundation that was supported in kind by Cochlear Europe Ltd. through the provision of device accessories for their implant systems.	Non-personal financial non-specific	
	I have also accepted the hospitality of Cochlear Europe Ltd. to attend and present research findings at scientific meetings organised as part of their post-market surveillance programme.	Personal financial non-specific	
	My research has been supported in kind by Phonak UK, a manufacturer of hearing aids, who have provided devices for single-sided deafness patients participating in a multi-centre clinical study and also for laboratory-based work.	Non-personal financial specific	
	I have provided training on single-sided deafness to audiologists at an event organised and funded by Phonak UK.	Personal non-financial specific	
First meeting [23/06/2016]	N/A		
Second meeting [18/07/2016]	N/A		
Third meeting [22/09/2016]	N/A		
Fourth meeting	N/A		

Committee meeting	Declaration of interest	Classification	Action taken
[27/10/2016]			
Fifth meeting [28/11/2016]	N/A		
Sixth meeting [06/02/2017]	N/A		
Seventh meeting [07/02/2017]	N/A		
Eight meeting [11/05/2017]	N/A		
Ninth meeting [15/06/2017]	N/A		
Tenth meeting [11/07/2017]	N/A		
Eleventh meeting [12/07/2017]	No change to existing declarations		
Twelfth meeting [07/09/2017]	N/A		
Thirteenth meeting [08/02/2018]			

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2 **NGC team**

Committee meeting	Declaration of interest	Classification	Action taken
First meeting [23/06/2016]	In receipt of NICE commissions	N/A	N/A
Second meeting [18/07/2016]	No change to existing declarations.	N/A	N/A
Third meeting [22/09/2016]	No change to existing declarations.	N/A	N/A
Fourth meeting [27/10/2016]	No change to existing declarations.	N/A	N/A
Fifth meeting [28/11/2016]	No change to existing declarations.	N/A	N/A
Sixth meeting [06/02/2017]	No change to existing declarations.	N/A	N/A
Seventh meeting [07/02/2017]	No change to existing declarations.	N/A	N/A
Eight meeting [11/05/2017]	No change to existing declarations.	N/A	N/A
Ninth meeting	No change to existing	N/A	N/A

Committee meeting	Declaration of interest	Classification	Action taken
[15/06/2017]	declarations.		
Tenth meeting [11/07/2017]	No change to existing declarations.	N/A	N/A
Eleventh meeting [12/07/2017]	No change to existing declarations.	N/A	N/A
Twelfth meeting [07/09/2017]	No change to existing declarations.	N/A	N/A
Thirteenth meeting [08/02/2018]	No change to existing declarations.	N/A	N/A

Appendix C: Clinical review protocols

C.1 Urgent and routine referral

C.1.1 Urgent referral

Table 1: Review protocol: signs and symptoms for urgent referral

Review question	What are the signs and symptoms that allow early recognition of hearing loss needing immediate or urgent referral to a secondary care specialist?
Objectives	To determine the diagnostic accuracy of specific signs and symptoms associated with hearing loss that may be indicative of the serious underlying conditions listed below and which require urgent referral for specialist care: Severe infections: otitis media with facial nerve impairment, otitis externa (malignant or necrotising), Rapidly progressing cholesteatoma Rapidly growing vestibular schwannoma Nasopharyngeal cancer and intracranial tumours Stroke Autoimmune disease
Population	Adults (18 years and over) presenting with hearing loss
Index tests: sign(s) or symptom(s)	Sudden onset Rapid progression Cranial nerve involvement (or CNS symptoms), for example, facial paralysis, diplopia, speech and swallowing difficulties (bulbar paralysis) Vertigo (sudden onset) Recent onset unilateral hearing loss Additional systemic symptoms (skin, eye problems, joints; symptoms suggestive of autoimmune disease) severe otalgia with comorbid conditions, for example, diabetes Spontaneous bleeding from ear (exclude malignancy)
Reference standard(s)	Imaging including MRI Blood tests Diagnosis by a specialist clinician Or as defined by study
Review strategy	Study designs: Cross-sectional studies, cohort studies (prospective and retrospective) with multivariate analyses that adjust for any of the key confounders listed below Systematic reviews of the above Appraisal of methodological quality: The methodological quality of each study will be assessed using the QUADAS-2 checklist. Synthesis of data: Diagnostic meta-analysis will be conducted where appropriate data is available and can be pooled.
Statistical measures	Sensitivity Specificity Positive predictive value Negative predictive value

Review question	What are the signs and symptoms that allow early recognition of hearing loss needing immediate or urgent referral to a secondary care specialist?
	ROC curve or area under the curve Adjusted odds ratios
Key confounders	For studies reporting ORs, the following factors have been identified as key confounders and papers should include a multivariable analysis that adjusts for at least some of these confounders: Wax Otitis externa (ordinary) Ear infections Middle ear effusion (due to infection, flight or diving) Meniere's disease Multiple sclerosis
Exclusions	Studies reporting ORs that do not adjust for any of the confounders stated above Studies with fewer than 10 participants per confounder Univariate-based analyses Conference abstracts Non-English language
How the information will be searched	The databases to be searched are Medline, Embase, The Cochrane Library.

C.1.2 Routine referral

Table 2: Review protocol: routine referral

Review question	Who should be routinely referred to audiovestibular medicine or ear, nose and throat (ENT) surgery for medical assessment?
Objectives	To identify who needs to go to secondary or specialist medical care in addition to (non-medical) audiology, that is they need audiological assessment but also medical care. Looking at routine referral criteria for people with hearing loss who need to be referred to audiovestibular medicine or ear, nose and throat (ENT) surgery for medical assessment
Population	Adults (18 years and over)
Risk assessment tools	Referral criteria Risk assessment tools
Reference standard	Confirmed diagnosis of conditions requiring medical and audiological assessment, for example: • vestibular schwannoma and cholesteatoma in the absence of sudden hearing loss • perforated tympanic membrane • Infections
Review strategy	Study designs: Prospective cohort studies with multivariate analyses that adjust for any of the key confounders listed below Systematic reviews of the above Appraisal of methodological quality: The methodological quality of each study will be assessed using the QUADAS-2 checklist. Synthesis of data: Meta-analysis will be conducted where appropriate using hierarchical methods.
Statistical	Sensitivity

Review question	Who should be routinely referred to audiovestibular medicine or ear, nose and throat (ENT) surgery for medical assessment?
measures	Specificity Positive predictive value Negative predictive value ROC curve or area under the curve Adjusted odds ratios
Key confounders	Age Medication
Exclusions	Studies that do not adjust for any of the confounders stated above Studies with fewer than 10 participants per confounder Univariate-based analyses Conference abstracts. Non-English language Studies will be limited to UK settings only
How the information will be searched	The databases to be searched are Medline, Embase, The Cochrane Library.

7 C.2 MRI

8 **Table 3: Review protocol: MRI**

Review question	In people who have been referred to secondary care with sensorineural hearing loss, who needs MRI to assess the underlying cause of hearing loss?
Objectives	To determine the accuracy of any published referral criteria or risk assessment tools in refining the choice of which patients with sensorineural hearing loss need to be referred for MRI to determine the underlying cause of hearing loss. This would mainly be the exclusion of vestibular schwannomas but may also include other pathologies.
Population	Adults (18 years and over) presenting with hearing loss who have been referred to secondary care
Risk assessment tools:	Referral criteria Risk assessment tools
Reference standard / target condition	Vestibular schwannoma or other causative lesions confirmed by MRI
Review strategy	Study designs: Diagnostic accuracy studies Systematic reviews of the above Appraisal of methodological quality: The methodological quality of each study will be assessed using the QUADAS-2 checklist. Synthesis of data: Meta-analysis will be conducted where appropriate using hierarchical methods.
Statistical measures	Sensitivity Specificity Positive Predictive Value Negative Predictive Value ROC curve or area under the curve Adjusted odds ratios

Review question	In people who have been referred to secondary care with sensorineural hearing loss, who needs MRI to assess the underlying cause of hearing loss?
Exclusions	Conference abstracts. Non English language
How the information will be searched	The databases to be searched are Medline, Embase, The Cochrane Library.

C.3 Subgroups

Table 4: Review protocol: subgroups

Review question	Which groups of people are more likely than the general population to miss having hearing loss identified?
Objectives	Question in the scope: In whom should hearing loss be suspected? For example, people with dementia, mild cognitive impairment and learning difficulties. To identify groups of people who may have hearing loss but may not be able to report it and therefore may have missed identification. Identifying these subgroups would encourage clinicians to actively consider whether these patients may have hearing loss.
Population	Adults 18 years or older
Presence or absence of indicators	• Mild cognitive impairment • Dementia • Learning disabilities
Outcomes	• Missed identification (diagnoses) of hearing loss (no diagnosis prior to assessment and new diagnosis after assessment) • Identification (diagnoses) rates of hearing loss
Study design	Studies in which participants are divided into two groups by the presence/absence of one of the indicators listed above and all participants are formally assessed for the presence of hearing loss. Prevalence, incidence, epidemiology studies.
Exclusions	Cross-sectional prevalence studies including a population that is selected so as not to be generally representative of the primary care population
How the information will be searched	The databases to be searched are Medline, Embase, The Cochrane Library. Studies will be restricted to English language only. No date restriction will be applied.
Key confounders	None identified
The review strategy	• The methodological quality of each study will be assessed using the appropriate NICE checklist • GRADE will be used to assess the overall quality and strength of evidence for each outcome. • Missed diagnoses will be extracted where studies provide information on the number of people with diagnoses prior to formal assessment and after formal assessment in the groups with the indicators versus those without. • Meta-analysis will be conducted where appropriate outcome data is available and can be pooled.

C.4 Early versus delayed management of hearing loss

Table 5: Review protocol: early versus delayed management

Review question	**What is the clinical and cost effectiveness of early versus delayed management of hearing loss on patient outcomes?**
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To determine whether early management of hearing loss leads to improved outcomes for patients.
Review population	Adults aged 18 and over presenting with hearing loss
Interventions and comparators	Early identification and management: at first presentation or short history and mild or minimal symptoms Delayed identification: long history (as defined by the studies)
Outcomes	**Critical outcomes** • Hearing-specific health-related quality of life ○ Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) ○ Quantified Denver Scale of Communication (QDS) ○ Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) ○ Device Orientated Subjective Outcome Scale ○ Any questionnaire not specified above that is relevant • Health-related quality of life ○ Health Utilities Index Mark 3 (HUI-3) ○ EQ-5D ○ SF-36 ○ Glasgow Benefit Inventory (GBI) ○ WHO Disability Assessment Schedule (WHODAS) ○ Self-Evaluation of Life Function (SELF) ○ Any questionnaire not specified above that is relevant • Listening ability ○ Abbreviated Profile of Hearing Aid Benefit (APHAB) ○ Speech, Spatial and Qualities of Hearing (SSQ) ○ Glasgow Hearing Aid Benefit Profile (GHABP) disability subscale ○ Any questionnaire not specified above that is relevant • Outcomes reported by carer or 'communications partner' **Important outcomes** • Usage of hearing aids (including data logging and self-report (see above) • Change in cognitive function (Mini-Mental State Examination, MMSE; Modified Mini-Mental State Examination (3MS) • Social functioning or employment • Sound localisation as measured by laboratory test • Speech in noise detection as measured by laboratory tests
Study design	RCTs Non-randomised comparative studies If no RCTs are available prospective and retrospective observational studies will be included. Key confounders to be controlled for are: • Wax

Review question	What is the clinical and cost effectiveness of early versus delayed management of hearing loss on patient outcomes?
	• Infections • Age • Cognitive ability • Education • Socio-economic status
Unit of randomisation	Patient
Crossover study	No
Minimum duration of study/treatment	No minimum
Other exclusions	Conference abstracts Non-English language Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss SSNHL population
Population stratification	Bilateral or unilateral
Reasons for stratification	Different needs
Subgroup analysis if there is heterogeneity	None identified

C.5 Communication needs

Table 6: Review protocol: communication needs

Review question	What is the clinical and cost effectiveness of communication needs assessment in adults with hearing loss?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	Measures of hearing are often used to determine which intervention to give to people with hearing loss or communication needs but they do not necessarily reflect the real communication needs. This review question aims to determine the most clinically and cost-effective ways of measuring communication needs. The aim is to determine if the use of a fully comprehensive assessment of communication needs, for example, self-report questionnaires, or identification of individual needs compared to an assessment of hearing threshold levels (a pure-tone audiogram) improves health-related and hearing-related quality of life.
Review population	Adults aged 18 and over presenting with hearing loss
Interventions and comparators	Interventions: • Fully comprehensive assessment of communication needs: • Measures of activity limitations (disability) for example GHABP (initial disability or disability pre-intervention) • Measures of participation restriction (handicap) HHIE (pre-intervention) • Measures of individual needs for example COSI

Review question	**What is the clinical and cost effectiveness of communication needs assessment in adults with hearing loss?**
	• Individual managements plans Comparators: • Pure tone audiogram before an intervention of hearing aids or auditory training • Speech and hearing in noise tests before an intervention of hearing aids or auditory training • Whisper voice test before an intervention of hearing aids or auditory training
Outcomes	Critical outcomes • Hearing-specific health-related quality of life ○ Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) ○ Quantified Denver Scale of Communication (QDS) ○ Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) ○ GHABP ○ CPHI ○ COSI ○ Device Orientated Subjective Outcome Scale ○ Any questionnaire not specified above that is relevant • Listening ability ○ Abbreviated Profile of Hearing Aid Benefit (APHAB) ○ Speech, Spatial and Qualities of Hearing (SSQ) ○ Glasgow Hearing Aid Benefit Profile (GHABP) residual disability subscale Important outcomes • Social functioning or employment • Usage of hearing aids (including data logging and self-report (if applicable)
Study design	RCTs and systematic reviews of RCTs
Unit of randomisation	Patient
Crossover study	No
Minimum duration of study/treatment	4 weeks (should not be immediate. Need to allow for period of adjustment)
Review strategy	• The methodological quality of each study will be assessed using NICE checklists. • Meta-analysis will be conducted where appropriate outcome data is available and can be pooled. • GRADE will be used to assess the overall quality and strength of evidence for each outcome. • The minimal important difference on the HHIE scale is reported to be 18.7 for face-to face administration and 36 for pencil and paper (Weinstein 1986) • The minimal important difference for the verbal subscale of the CPHI is 0.93 at the 0.05 level (Demorest 1988)
Population stratification	• Age • Severity of hearing loss • Degree of asymmetry

Review question	What is the clinical and cost effectiveness of communication needs assessment in adults with hearing loss?
Reasons for stratification	Could impact on the measures of disability and handicap
Subgroup analysis if there is heterogeneity	• Severity of hearing loss • Auditory lifestyle as evaluated with the Auditory Lifestyle and Demand Questionnaire (ALDQ; Gatehouse et al., 1999), which assesses the diversity of listening situations encountered by an individual. (-low versus high demand as described by questionnaire)
Other exclusions	• Conference abstracts • Non-English language • Adults who presented with hearing loss before the age of 18 • Tinnitus (without hearing loss) • Vertigo (without hearing loss) • Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. • Management of disease processes underlying hearing loss. • Sudden sensorineural hearing loss
Search strategy	• The databases to be searched are Medline, Embase and The Cochrane Library. • Studies will be restricted to English language only. • Systematic review and RCT search filters will be applied.

15 C.6 Management of earwax

16 C.6.1 Treatment

17 **Table 7: Review protocol: earwax treatment**

Review question	What is the most clinically and cost-effective method of removing earwax?
Guideline condition and its definition	Hearing loss
Objectives	To estimate the clinical and cost effectiveness of treatments of earwax (adult presentation)
Review population	Adults aged 18 and over with earwax
	Line of therapy not an inclusion criterion Cure or prevention
Interventions and comparators: generic/class; specific/drug (All interventions will be compared with each other, unless otherwise stated)	Earwax softeners; Oil based (including olive oil) Earwax softeners; Water based (including sodium bicarbonate) Earwax softeners; Water Earwax softeners; Other Ear irrigation using pump Ear irrigation using syringe (self-administered) Ear irrigation using syringe (non-self-administered) Mechanical removal ; Manual Mechanical removal ; Suction Cotton buds Placebo No treatment Combinations of the above
Outcomes	- Health related quality of life (Continuous) CRITICAL - Adverse events (Dichotomous) CRITICAL

Review question	What is the most clinically and cost-effective method of removing earwax?
	- Pure tone audiometry (Continuous) - Wax related (including ability to remove by other means) (Dichotomous) - Global impression of treatment efficacy (Continuous)
Study design	RCT Systematic Reviews of RCT
Unit of randomisation	Patient Ear
Crossover study	Excluded (unless data reported prior to cross-over)
Minimum duration of study	No minimum
Other exclusions	Conference abstracts Non English language Children or young people under 18 Alternative therapies, for example ear candles
Subgroup analyses if there is heterogeneity	- Hearing aid - Administration (self-administration ; HCP administered)
Search criteria	Databases: Medline, EMBASE, Cochrane Date limits for search: no limits Language: English

C.6.2 Settings

Table 8: Review protocol: earwax settings

Review question	What is the most clinically and cost-effective setting for the identification and treatment of earwax?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To compare the clinical and cost effectiveness of treating patients with earwax in primary versus secondary care settings. The question from the scope is: “Which causes of hearing difficulty can be identified and treated in primary care or audiology service?” The committee identified earwax and ear infections as the only 2 causes of hearing difficulty that could be identified and treated in primary care. However, there is an existing NICE guideline on management of ear infection. Therefore this review protocol was developed to compare identification and treatment of earwax in primary versus secondary care.
Review population	Adults aged 18 years and over who have difficulties hearing due to earwax
Interventions and comparators	Treatment in a primary care setting, for example a GP’s surgery Secondary care Compared to each other
Outcomes	Critical Success of earwax removal Improvement in hearing Adverse events Earwax related - perforation - Infection - vertigo

Review question	What is the most clinically and cost-effective setting for the identification and treatment of earwax?
	- bleeding - Discomfort Hearing-specific health-related quality of life Any patient-reported scale that has been validated to provide health utility measure, for example: WHO DAS II HUI2/HUI3 Cambridge Otology QOL Questionnaire Speech, Spatial and Qualities of Hearing Scale (SSQ) Patient-reported disability or benefit Measures validated to demonstrate changes with audiology care in the population under study, for example: Device Orientated Subjective Outcome Scale Glasgow Hearing Aid Benefit Profile Hearing Handicap Inventory for the Elderly – for elderly only
Study design	RCT Systematic review of RCTs If not enough RCT evidence is identified, cohort studies will be considered.
Unit of randomisation	Patient
Crossover study	Not permitted
Minimum duration of study	No minimum
Other exclusions	Conference abstracts Non-English language Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss Surgical management of hearing loss.
Population stratification	No stratification
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	Type of infection Hearing aid users or non-users Primary or recurrent condition

C.7 Sudden sensorineural hearing loss

C.7.1 Treatment

Table 9: Review protocol: treatment for idiopathic sudden sensorineural hearing loss

Review question	What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To determine the safest and most clinically and cost-effective treatment

Review question	**What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?**
	for SSNHL to improve hearing by comparing steroids and antivirals. If there is no difference between treatments, or steroids prove to be the better option, then additional analysis will be carried out to determine the best route of administration of steroids
Review population	Adults aged 18 and over with SSNHL
Interventions and comparators	**Interventions:** Steroids - Prednisolone - Dexamethasone (also known as betamethasone) - Hydrocortisone Antivirals - Acyclovir - Amantadine - Valacyclovir - Famciclovir - Ganciclovir **Comparisons:** Compared to each other or to placebo / no treatment (if applicable) Include: Combination (steroids and antivirals only) and different dosages
Outcomes	- Health-related quality of life (Continuous) CRITICAL - Adverse events (Dichotomous) IMPORTANT - Pure tone audiometry (Continuous) CRITICAL - Speech discrimination (Continuous) CRITICAL - Hearing-specific health-related quality of life (Continuous) CRITICAL
Study design	Systematic review of RCTs RCT
Unit of randomisation	Patient
Crossover study	Permitted only if data is also reported at the end of the first phase prior to cross over
Minimum duration of study/treatment	No minimum
Review strategy	The methodological quality of each study will be assessed using NICE checklists and GRADE. Meta-analysis will be conducted where appropriate outcome data is available Classes of drugs will be initially analysed together and then separately regardless of the route of administration Additional analysis of studies looking of different routes of administration of steroids will also be carried out if steroids are found to be better or equivalent to other treatments
Population stratification	Patients refractory to treatment Treatment-naïve patients presenting with a recurrence

Review question	**What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?**
Reasons for stratification	Patients refractory to treatment may need higher doses of treatment or may have underlying causes of non-responsiveness which may have an effect which is different to the non-refractory patients
Subgroup analysis if there is heterogeneity	Specific drugs within each class Routes of administration Bilateral SSNHL Rehabilitation as adjunct to medical treatment
Other exclusions	Non randomised trials Conference abstracts Non-English language Children Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss.
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

C.7.2 Routes of administration

Table 10: Review protocol: routes of administration for idiopathic sudden sensorineural hearing loss treatment

Review questions	**What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?** Sub-question (if applicable): **What is the clinical and cost effectiveness of different routes of administration of steroids (for example oral or intratympanic) in the treatment of sudden sensorineural hearing loss (SSNHL)?**
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To determine the safest and most clinically and cost-effective treatment for SSNHL to improve hearing by comparing steroids and antivirals. If there is no difference between treatments, or steroids prove to be the better option, then additional analysis will be carried out to determine the best route of administration of steroids.
Review population	Adults aged 18 and over with SSNHL
Interventions and comparators	**Interventions:** Steroids - Prednisolone - Dexamethasone (also known as betamethasone) - Hydrocortisone

Review questions	**What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?** Sub-question (if applicable): **What is the clinical and cost effectiveness of different routes of administration of steroids (for example oral or intratympanic) in the treatment of sudden sensorineural hearing loss (SSNHL)?**
	Antivirals - Acyclovir - Amantadine - Valacyclovir - Famciclovir - Ganciclovir **Comparisons:** Compared to each other or to placebo / no treatment (if applicable) Include: Combination (steroids and antivirals only) and different dosages ********* For the routes of administration question, we will look for studies that include any of the steroids listed above and that compare different routes of administration such as intratympanic and oral administration.
Outcomes	- Health-related quality of life (Continuous) CRITICAL - Pure tone audiometry or pure tone average (Continuous) CRITICAL - Speech discrimination (Continuous) CRITICAL - Hearing-specific health-related quality of life (Continuous) CRITICAL - Adverse events (Dichotomous) IMPORTANT
Study design	Systematic review of RCTs RCT
Unit of randomisation	Patient
Crossover study	Permitted only if data is also reported at the end of the first phase prior to cross over
Minimum duration of study/treatment	No minimum
Review strategy	The methodological quality of each study will be assessed using NICE checklists and GRADE. Meta-analysis will be conducted where appropriate outcome data is available Classes of drugs will be initially analysed together and then separately regardless of the route of administration Additional analysis of studies looking of different routes of

Review questions	**What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?** Sub-question (if applicable): **What is the clinical and cost effectiveness of different routes of administration of steroids (for example oral or intratympanic) in the treatment of sudden sensorineural hearing loss (SSNHL)?**
	administration of steroids will also be carried out if steroids are found to be better or equivalent to other treatments
Population stratification	Patients refractory to treatment Treatment-naïve patients presenting with a recurrence
Reasons for stratification	Patients refractory to treatment may need higher doses of treatment or may have underlying causes of non-responsiveness which may have an effect which is different to the non-refractory patients
Subgroup analysis if there is heterogeneity	Specific drugs within each class Routes of administration Bilateral SSNHL Rehabilitation as adjunct to medical treatment
Other exclusions	Non randomised trials Conference abstracts Non-English language Children Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss.
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

26 C.8 Information and advice

27 **Table 11: Review protocol: information, support and advice**

Review question	What are the information, support and advice needs of people with hearing difficulty and their families and carers?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To assess the information, support and advice needs of patients with hearing loss (adult presentation), their families, and carers.
Review population	Adults aged 18 and over with hearing loss Families, carers and 'communication partners' of people with hearing loss
Context	Any type of information, support and advice described by studies. For example, Content of information, support and advice required How and by whom information, support and advice is delivered Information for carers and family members as well as information for patients Timing of information and support

Study design	Qualitative studies Systematic reviews of qualitative studies
Review strategy	Synthesis of qualitative research: thematic analysis – information synthesised into main review findings. Results presented in a detailed narrative and in table format with summary statements of main review findings. The methodological quality of each study will be assessed using NGC modified NICE checklists and the quality of the body of evidence as a whole will be assessed by a GRADE CerQual approach for each review finding.
Minimum duration of study	No minimum
Other exclusions	Conference abstracts Non English language Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions Management of disease processes underlying hearing loss Surgical management of hearing loss Analogue hearing aids
Population stratification	Severity of hearing loss Speed of onset Employment/education status Age Patient; carer or 'communication partner'
Reasons for stratification	Likely that needs differ by severity, employment status and age. Likely needs of patient and carer or 'communication partner' differ.
Subgroup analysis if there is heterogeneity	None identified

28 C.9 Decision tools

29 **Table 12: Review protocol: patient-centred decision tools**

Review question	**What is the clinical and cost effectiveness of using patient-centred tools to help patients with hearing loss decide between different management strategies?**
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To determine whether using patient-centred tools to choose management strategies for patients with hearing loss has a positive impact on their hearing related and quality of life outcomes and helps with adherence to the chosen strategy.
Review population	Adults aged 18 and over presenting with hearing loss
Interventions and comparators	**Interventions:** Tools specific to hearing for example Ida Institute motivational tools Option grids, shared decision-making or decision aids **Comparators:** No decision aid/no patient choice / professional decision

Review question	**What is the clinical and cost effectiveness of using patient-centred tools to help patients with hearing loss decide between different management strategies?**
Outcomes	Critical outcomes • ***Hearing-specific health-related quality of life*** ○ Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) ○ Quantified Denver Scale of Communication (QDS) ○ Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) ○ Device Orientated Subjective Outcome Scale ○ Abbreviated Profile of Hearing Aid Benefit (APHAB) ○ Speech, Spatial and Qualities of Hearing (SSQ) ○ Glasgow Hearing Aid Benefit Profile (GHABP) residual disability subscale ○ Any questionnaire not specified above that is relevant • ***Adherence to chosen strategy for example usage of hearing aids (including data logging and self-report (if applicable)*** Important outcomes • ***Any outcomes reporting:*** ○ Restricted participation/activity limitation ○ Social interactions, employment and education • ***Health-related quality of life*** ○ Health Utilities Index Mark 3 (HUI-3) ○ EQ-5D ○ SF-36 ○ Glasgow Benefit Inventory (GBI) ○ WHO Disability Assessment Schedule (WHODAS) ○ Self-Evaluation of Life Function (SELF) ○ Any questionnaire not specified above that is relevant
Study design	RCTs and systematic reviews of RCTs
Unit of randomisation	Patient
Crossover study	No
Minimum duration of study/treatment	4 weeks
Review strategy	The methodological quality of each study will be assessed using NICE checklists. Meta-analysis will be conducted where appropriate outcome data is available and can be pooled. GRADE will be used to assess the overall quality and strength of evidence for each outcome. The minimal important difference on the HHIE scale is reported to be 18.7 for face-to face administration and 36 for pencil and paper (Weinstein 1986)
Population stratification	None identified
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	Types of tools Auditory lifestyle as evaluated with the Auditory Lifestyle and Demand Questionnaire (ALDQ; Gatehouse et al., 1999), which assesses the diversity of listening situations encountered by an individual (low versus demand as described by questionnaire).
Other exclusions	Conference abstracts Non-English language

Review question	**What is the clinical and cost effectiveness of using patient-centred tools to help patients with hearing loss decide between different management strategies?**
	Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss. Sudden sensorineural hearing loss Comparisons of different tools or management strategies to each other
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

C.10 Assistive listening devices

Table 13: Review protocol: assistive listening devices

Review question	**What is the clinical and cost effectiveness of assistive listening devices (such as loops) to support communication?**
Guideline condition and its definition	Hearing loss. Definition: People with adult onset hearing loss
Objectives	To determine the clinical and cost effectiveness of assistive listening devices that can help support communication of patients with hearing loss. These will include standalone devices as well as add-on devices that provide additional features to conventional hearing aids.
Review population	Adults with hearing loss who use hearing aids
	18 and over Overall
	Line of therapy not an inclusion criterion
Interventions and comparators: generic/class; specific/drug (All interventions will be compared with each other, unless otherwise stated)	Assistive listening devices FM / RF radio frequency modulators; Telephone/television amplifiers, Assistive listening devices FM / RF radio frequency modulators; Amplifiers for telephone/doorbell/smoke detector Assistive listening devices FM / RF radio frequency modulators; Loop system (personal or in-built) Assistive listening devices FM / RF radio frequency modulators; Telecoils Assistive listening devices FM / RF radio frequency modulators; Hearing aid Apps Assistive listening devices FM / RF radio frequency modulators; Bluetooth devices Assistive listening devices FM / RF radio frequency modulators; PSAPs (personal sound amplification products) Assistive listening devices FM / RF radio frequency modulators; Any ALDs compared to each other ALDs compared to hearing aids Conventional hearing aids compared to hearing aids in conjunction with amplification devices such as FM and smartphone Apps No ALD; No assistive device used
Outcomes	- Hearing-specific health related quality of life (Continuous) CRITICAL - Health-related quality of life (Continuous) CRITICAL - Outcomes reporting restricted participation or activity limitations

Review question	What is the clinical and cost effectiveness of assistive listening devices (such as loops) to support communication?
	(Continuous) IMPORTANT - Outcomes reporting social interactions, employment or education (Continuous) IMPORTANT - Listening ability (Continuous) CRITICAL
Study design	RCT Systematic Review
Unit of randomisation	Patient
Crossover study	Permitted
Minimum duration of study	Not defined
Other exclusions	Children Tinnitus without hearing loss Vertigo without hearing loss Laboratory based simulations not on wearable hearing aids Analogue hearing aids
Subgroup analyses if there is heterogeneity	- Auditory lifestyle as evaluated with the Auditory Lifestyle and Demand Questionnaire (Not applicable; Not stated / Unclear; Auditory lifestyle demand (low versus high)); This assesses the diversity of listening situations encountered by an individual. The demand may be different for different lifestyles. The subgroup analysis will look at low versus demand as described by questionnaire
Search criteria	Databases: Date limits for search: Language:

32 C.11 Hearing aids

33 C.11.1 Hearing aids versus no hearing aids

34 **Table 14: Review protocol**

Review question	What is the clinical effectiveness of hearing aids for mild to moderate hearing loss in adults who have been prescribed at least 1 hearing aid?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To evaluate the effectiveness of hearing aids for mild to moderate hearing loss in adults who have been prescribed at least 1 hearing aid.
Review population	Adults age 18 years and over who have mild to moderate hearing loss Hearing loss defined either: • Qualitatively as ‘mild’ or ‘moderate’, OR • Quantitatively following WHO definitions of mild and moderate hearing loss (mild: 26-40 dB HL inclusive; moderate: 41-70 dB HL inclusive
Intervention	Acoustic hearing aids, irrespective of where they were worn or the type of technology (analogue or digital)
Comparisons	• Passive control (placebo; no intervention; or waiting list) OR • Active control (information/education only, listening tactics and communication training; assistive listening devices; or auditory training)
Outcomes	<u>Critical outcomes:</u>

	1. Hearing-specific health-related quality of life (key domain: participation) 2. Adverse effects: Pain Important outcomes: 3. Health-related quality of life 4. Listening ability 5. Adverse effects: Noise-induced hearing loss
Study design	RCT Systematic review of RCTs
Unit of randomisation	Patient
Crossover study	Permitted only if data are also reported at the end of the first phase prior to cross over
Minimum duration of study	None
Review strategy	The methodological quality of each study will be assessed using NICE checklists and GRADE. Data extracted will be presented in a format similar to Evibase outputs Meta-analysis will be conducted where appropriate outcome data is available
Population stratification	No stratification
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	Age at hearing aid fitting, Gender Degree of hearing loss (i.e. mild or moderate)
Other exclusions	Hearing aids or implantable devices whose primary purpose is to deliver bone conduction sound or those that detect and deliver sound via air conduction to the contralateral ear. Interventions delivered in group settings
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

35 C.11.2 1 hearing aid versus 2 hearing aids

36 **Table 15: Review protocol: 1 hearing aid versus 2 hearing aids**

Review question	What is the clinical and cost effectiveness of fitting 1 hearing aid compared with fitting 2 hearing aids for people when both ears have an aidable hearing loss?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To estimate the clinical and cost effectiveness of 1 hearing aid compared with 2 hearing aids in the management of patients with hearing loss (adult presentation)
Review population	Adults age 18 years and over with bilateral hearing loss, where both ears would be suitable for amplification
Interventions and	2 hearing aids

Review question	What is the clinical and cost effectiveness of fitting 1 hearing aid compared with fitting 2 hearing aids for people when both ears have an aidable hearing loss?
comparators	1 hearing aid, that is a single hearing aid fitted to either the right or left ear No hearing aids Compared to each other
Outcomes	Critical outcomes: • Hearing-specific health-related quality of life ○ Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) ○ Quantified Denver Scale of Communication (QDS) ○ Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) ○ Any questionnaire not specified above that is relevant • Health-related quality of life ○ Health Utilities Index Mark 3 (HUI-3) ○ EQ-5D ○ SF-36 ○ Glasgow Benefit Inventory (GBI) ○ WHO Disability Assessment Schedule (WHODAS) ○ Self-Evaluation of Life Function (SELF) ○ Any questionnaire not specified above that is relevant • Listening ability ○ Abbreviated Profile of Hearing Aid Benefit (APHAB) ○ Speech, Spatial and Qualities of Hearing (SSQ) ○ Glasgow Hearing Aid Benefit Profile (GHABP) disability subscale ○ Any questionnaire not specified above that is relevant • Device Orientated Subjective Outcome Scale • Outcomes reported by carer or 'communications partner' • Patient preference Important outcomes: • Usage of hearing aids (including data logging and self- report) • Adverse effects, such as pain, infection • Annoyance scale in patient reported outcome measures • Sound localisation as measured by laboratory test Speech in noise detection as measured by laboratory tests
Study design	RCT Systematic review of RCTs If no RCTs or systematic reviews of RCTs are identified we will include prospective or retrospective (data bases)cohort studies and case–control studies with multivariate analyses that adjust for the following key confounders: Age Hearing (loss) level Types of devices Degree of asymmetry
Unit of randomisation	Patient with hearing loss in both ears
Crossover study	Permitted only if data are also reported at the end of the first phase prior to cross over
Minimum duration of study	8 weeks (if less include and downgrade)
Review strategy	The methodological quality of each study will be assessed using NICE checklists

Review question	What is the clinical and cost effectiveness of fitting 1 hearing aid compared with fitting 2 hearing aids for people when both ears have an aidable hearing loss?
	and GRADE. Data extracted will be presented in a format similar to Evibase outputs Meta-analysis will be conducted where appropriate outcome data is available Data from RCTs and non-RCTs will not be meta-analysed together
Population stratification	No stratification
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	Type of hearing aid Age Cognitive impairment Asymmetric hearing loss Visual impairment Severity of hearing loss Tinnitus with hearing loss First-time users of hearing aids
Other exclusions	Studies unadjusted for any of the identified predictors listed above Studies with univariate analysis only Patients with an aidable hearing loss in one ear only Conference abstracts Non-English language Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss Surgical management of hearing loss. Implantable hearing aids
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

C.12 Hearing aid microphones and noise reduction algorithms

C.12.1 Microphones

Table 16: Review protocol: Omnidirectional versus directional microphones

Review question	What is the clinical and cost effectiveness of directional versus omnidirectional microphones?
Guideline condition and its definition	Hearing loss. Definition: People with adult onset hearing loss
Objectives	To estimate the clinical and cost effectiveness of directional microphones to improve listening in the presence of background noise.
Review population	Adults with hearing loss who use hearing aids
	18 and over Overall

	Line of therapy not an inclusion criterion
Interventions and comparators: generic/class; specific/drug (All interventions will be compared with each other, unless otherwise stated)	Hearing aids with directional microphones; Unilateral hearing aid with directional microphone (front) Hearing aids with directional microphones; Bilateral hearing aids with directional microphone (side) Hearing aids with directional microphones; Bilateral hearing aids with directional microphone (back) Hearing aids with directional microphones; Bilateral hearing aids with directional microphone (front) Hearing aids with directional microphones; Unilateral hearing aid with directional microphone (side) Hearing aids with directional microphones; Unilateral hearing aid with directional microphone (back) Hearing aids with omnidirectional microphones; Unilateral hearing aid with omnidirectional microphones (all directions) Hearing aids with omnidirectional microphones; Unilateral hearing aid with disabled directional microphones Hearing aids with omnidirectional microphones; Bilateral hearing aids with disabled directional microphones Hearing aids with omnidirectional microphones; Bilateral hearing aid with omnidirectional microphones (all directions)fine
Outcomes	- Hearing-specific health related quality of life (Continuous) CRITICAL - Adverse events (Dichotomous) CRITICAL - Speech recognition in noise (Continuous) CRITICAL - Ease of listening/ listening effort (Continuous) CRITICAL - Health-related quality of life (Continuous) IMPORTANT - Outcomes reporting restricted participation or activity limitations (Continuous) IMPORTANT - Outcomes reporting social interactions, employment or education (Continuous) IMPORTANT - Listening ability (Continuous) IMPORTANT - Safety (Dichotomous) IMPORTANT - Adherence (Dichotomous)
Study design	RCT Systematic Review
Unit of randomisation	Patient
Crossover study	Permitted
Minimum duration of study	Not defined
Other exclusions	Children Tinnitus without hearing loss Vertigo without hearing loss
Subgroup analyses if there is heterogeneity	- Hearing loss severity (Not applicable; Not stated / Unclear; Mild; Moderate; Severe; Mixed); Severity may impact effect - Unilateral or bilateral hearing aids (Not applicable; Not stated / Unclear; Unilateral; Bilateral); May impact effect
Search criteria	Databases: Date limits for search: Language:

C.12.2 Noise reduction algorithms

Table 17: Review protocol: noise reduction algorithms

Review question	What is the clinical and cost effectiveness of noise reduction algorithms?
Guideline condition and its definition	Hearing loss. Definition: People with adult onset hearing loss
Objectives	To estimate the clinical and cost effectiveness of technology used to improve listening in the presence of background noise
Review population	Adults with hearing loss who use hearing aids
	18 and over Overall
	Line of therapy not an inclusion criterion
Interventions and comparators (All interventions will be compared with each other, unless otherwise stated)	Noise reduction algorithms; Noise reduction algorithm Adaptive noise reduction No noise reduction Noise reduction algorithm disabled
Outcomes	- Hearing-specific health related quality of life (Continuous) CRITICAL - Safety (Dichotomous) IMPORTANT - Speech in noise recognition (Continuous) CRITICAL - Ease of listening (Continuous) CRITICAL - Health-related quality of life (Continuous) IMPORTANT - Restricted participation or activity limitation (Dichotomous) IMPORTANT - Social interactions, employment and education (Dichotomous) IMPORTANT - Adherence (Dichotomous) IMPORTANT - Hearing aid benefit (Dichotomous) IMPORTANT
Study design	RCT Systematic Review
Unit of randomisation	Patient
Crossover study	Permitted
Minimum duration of study	Not defined
Other exclusions	Children Tinnitus without hearing loss Vertigo without hearing loss
Subgroup analyses if there is heterogeneity	- Hearing loss severity (Not applicable; Not stated / Unclear; Mild; Moderate; Severe; Mixed); Severity may impact effect - Unilateral or bilateral hearing aids (Not applicable; Not stated / Unclear; Unilateral; Bilateral); May impact effect
Search criteria	Databases: Date limits for search: Language:

C.13 Monitoring and follow-up

Table 18: Review protocol: methods of monitoring

Review question	What is the most clinically and cost-effective method of delivery of monitoring and follow-up of people with hearing-related communication needs (including those with hearing aids)?

Review question	**What is the most clinically and cost-effective method of delivery of monitoring and follow-up of people with hearing-related communication needs (including those with hearing aids)?**
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To identify the most effective and cost-effective method of delivery of monitoring and following up of people with hearing related communication needs (including those with hearing aids).
Review population	Adults aged 18 and over presenting with hearing loss
Interventions and comparators	Examples mode of delivery: • Telephone • Email • face-to-face • questionnaire • online resources Compared to each other and to no follow-up or usual care
Outcomes	<u>Critical outcomes</u> 1. Hearing-specific health-related quality of life • Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) • Quantified Denver Scale of Communication (QDS) • Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) • Device Orientated Subjective Outcome Scale • Any questionnaire not specified above that is relevant 2. Health-related quality of life • Health Utilities Index Mark 3 (HUI-3) • EQ-5D • SF-36 • Glasgow Benefit Inventory (GBI) • WHO Disability Assessment Schedule (WHODAS) • Self-Evaluation of Life Function (SELF) • Any questionnaire not specified above that is relevant 3. Listening ability • Abbreviated Profile of Hearing Aid Benefit (APHAB) • Speech, Spatial and Qualities of Hearing (SSQ) • Glasgow Hearing Aid Benefit Profile (GHABP) residual disability subscale 4. Speech recognition in noise test 5. Usage of hearing aids (including data logging and self-report (if applicable) <u>Important outcomes</u> 6. Social functioning/employment

Review question	What is the most clinically and cost-effective method of delivery of monitoring and follow-up of people with hearing-related communication needs (including those with hearing aids)?
Study design	RCT and systematic reviews of RCTs If not enough RCT evidence is found, cohort studies will be considered
Unit of randomisation	Patient
Crossover study	No
Minimum duration of study/treatment	No minimum
Review strategy	The methodological quality of each study will be assessed using NICE checklists. Meta-analysis will be conducted where appropriate outcome data is available and can be pooled. GRADE will be used to assess the overall quality and strength of evidence for each outcome. The minimal important difference on the HHIE scale is reported to be 18.7 for face-to face administration and 36 for pencil and paper (Weinstein 1986)
Population stratification	None identified
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	Type of delivery method
Other exclusions	Conference abstracts Non-English language Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss.
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

44 **Table 19: Review protocol: timing of monitoring**

Review question	When should people with hearing-related communication needs (including those with hearing aids) be monitored and followed up?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To determine which time-points for monitoring and following-up patients with hearing-related communication needs lead to better outcomes.
Review population	Adults aged 18 and over presenting with hearing loss
Interventions and comparators	Short-term: less than 12 weeks Medium term: 1 year Long-term: 3 years Compared to each other or to no follow-up if appropriate
Outcomes	<u>Critical outcomes</u>

Review question	When should people with hearing-related communication needs (including those with hearing aids) be monitored and followed up?
	1. Hearing-specific health-related quality of life • Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) • Quantified Denver Scale of Communication (QDS) • Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) • Device Orientated Subjective Outcome Scale • Any questionnaire not specified above that is relevant 2. Health-related quality of life • Health Utilities Index Mark 3 (HUI-3) • EQ-5D • SF-36 • Glasgow Benefit Inventory (GBI) • WHO Disability Assessment Schedule (WHODAS) • Self-Evaluation of Life Function (SELF) • Any questionnaire not specified above that is relevant 3. Listening ability • Abbreviated Profile of Hearing Aid Benefit (APHAB) • Speech, Spatial and Qualities of Hearing (SSQ) • Glasgow Hearing Aid Benefit Profile (GHABP) residual disability subscale 4. Speech recognition in noise test 5. Usage of hearing aids (including data logging and self-report (if applicable) <u>Important outcomes</u> 6. Social functioning/employment
Study design	RCT and systematic reviews of RCTs
Unit of randomisation	Patient
Crossover study	No
Minimum duration of study/treatment	No minimum
Review strategy	The methodological quality of each study will be assessed using NICE checklists. Meta-analysis will be conducted where appropriate outcome data is available and can be pooled. GRADE will be used to assess the overall quality and strength of evidence for each outcome. The minimal important difference on the HHIE scale is reported to be 18.7 for face-to face administration and 36 for pencil and paper (Weinstein 1986)
Population stratification	None identified
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	None identified
Other exclusions	Conference abstracts

Review question	When should people with hearing-related communication needs (including those with hearing aids) be monitored and followed up?
	Non-English language Adults who presented with hearing loss before the age of 18 Tinnitus (without hearing loss) Vertigo (without hearing loss) Acute temporary hearing loss caused by traumatic head injuries, for example perforated tympanic membranes or middle ear effusions. Management of disease processes underlying hearing loss.
Search strategy	The databases to be searched are Medline, Embase and The Cochrane Library. Studies will be restricted to English language only. Systematic review and RCT search filters will be applied.

C.14 Interventions to support the use of hearing aids

Table 20: Review protocol: interventions to support continuing use of hearing aids

Review question	What is the clinical and cost effectiveness of interventions to support continuing use of hearing devices?
Guideline condition and its definition	Hearing loss (adult presentation)
Objectives	To determine the most clinically and cost-effective intervention that would increase the use of hearing aids in people with adult onset hearing loss who have been prescribed hearing aids
Review population	Adults aged 18 and over using at least 1 prescribed hearing aid
Interventions and comparators	Any intervention that aims to promote or improve usage of prescribed hearing aids for adults with hearing loss, including: • patient education (for example online resources and communication strategies) • patient activation • peer support • self-management resources and tools • collaborative decision-making • maintenance and repairs • battery replacement services • provision of additional equipment to improve hearing aid benefit
Outcomes	• Hearing aid use (measured as adherence or daily hours of use) • Adverse effects (inappropriate advice or clinical practice, or patient complaints) • Hearing-specific health-related quality of life (Fergusson 2016 primary outcome) ○ Hearing Handicap Inventory for the Elderly (HHIE) or HHI for Adults (HHIA) ○ Quantified Denver Scale of Communication (QDS) ○ Auditory Disability Preference – Visual Analog Scale (ADPI-VAS) ○ Device Orientated Subjective Outcome Scale ○ Any questionnaire not specified above that is relevant • Health-related quality of life ○ Health Utilities Index Mark 3 (HUI-3) ○ EQ-5D ○ SF-36

	○ Glasgow Benefit Inventory (GBI) ○ WHO Disability Assessment Schedule (WHODAS) ○ Self-Evaluation of Life Function (SELF) ○ Any questionnaire not specified above that is relevant • Restricted participation/activity limitation • Hearing aid benefit and communication • Outcomes reported by carers or relatives Outcomes measured over the short (≤12 weeks), medium (>12 to <52 weeks) and long term (≥1 year).
Study design	RCT Quasi RCTs Systematic review of RCTs
Unit of randomisation	Patient
Crossover study	Only report data in the first phase of the trial prior to crossover
Minimum duration of study	No minimum
Other exclusions	Adults who presented with hearing loss before the age of 18 Studies including implantable devices such as bone anchored hearing aids and cochlear implants Interventions involving changes in service provision or model of care Comparisons of different types of hearing aid technologies
Population stratification	No stratification
Reasons for stratification	N/A
Subgroup analysis if there is heterogeneity	Self-management support content Delivery system design format and Follow-up schedule

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Appendix D: Health economic review protocol

Table 21: Health economic review protocol

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions and comparators must be as specified in the clinical review protocols in appendix C above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix G.
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2001, abstract-only studies and studies from non-OECD countries or the USA will also be excluded. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).[398] **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations' then it will be included in the guideline. A health economic evidence table will be completed and it will be included in the health economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations' then it will usually be excluded from the guideline. If it is excluded then a health economic evidence table will not be completed and it will not be included in the health economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included. **Where there is discretion** The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the guideline committee if required. The ultimate aim is to include health economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation as excluded health economic studies in appendix M. The health economist will be guided by the following hierarchies. *Setting:*

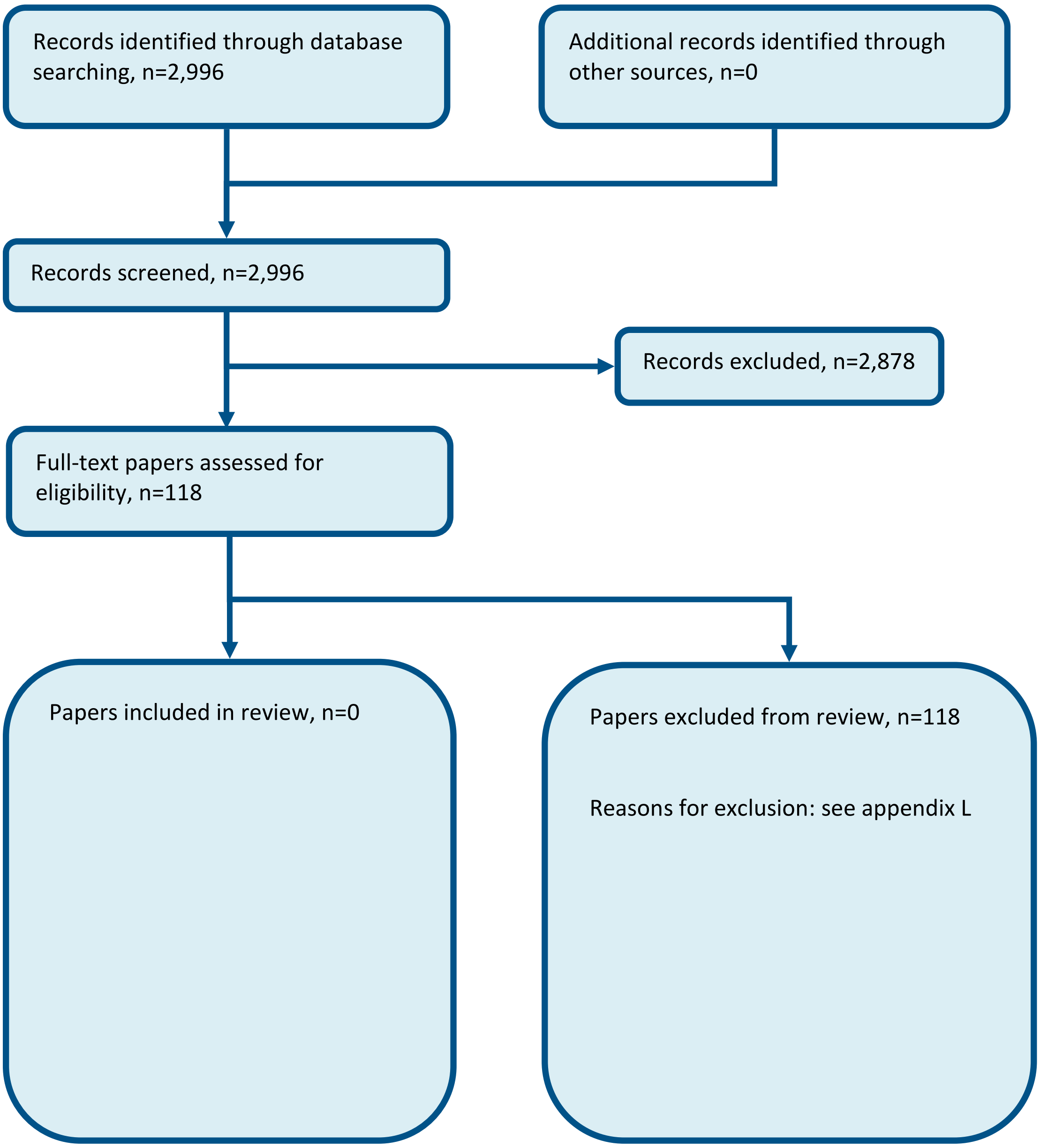
	- UK NHS (most applicable). - OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden). - OECD countries with predominantly private health insurance systems (for example, Switzerland). - Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations. *Health economic study type:* - Cost–utility analysis (most applicable). - Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis). - Comparative cost analysis. - Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations. *Year of analysis:* - The more recent the study, the more applicable it will be. - Studies published in 2001 or later but that depend on unit costs and resource data entirely or predominantly from before 2001 will be rated as 'Not applicable'. - Studies published before 2001 will be excluded before being assessed for applicability and methodological limitations. *Quality and relevance of effectiveness data used in the health economic analysis:* - The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

Appendix E: Clinical study selection

E.1 Urgent and routine referral

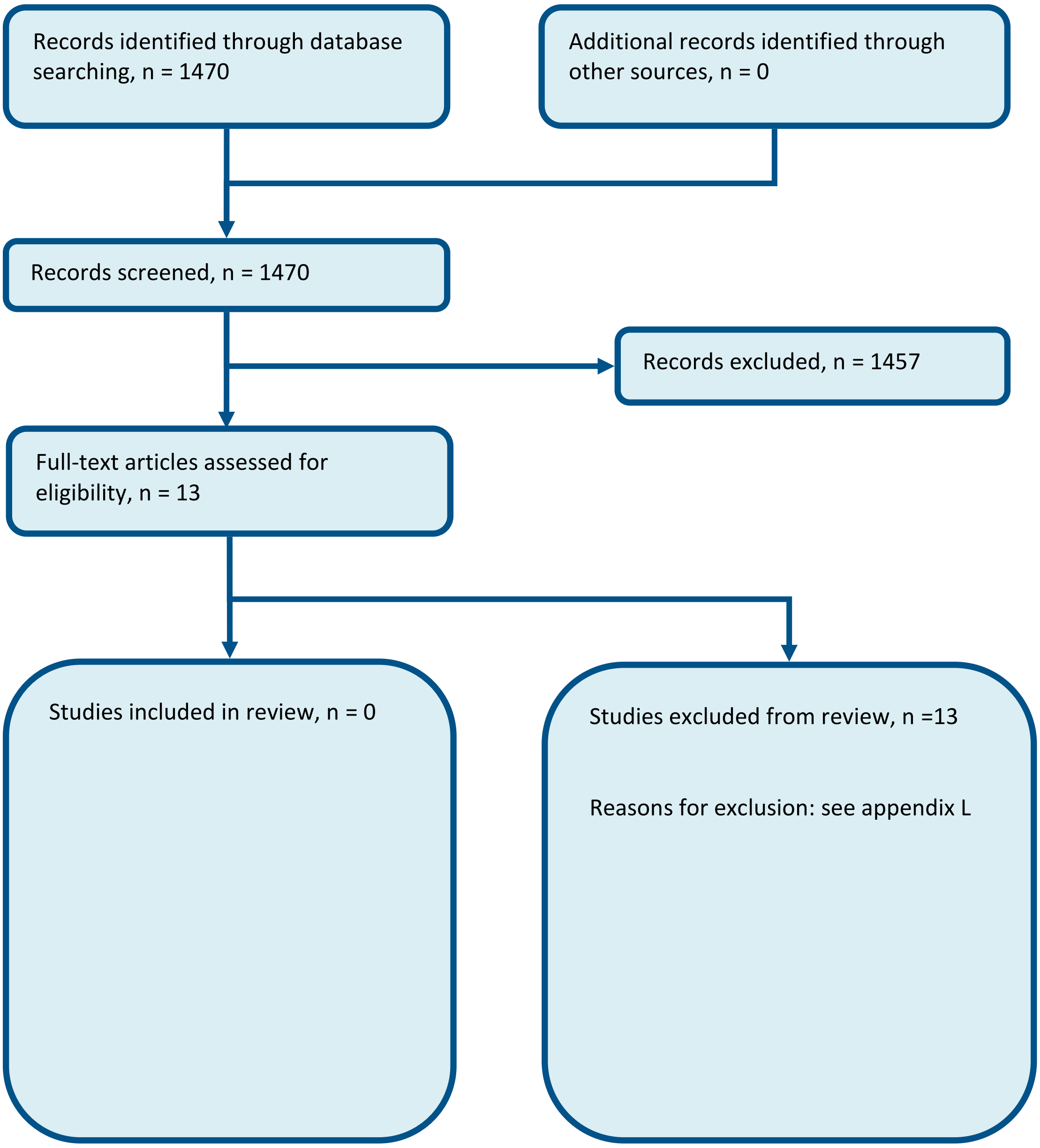
E.1.1 Urgent referral

Figure 1: Flow chart of clinical study selection for the review of signs and symptoms for urgent referral



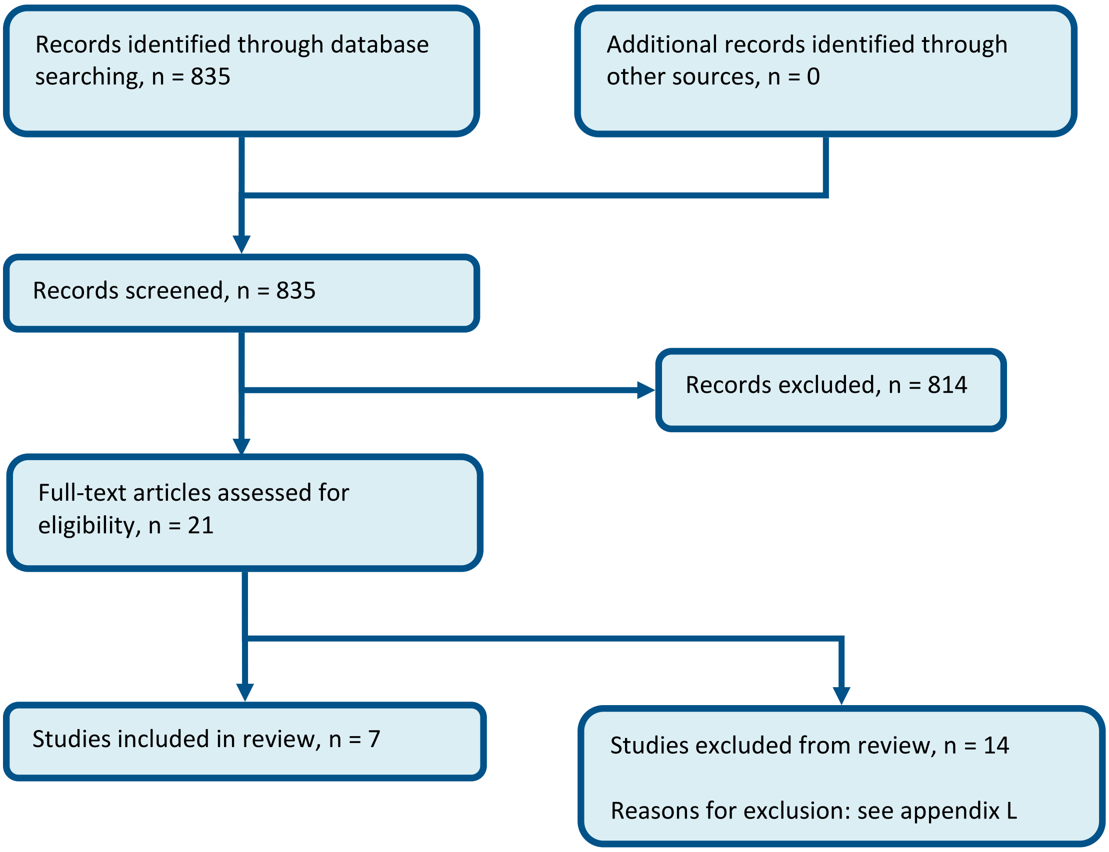
E.1.2 Routine referral

Figure 2: Flow diagram of article selection for the review of routine referral



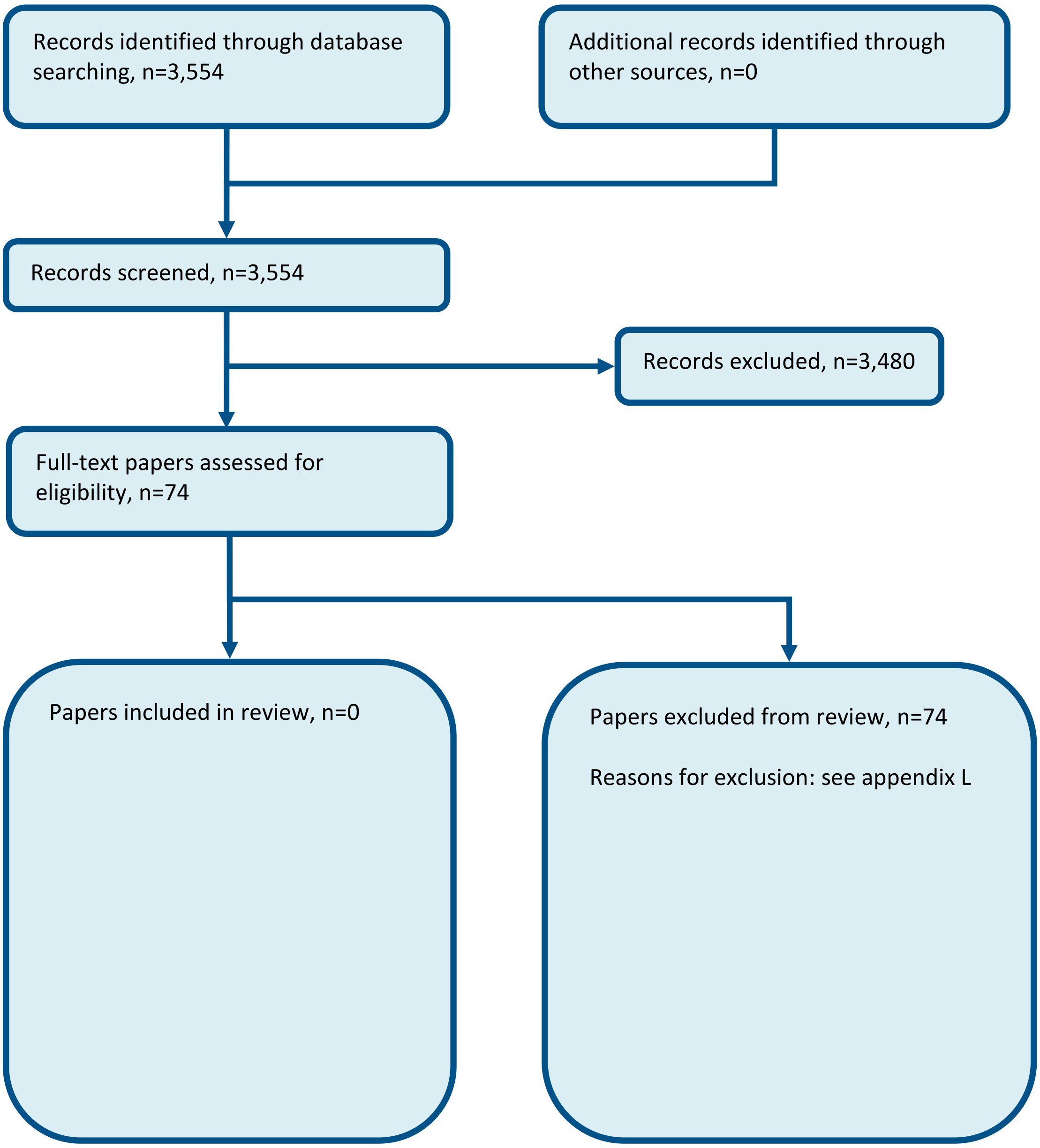
E.2 MRI

Figure 3: Flow diagram of article selection for the review of MRI to assess the underlying cause of hearing loss



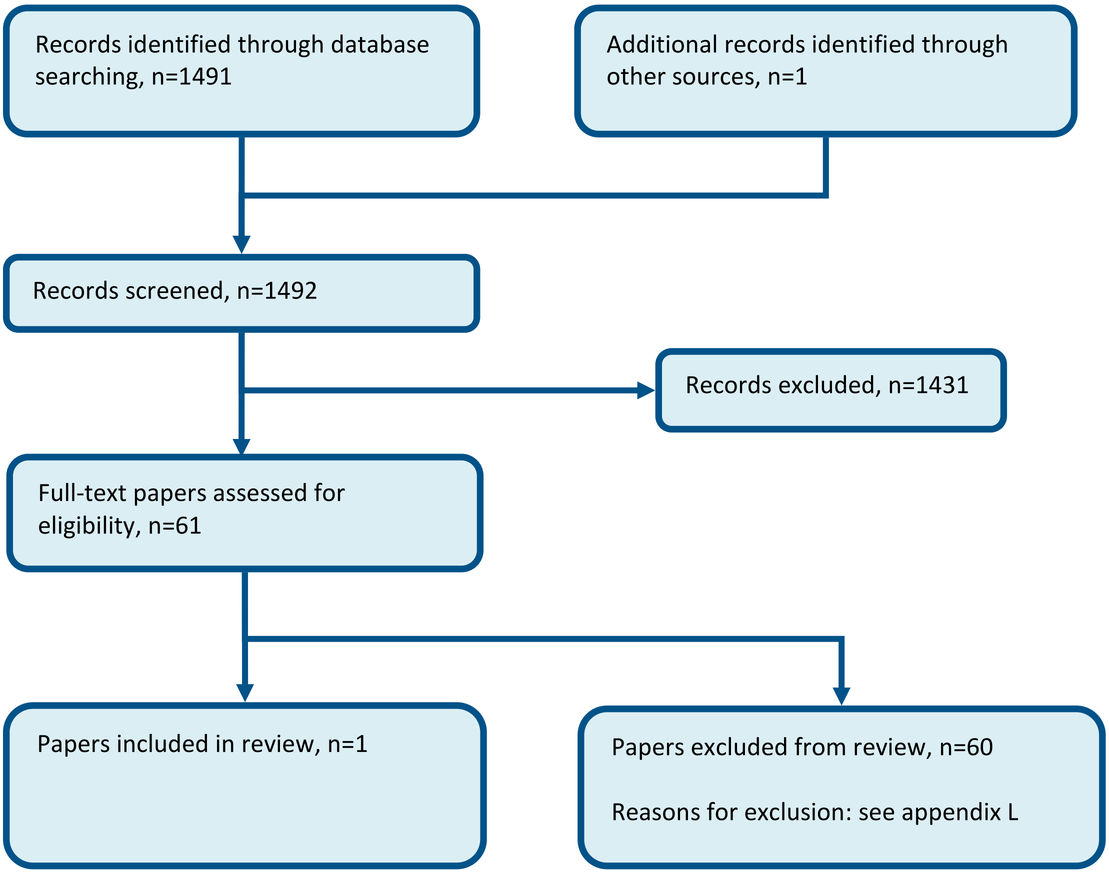
E.3 Subgroups

Figure 4: Flow chart of clinical study selection for the review of in whom to suspect hearing loss



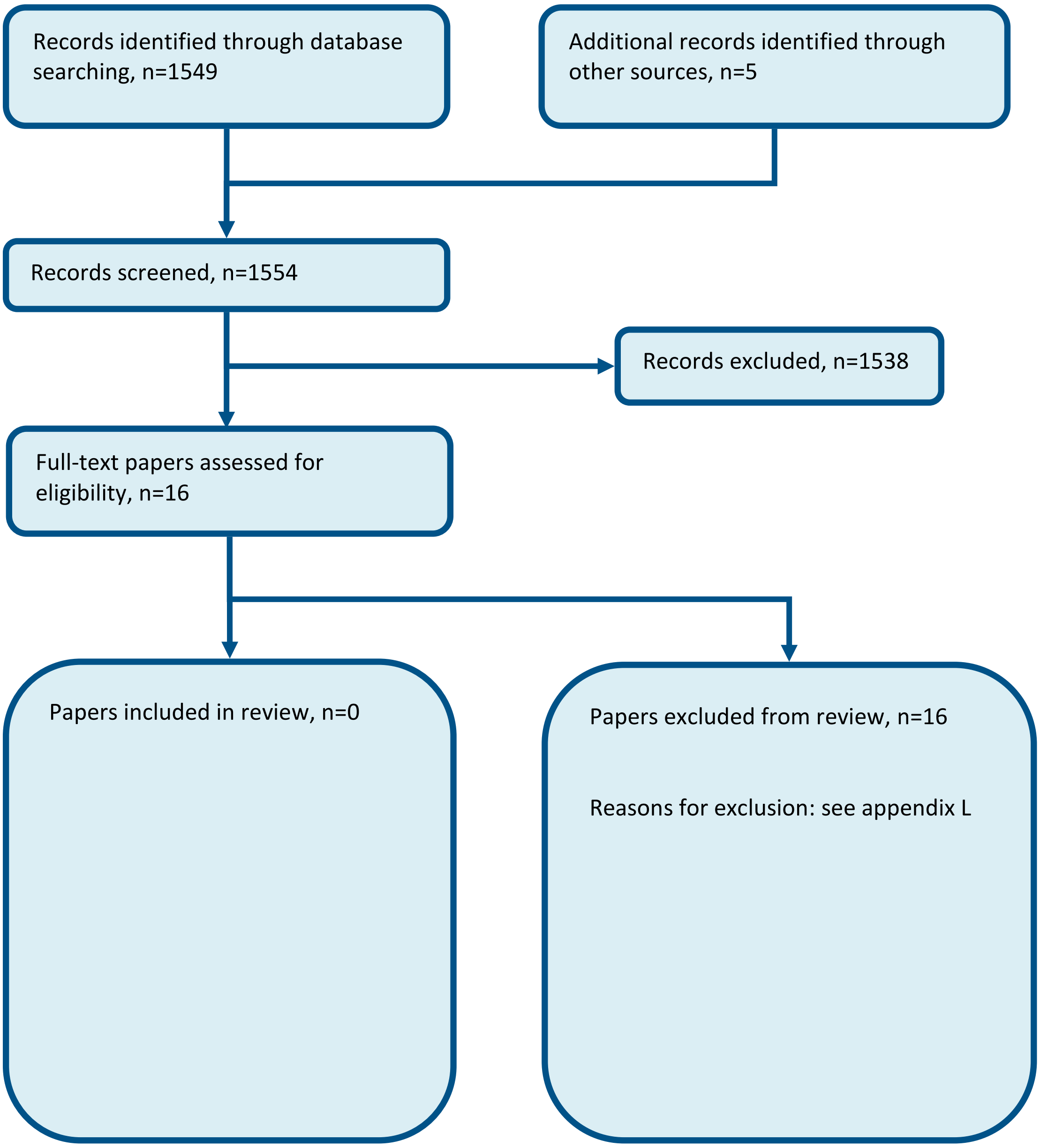
E.4 Early versus delayed management of hearing loss

Figure 5: Flow chart of clinical study selection for the review of early versus delayed management



E.5 Communication needs

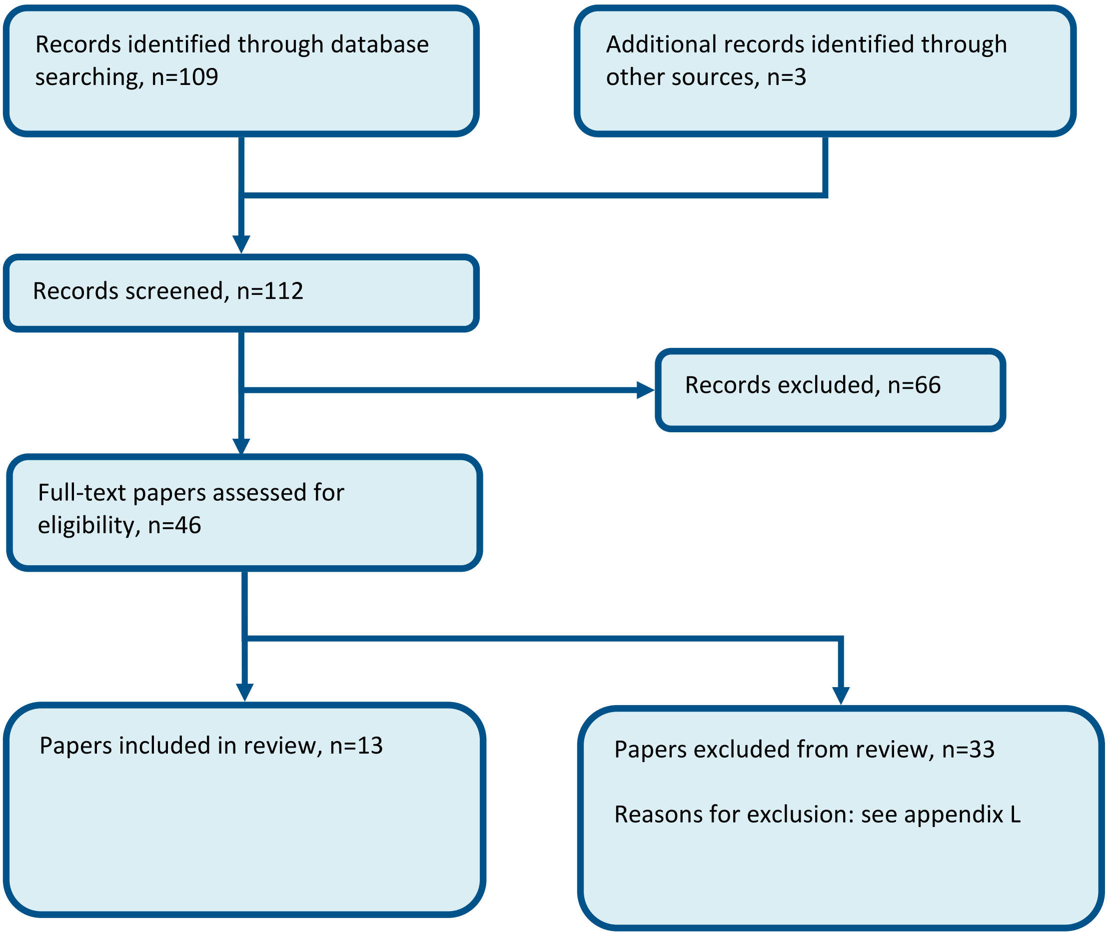
Figure 6: Flow chart of clinical study selection for the review of assessing hearing and communication needs



E.6 Management of earwax

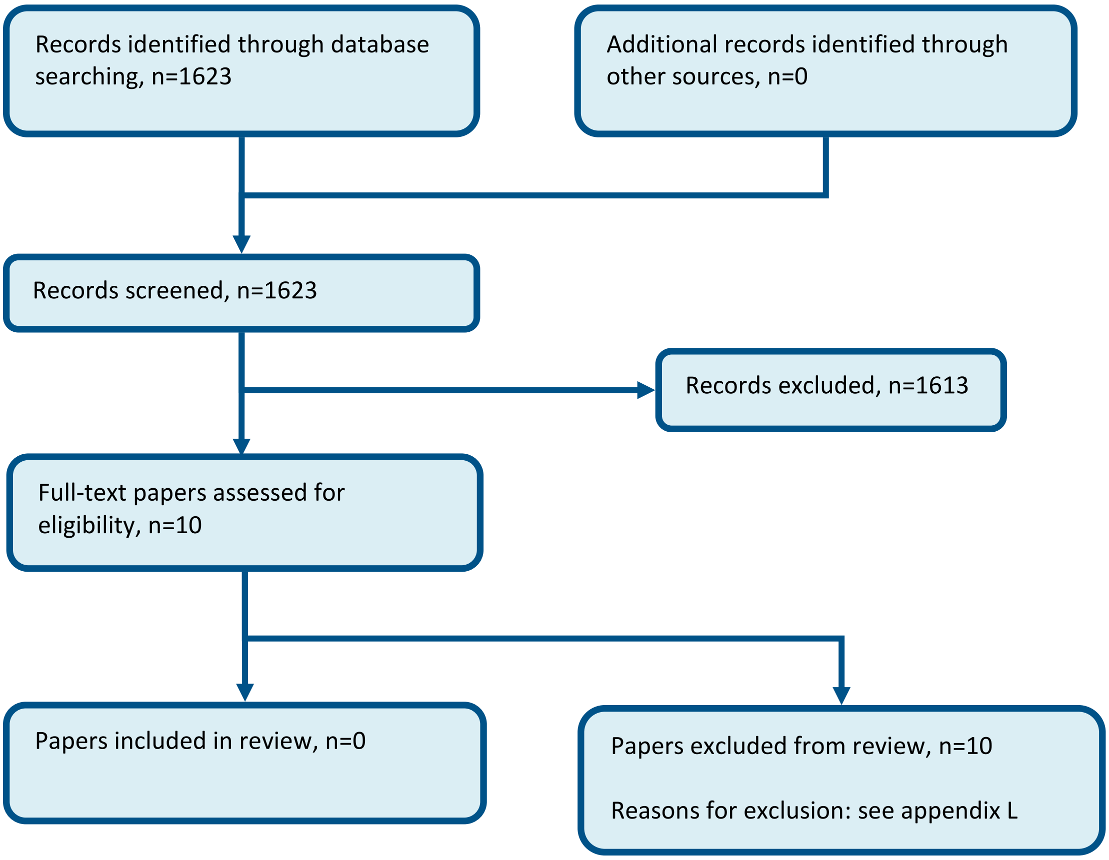
E.6.1 Treatment

Figure 7: Flow chart of clinical study selection for the review of management of earwax



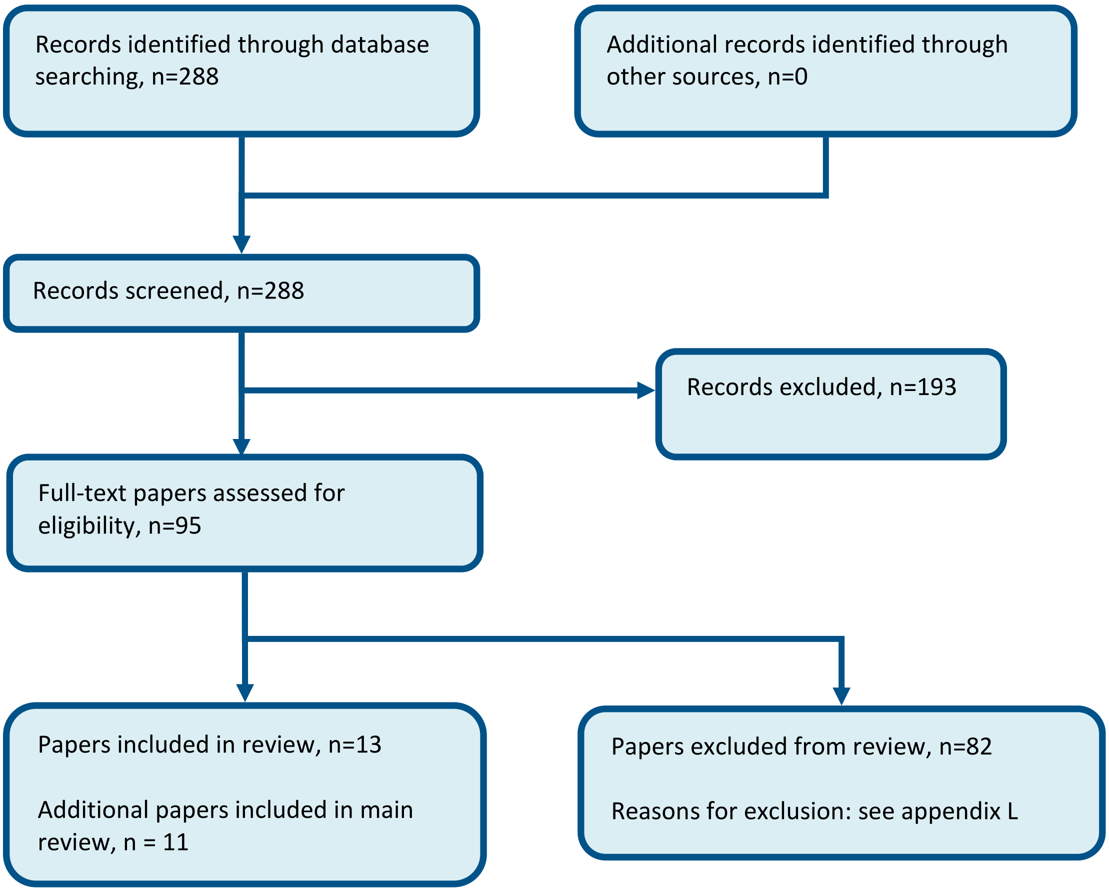
E.6.2 Settings

Figure 8: Flow chart of clinical study selection for the review of settings for the identification and treatment of earwax



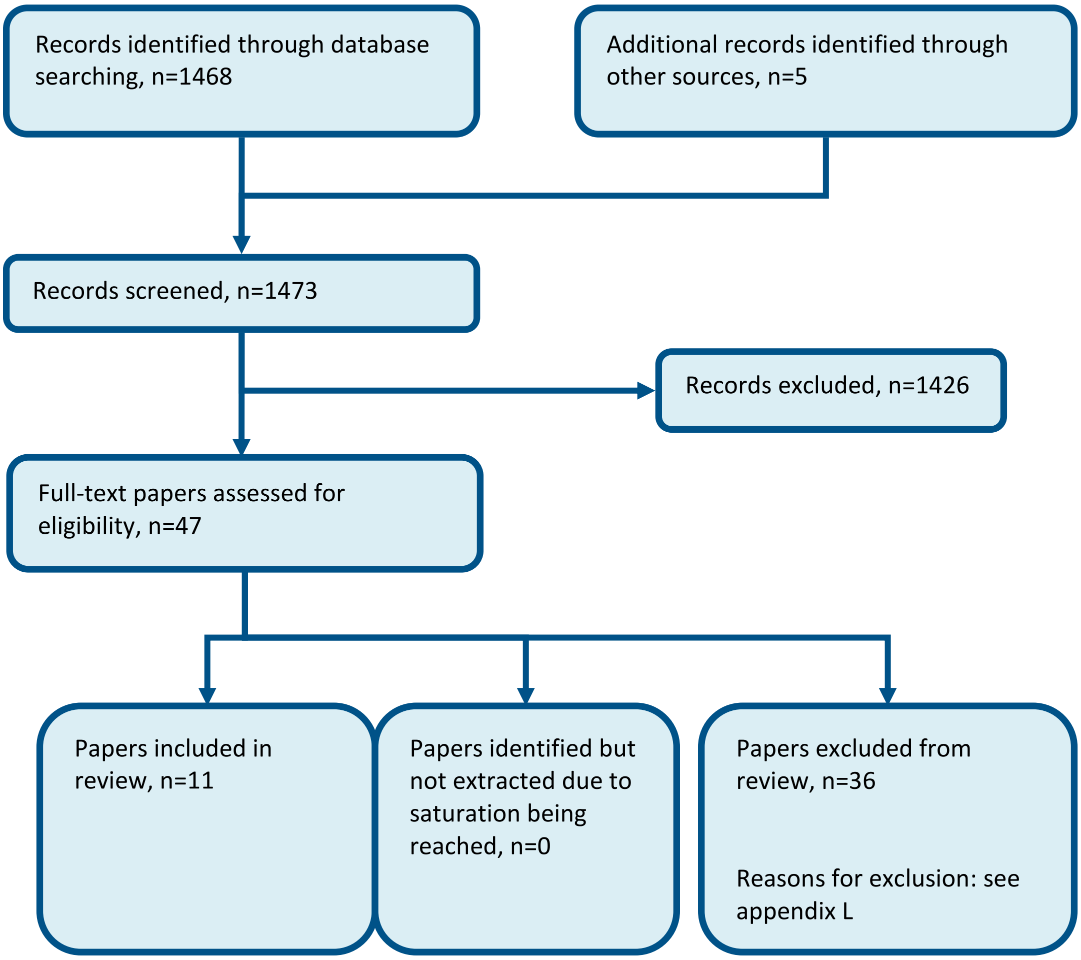
E.7 Sudden sensorineural hearing loss

Figure 9: Flow chart of clinical study selection for the review of idiopathic sudden sensorineural hearing loss treatment and routes of administration



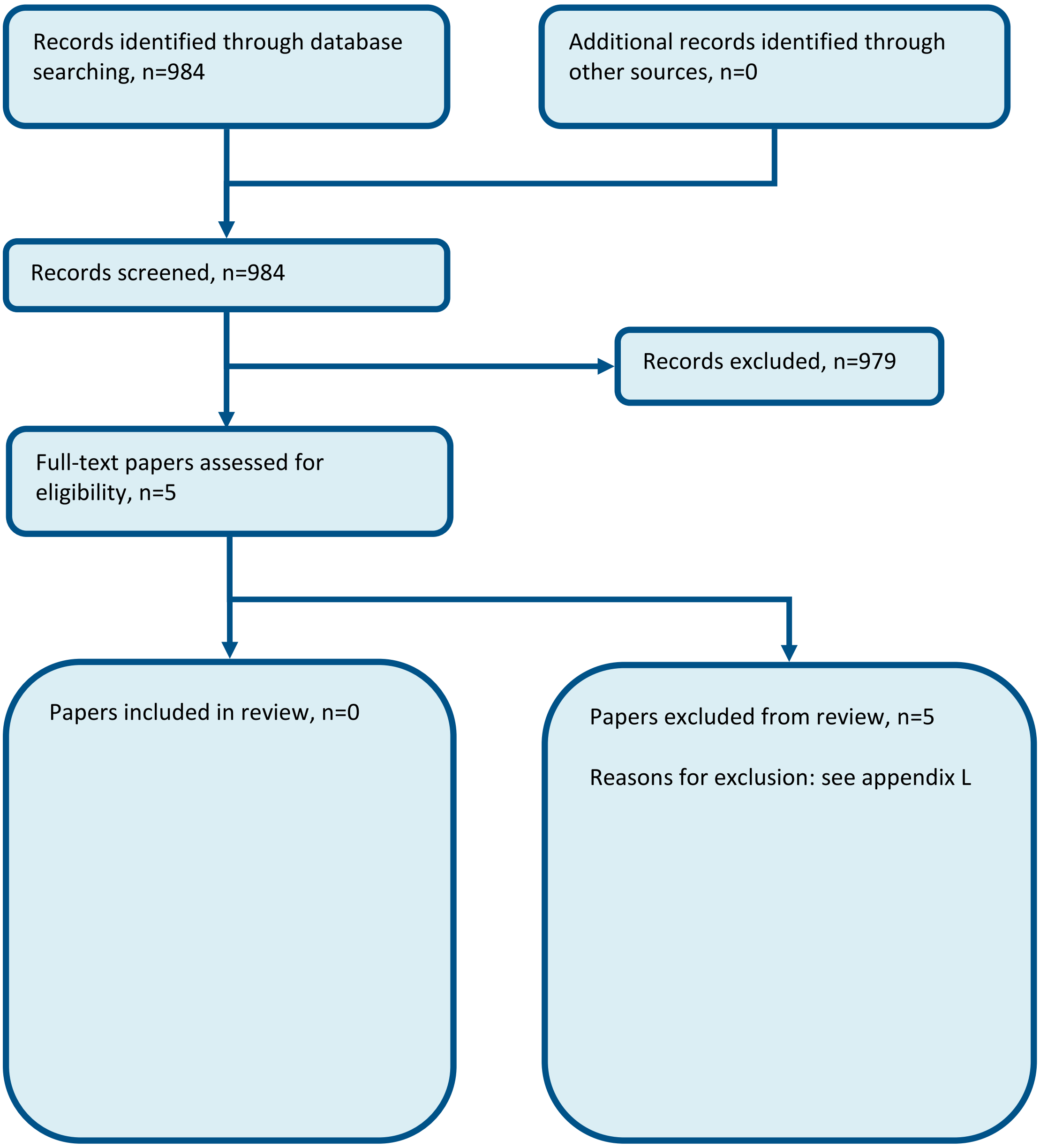
E.8 Information and advice

Figure 10: Flow chart of clinical study selection for the review of information, support and advice needs



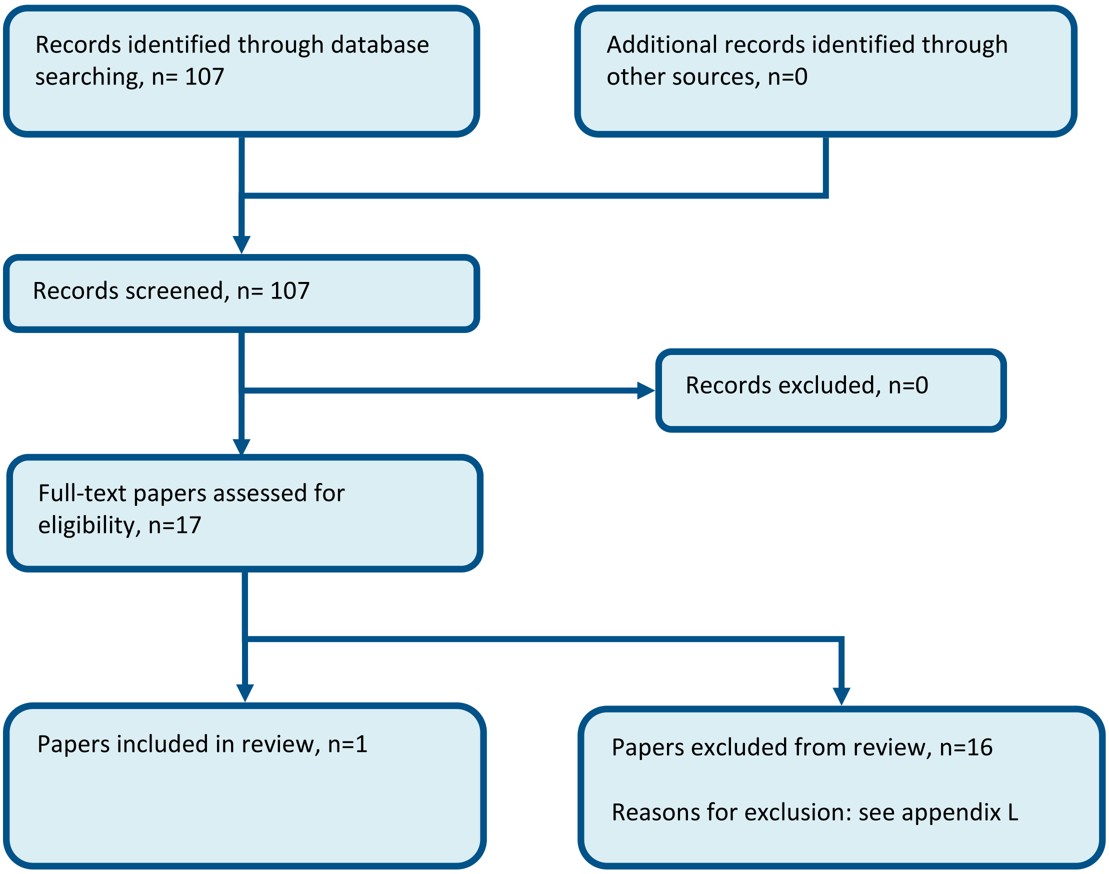
E.9 Decision tools

Figure 11: Flow chart of clinical study selection for the review of patient-centred decision tools



E.10 Assistive listening devices

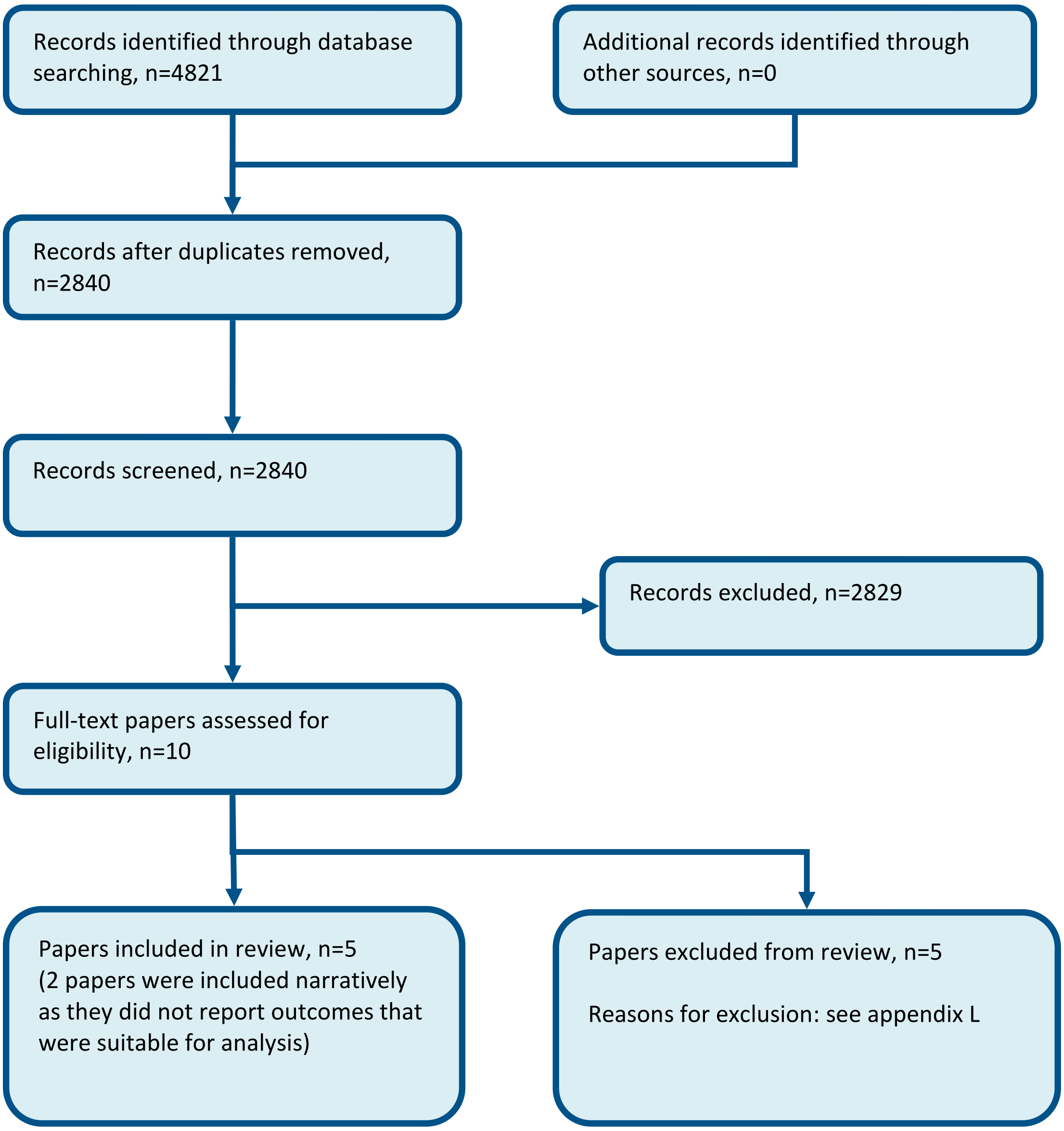
Figure 12: Flow chart of clinical study selection for the review of assistive listening devices



E.11 Hearing aids

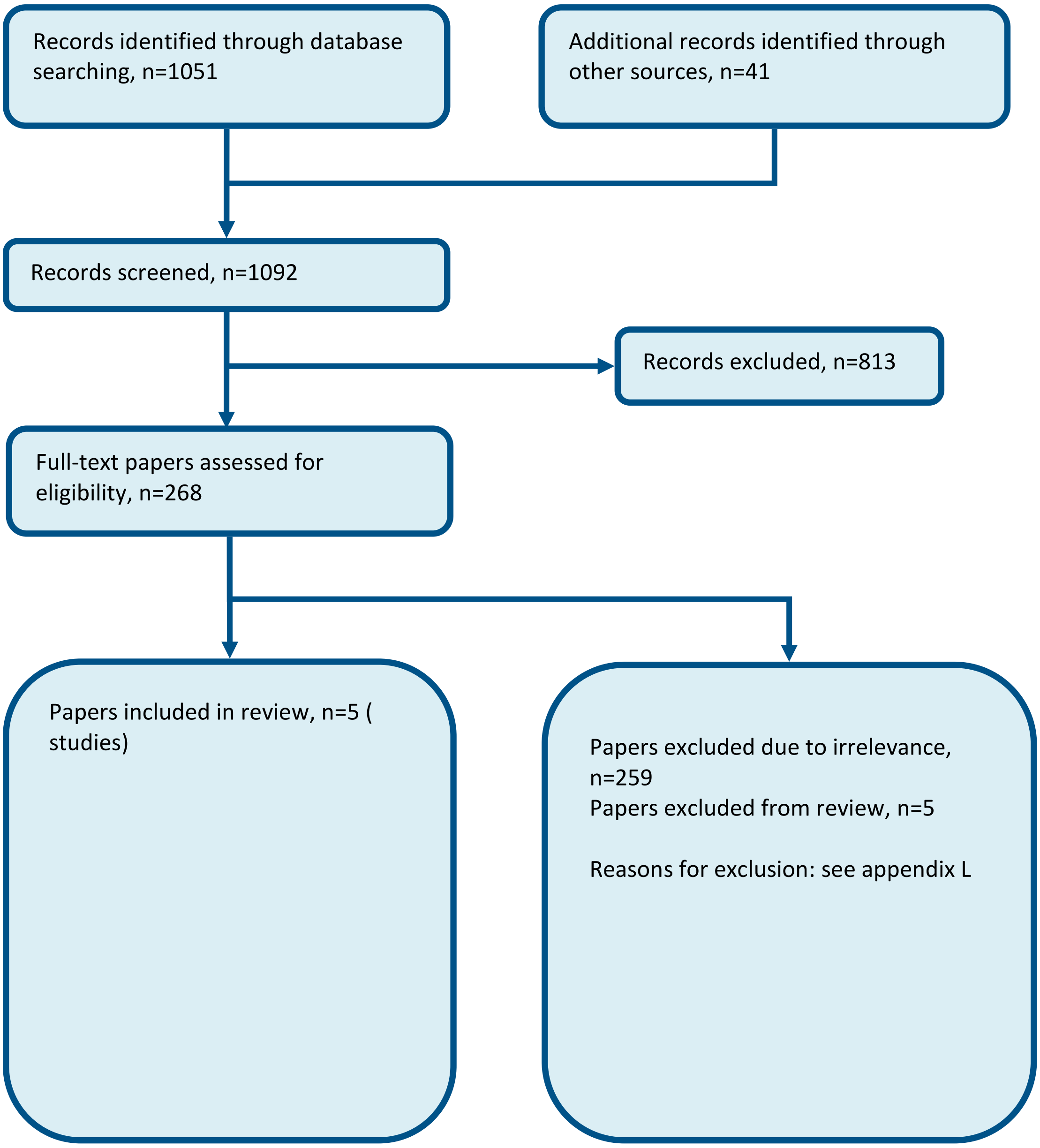
E.11.1 Hearing aids versus no hearing aids

Figure 13: Flow chart of clinical study selection for the review of hearing aids versus no hearing aids in adults with mild to moderate hearing loss



E.11.2 1 hearing aid versus 2 hearing aids

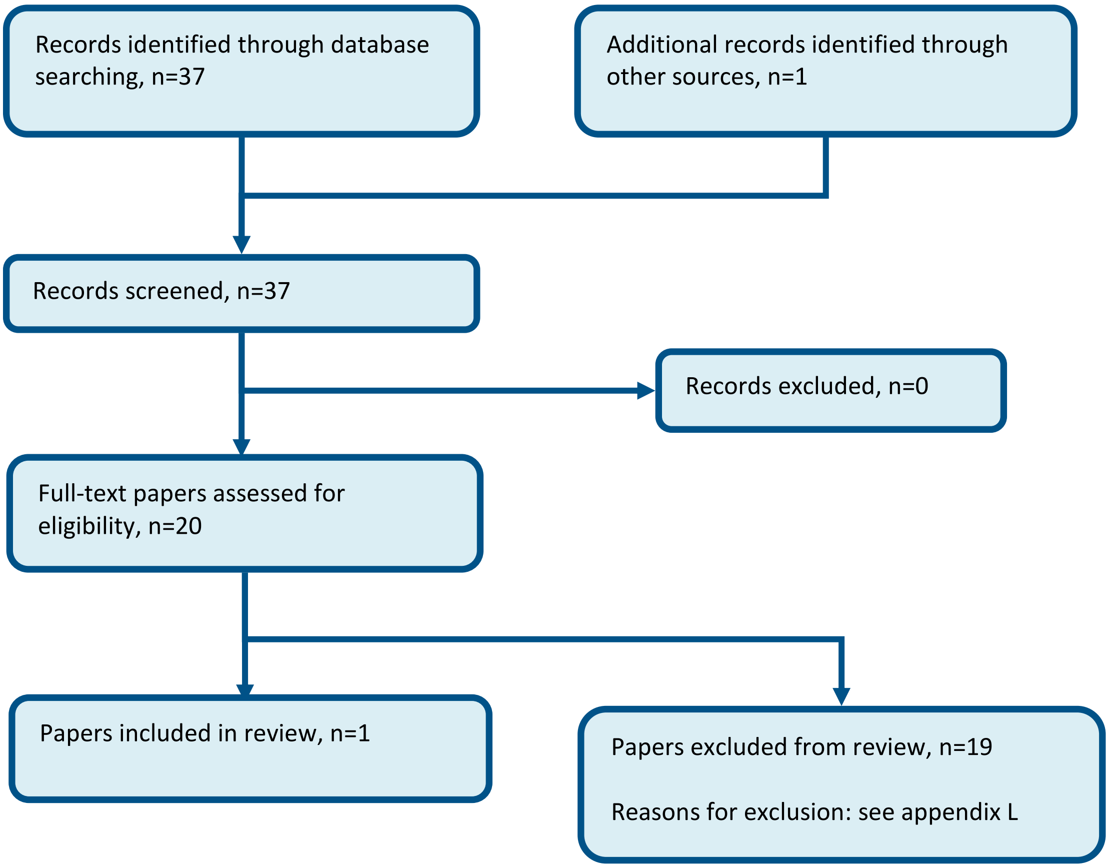
Figure 14: Flow chart of clinical study selection for the review of fitting 1 hearing aid versus fitting 2 hearing aids



E.12 Hearing aid microphones and noise reduction algorithms

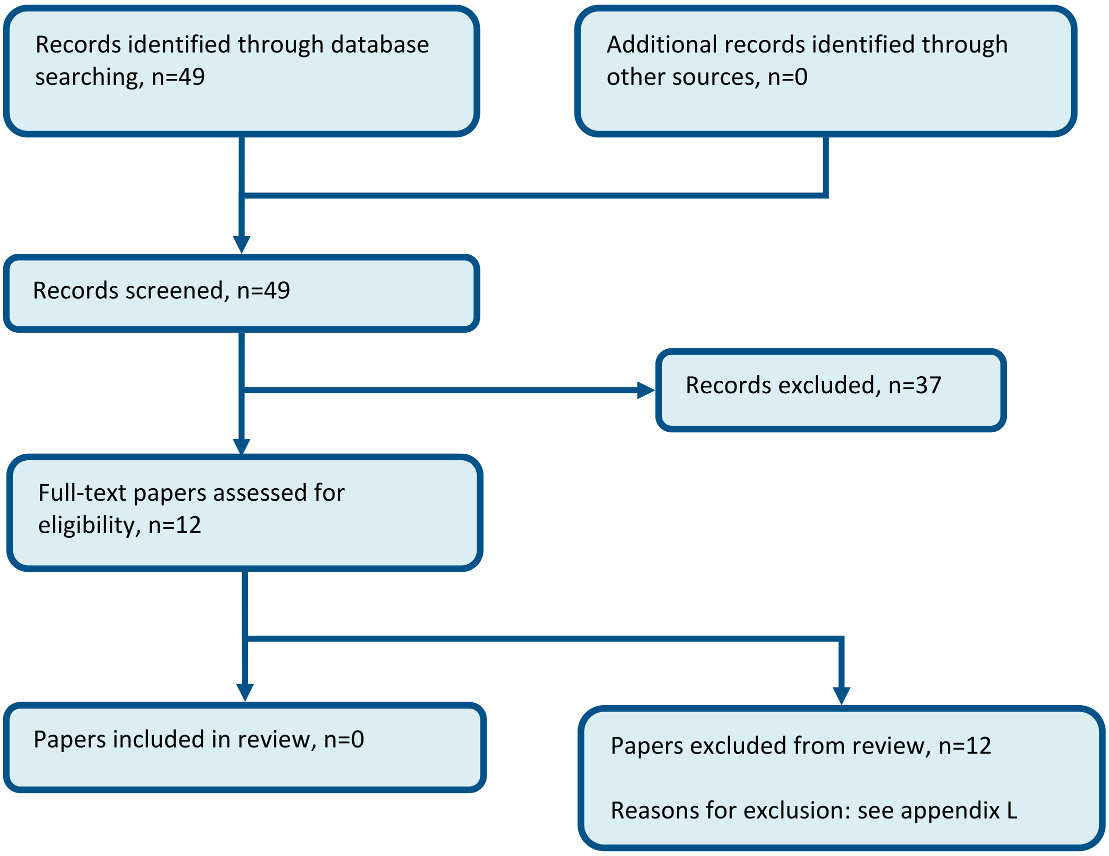
E.12.1 Microphones

Figure 15: Flow chart of clinical study selection for the review of directional versus omnidirectional microphones



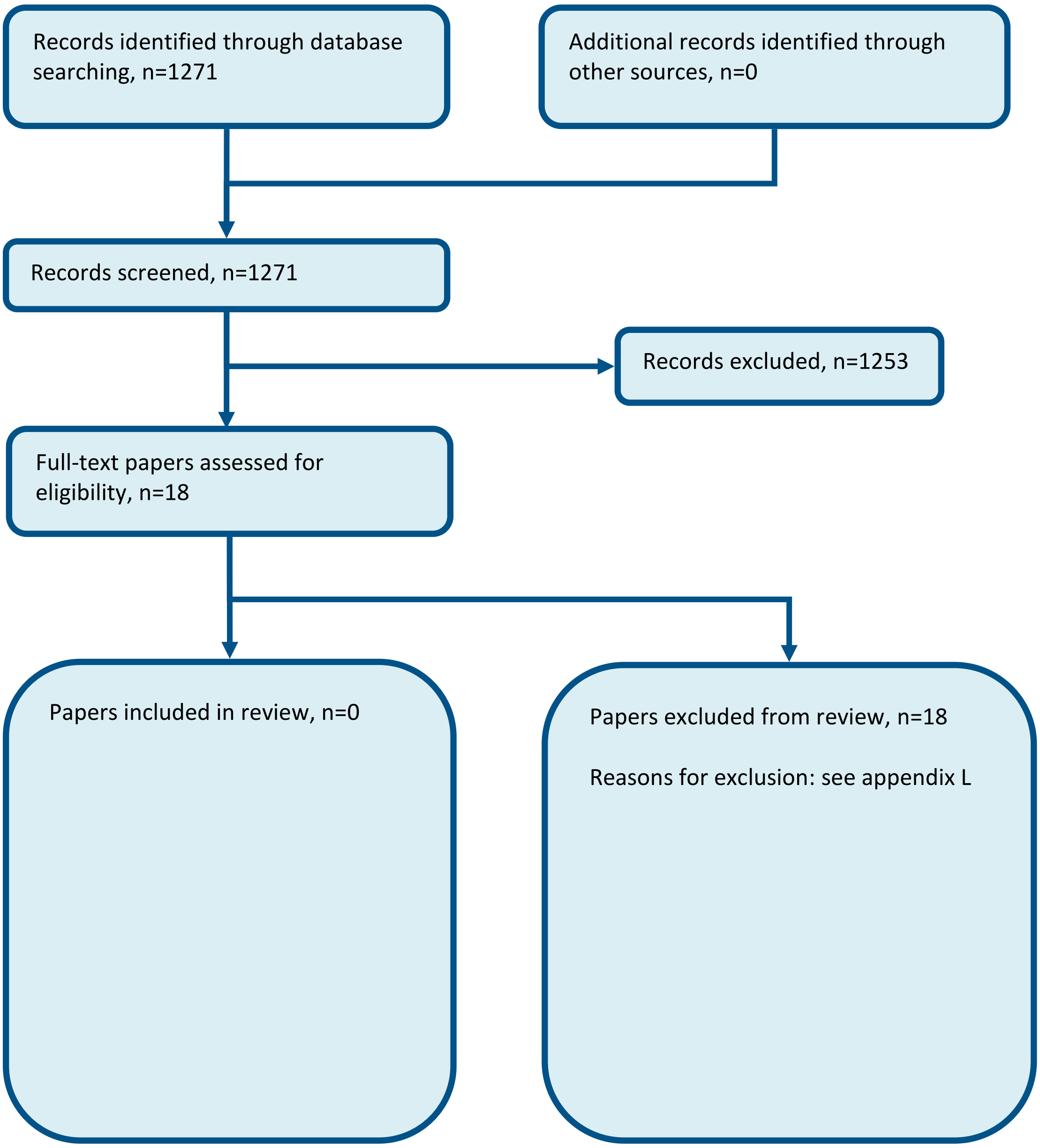
E.12.2 Noise reduction algorithms

Figure 16: Flow chart of clinical study selection for the review of noise reduction algorithms



38E.13 Monitoring and follow-up

Figure 17: Flow chart of clinical study selection for the review of monitoring and follow-up



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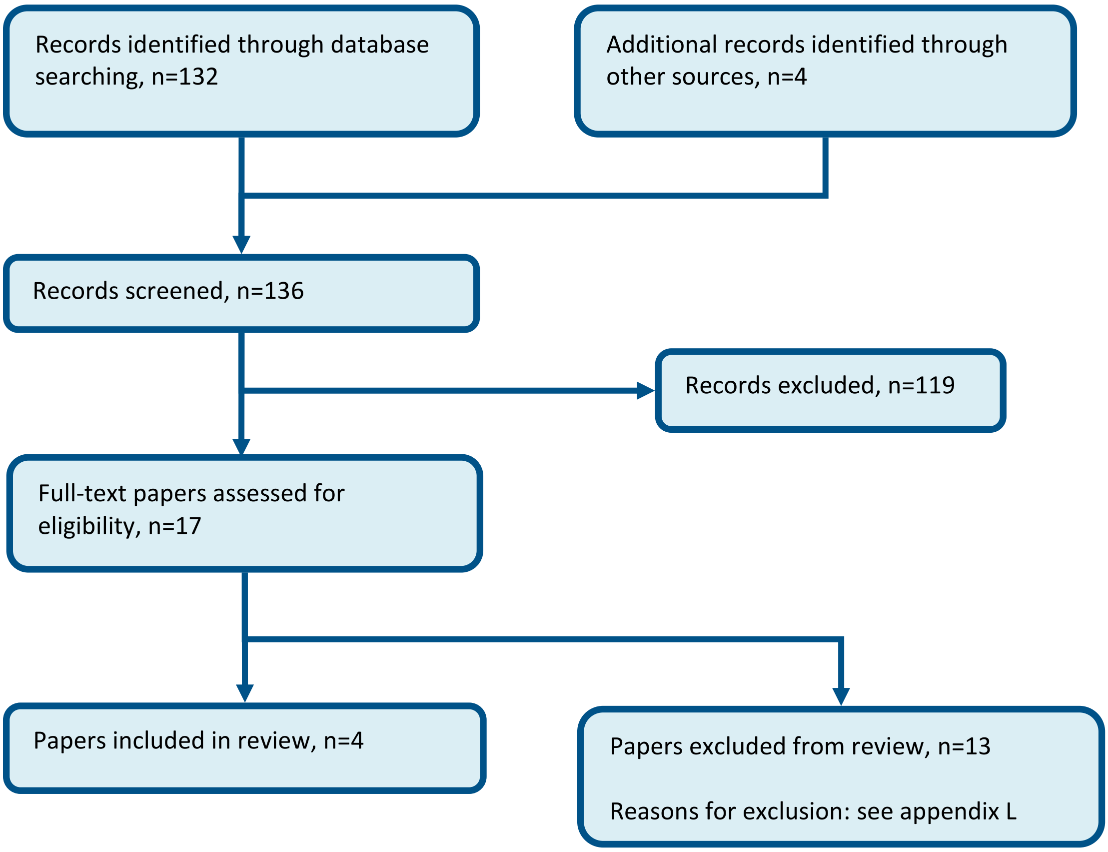
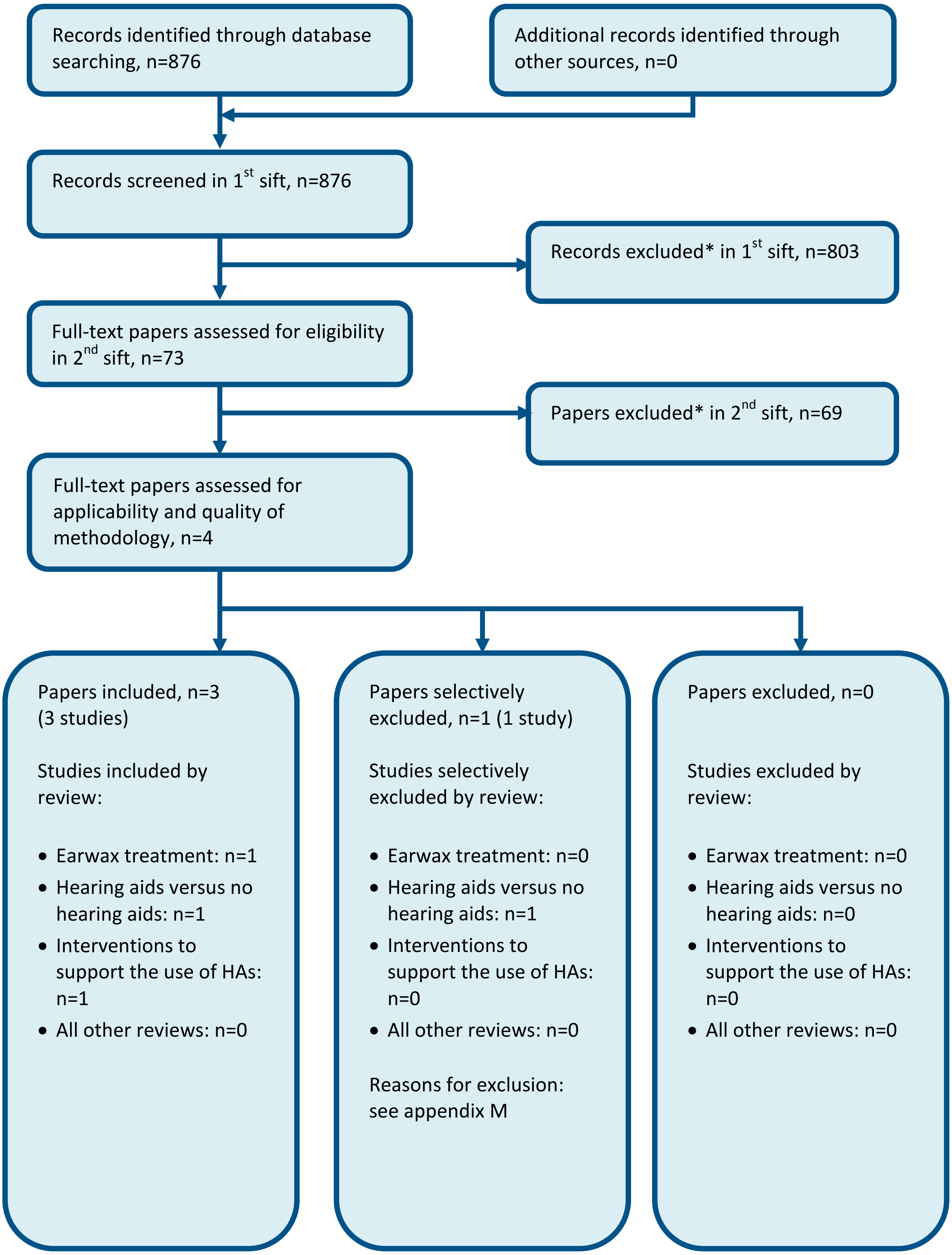
E.14 Interventions to support the use of hearing aids

Figure 18: Flow chart of clinical study selection for the review of interventions to support continuing use of hearing aids



Appendix F: Health economic study selection

Figure 19: Flow chart of health economic study selection for the hearing loss guideline



* Non-relevant population, intervention, comparison, design or setting; non-English language

Appendix G: Literature search strategies

G.1 Contents

Search strategies used for the Hearing loss guideline are outlined below and were run in accordance with the methodology in the NICE guidelines manual 2014, available from https://www.nice.org.uk/article/pmg20/. Clinical search cut off dates were between 3 October 2016 and 21 June 2017, please see section G.4 for specific dates. Any studies added to the databases after these date (even those published prior to this date) were not included unless specifically stated in the text. Where possible searches were limited to retrieve material published in English.

Searches for the **clinical reviews** were run in Medline (OVID), Embase (OVID) and the Cochrane Library (Wiley). Additional searches were run in CINAHL, Current Nursing and Allied Health Literature (EBSCO) and PsycINFO (ProQuest), see Table 22.

Searches for **intervention and diagnostic studies** were usually constructed using a PICO format where population (P) terms were combined with Intervention (I) and sometimes Comparison (C) terms. An intervention can be a drug, a procedure or a diagnostic test. Outcomes (O) are rarely used in search strategies for interventions. Search filters were also added to the search where appropriate.

Searches for **patient views** were run in Medline, Embase, CINAHL and PsycINFO. Searches were constructed by adding a patient views search filter to the population terms.

Table 22: Databases searched

Question	Question number	Databases
Aftercare	G.4.17	Medline, Embase, the Cochrane Library, CINAHL and PsycINFO
Assistive listening devices	G.4.16	Medline, Embase and the Cochrane Library
Communication needs	G.4.6	Medline, Embase and the Cochrane Library
Early versus delayed management	G.4.3	Medline, Embase and the Cochrane Library
Earwax	G.4.8	Medline, Embase and the Cochrane Library
Idiopathic sudden sensorineural hearing loss	G.4.14	Medline, Embase and the Cochrane Library
Information, support and advice	G.4.12	Medline, Embase, CINAHL and PsycINFO
Microphones	G.4.10	Medline, Embase and the Cochrane Library
Monitoring	G.4.15	Medline, Embase and the Cochrane Library
MRI imaging	G.4.7	Medline, Embase and the Cochrane Library
Noise reduction	G.4.11	Medline, Embase and the Cochrane Library
Patient-centred decision tools	G.4.9	Medline, Embase and the Cochrane Library
Settings	G.4.4	Medline, Embase and the Cochrane Library
Signs and symptoms (red flags)	G.4.2	Medline, Embase and the Cochrane Library
Signs and symptoms for non-urgent referral	G.4.5	Medline, Embase and the Cochrane Library
Suspected hearing loss	G.4.1	Medline, Embase and the Cochrane Library

Question	Question number	Databases
Unilateral versus bilateral hearing aids	G.4.13	Medline, Embase and the Cochrane Library

Searches for the health economic reviews were run in Medline, Embase, the NHS Economic Evaluations Database (NHS EED) and the Health Technology Assessment (HTA) database. NHS EED and HTA databases are hosted by the Centre for Research and Dissemination (CRD). NHS EED ceased to be updated after March 2015.

For Medline and Embase an economic filter (instead of a study type filter) was added to the same clinical search strategy. Searches in NHSEED and HTA were constructed using population terms only.

G.2 Population search strategies

G.2.1 Standard Hearing Loss population

The standard population was used for all questions except the following:

Intervention only terms were used: G.4.8, G.4.10 and G.4.11

A children only filter was applied: G.4.4

An alternative population for sudden onset hearing loss was used: G.4.14

Medline search terms

1.	exp hearing loss/
2.	(hearing adj2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral)).ti,ab.
3.	deaf*.ti,ab.
4.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*).ti,ab.
5.	persons with hearing impairments/
6.	or/1-5
7.	limit 6 to English language

Embase search terms

1.	exp *hearing impairment/
2.	(hearing adj2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral)).ti,ab.
3.	deaf*.ti,ab.
4.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*).ti,ab.
5.	or/1-4
6.	limit 5 to English language

Cochrane search terms

#1.	[mh "hearing loss"]
#2.	(hearing near/2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral)):ti,ab
#3.	deaf*:ti,ab
#4.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*):ti,ab
#5.	[mh ^"persons with hearing impairments"]
#6.	(or #1-#5)

CINAHL search terms

S1.	(mh "hearing disorders+")
S2.	deaf*
S3.	(hearing n2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral))
S4.	hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*
S5.	S1 or S2 or S3 or S4
	Limiters: English language, exclude Medline records

PsycINFO search terms

1.	su.exact.explode("hearing disorders") or ti,ab(deaf*) or ti,ab(hypoacus* or sociocus* or presbycus* or presbyacus*or nosocus* or anacus*) or ti,ab(hearing n/2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one-side* or unilateral))

CRD search terms

#1.	MeSH descriptor hearing loss explode all trees in NHSEED, HTA
#2.	((hearing adj2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral))) in nhseed, hta
#3.	(deaf*) in nhseed, hta
#4.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*) in nhseed, hta
#5.	MeSH descriptor persons with hearing impairments in NHSEED, HTA
#6.	#1 or #2 or #3 or #4 or #5

G.3 Study filter search terms

G.3.1 Excluded study designs and publication types

The following study designs and publication types were removed from retrieved results using the NOT operator.

Medline search terms

1.	letter/
2.	editorial/
3.	news/
4.	exp historical article/
5.	anecdotes as topic/
6.	comment/
7.	case report/
8.	(letter or comment*).ti.
9.	or/1-8
10.	randomized controlled trial/ or random*.ti,ab.
11.	9 not 10
12.	animals/ not humans/
13.	exp animals, laboratory/
14.	exp animal experimentation/
15.	exp models, animal/
16.	exp rodentia/

17.	(rat or rats or mouse or mice).ti.
18.	or/11-17

Embase search terms

1.	letter.pt. or letter/
2.	note.pt.
3.	editorial.pt.
4.	case report/ or case study/
5.	(letter or comment*).ti.
6.	or/1-5
7.	randomized controlled trial/ or random*.ti,ab.
8.	6 not 7
9.	animal/ not human/
10.	nonhuman/
11.	exp animal experiment/
12.	exp experimental animal/
13.	animal model/
14.	exp rodent/
15.	(rat or rats or mouse or mice).ti.
16.	or/8-15

CINAHL search terms

S1.	pt anecdote or pt audiovisual or pt bibliography or pt biography or pt book or pt book review or pt brief item or pt cartoon or pt commentary or pt computer program or pt editorial or pt games or pt glossary or pt historical material or pt interview or pt letter or pt listservs or pt masters thesis or pt obituary or pt pamphlet or pt pamphlet chapter or pt pictorial or pt poetry or pt proceedings or pt “questions and answers” or pt response or pt software or pt teaching materials or pt website

G.3.2 Randomised controlled trials (RCT)

Medline search terms

(Based on the sensitivity and precision maximising version reported in the Cochrane Handbook (http://handbook.cochrane.org/)).

1.	randomized controlled trial.pt.
2.	controlled clinical trial.pt.
3.	randomi#ed.ti,ab.
4.	placebo.ab.
5.	randomly.ab.ti
6.	clinical trials as topic.sh.
7.	trial.ti.
8.	or/1-7

Embase search terms

1.	random*.ti,ab.
2.	factorial*.ti,ab.
3.	(crossover* or cross over*).ti,ab.

4.	((doubl* or singl*) adj blind*).ti,ab.
5.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
6.	crossover procedure/
7.	double blind procedure/
8.	single blind procedure/
9.	randomized controlled trial/
10.	or/1-9

51 **PsycINFO search terms**

1.	(su.exact.explode("clinical trials") or ti,ab((clinical or control*) near/3 trial*) or ti,ab((singl* or doubl* or trebl* or tripl*) near/5 (blind* or mask*)) or ti,ab(volunteer* or control-group or controls) or su.exact("placebo") or ti,ab(placebo*))

52 G.3.3 Systematic reviews (SR)

53 **Medline search terms**

1.	meta-analysis/
2.	meta-analysis as topic/
3.	(meta analy* or metanaly* or metaanaly*).ti,ab.
4.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
5.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
6.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
7.	(search* adj4 literature).ab.
8.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
9.	cochrane.jw.
10.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
11.	or/1-10

54 **Embase search terms**

1.	systematic review/
2.	meta-analysis/
3.	(meta analy* or metanaly* or metaanaly*).ti,ab.
4.	((systematic or evidence) adj3 (review* or overview*)).ti,ab.
5.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
6.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
7.	(search* adj4 literature).ab.
8.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
9.	cochrane.jw.
10.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
11.	or/1-10

55 **PsycINFO search terms**

1.	((su.exact("literature review") or rtype(review) or ti(review) or me(literature review)) and (ti,ab(systematic or evidence or methodol* or quantitative*))) or (su.exact("meta analysis") or ti,ab(meta-analys* or metanalys* or metaanalys* or meta analys*) or ti,ab((systematic or evidence* or methodol* or quantitative*) near/3 (review* or overview*)) or ti,ab((pool* or combined or combining) near/2 (data or trials or studies or results)) or rtype(systematic or

	meta*) or me(meta analysis or systematic review))

G.3.4 Health economic studies (HE)

Medline search terms

1.	economics/
2.	value of life/
3.	exp "costs and cost analysis"/
4.	exp economics, hospital/
5.	exp economics, medical/
6.	economics, nursing/
7.	economics, pharmaceutical/
8.	exp "fees and charges"/
9.	exp budgets/
10.	budget*.ti,ab.
11.	cost*.ti.
12.	(economic* or pharmaco?economic*).ti.
13.	(price* or pricing*).ti,ab.
14.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
15.	(financ* or fee or fees).ti,ab.
16.	(value adj2 (money or monetary)).ti,ab.
17.	or/1-16

Embase search terms

1.	health economics/
2.	exp economic evaluation/
3.	exp health care cost/
4.	exp fee/
5.	budget/
6.	funding/
7.	budget*.ti,ab.
8.	cost*.ti.
9.	(economic* or pharmaco?economic*).ti.
10.	(price* or pricing*).ti,ab.
11.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
12.	(financ* or fee or fees).ti,ab.
13.	(value adj2 (money or monetary)).ti,ab.
14.	or/1-13

G.3.5 Quality of life studies (QoL)

Medline search terms

1.	quality-adjusted life years/
2.	sickness impact profile/
3.	(quality adj2 (wellbeing or well-being)).ti,ab.
4.	sickness impact profile.ti,ab.
5.	disability adjusted life.ti,ab.

6.	(qal* or qtime* or qwb* or daly*).ti,ab.
7.	(euroqol* or eq5d* or eq 5d*).ti,ab.
8.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
9.	(health utility* or utility score* or disutilit*).ti,ab.
10.	(hui or hui1 or hui2 or hui3).ti,ab.
11.	health* year* equivalent*.ti,ab.
12.	(hye or hyes).ti,ab.
13.	rosser.ti,ab.
14.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
15.	(sf36 or sf 36 or short form 36 or shortform 36 or shortform36).ti,ab.
16.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
17.	(sf12 or sf 12 or short form 12 or shortform 12 or shortform12).ti,ab.
18.	(sf8 or sf 8 or short form 8 or shortform 8 or shortform8).ti,ab.
19.	(sf6 or sf 6 or short form 6 or shortform 6 or shortform6).ti,ab.
20.	or/1-19

Embase search terms

1.	quality adjusted life year/
2.	"quality of life index"/
3.	short form 12/ or short form 20/ or short form 36/ or short form 8/
4.	sickness impact profile/
5.	(quality adj2 (wellbeing or well-being)).ti,ab.
6.	sickness impact profile.ti,ab.
7.	disability adjusted life.ti,ab.
8.	(qal* or qtime* or qwb* or daly*).ti,ab.
9.	(euroqol* or eq5d* or eq 5d*).ti,ab.
10.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
11.	(health utility* or utility score* or disutilit*).ti,ab.
12.	(hui or hui1 or hui2 or hui3).ti,ab.
13.	health* year* equivalent*.ti,ab.
14.	(hye or hyes).ti,ab.
15.	rosser.ti,ab.
16.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
17.	(sf36 or sf 36 or short form 36 or shortform 36 or shortform36).ti,ab.
18.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
19.	(sf12 or sf 12 or short form 12 or shortform 12 or shortform12).ti,ab.
20.	(sf8 or sf 8 or short form 8 or shortform 8 or shortform8).ti,ab.
21.	(sf6 or sf 6 or short form 6 or shortform 6 or shortform6).ti,ab.
22.	or/1-21

G.3.6 Economic Modelling (MOD)

Embase search terms

1.	statistical model/
2.	exp economic aspect/
3.	24 and 25

4.	*theoretical model/
5.	*nonbiological model/
6.	stochastic model/
7.	decision theory/
8.	decision tree/
9.	monte carlo method/
10.	(markov* or monte carlo).ti,ab.
11.	econom* model*.ti,ab.
12.	(decision* adj2 (tree* or analy* or model*)).ti,ab.
13.	or/1-12

64 **Medline search terms**

1.	exp models, economic/
2.	*models, theoretical/
3.	*models, organizational/
4.	markov chains/
5.	monte carlo method/
6.	exp decision theory/
7.	(markov* or monte carlo).ti,ab.
8.	econom* model*.ti,ab.
9.	(decision* adj2 (tree* or analy* or model*)).ti,ab.
10.	or/1-9

65 G.3.7 Diagnostic test accuracy studies (DIAG)

66 **Medline search terms**

14.	exp "sensitivity and specificity"/
15.	(sensitivity or specificity).ti,ab.
16.	((pre test or pretest or post test) adj probability).ti,ab.
17.	(predictive value* or ppv or npv).ti,ab.
18.	likelihood ratio*.ti,ab.
19.	likelihood function/
20.	(roc curve* or auc).ti,ab.
21.	(diagnos* adj3 (performance* or accurac* or utilit* or value* or efficien* or effectiveness)).ti,ab.
22.	gold standard.ab.
23.	or/1-9

67 **Embase search terms**

11.	exp "sensitivity and specificity"/
12.	(sensitivity or specificity).ti,ab.
13.	((pre test or pretest or post test) adj probability).ti,ab.
14.	(predictive value* or ppv or npv).ti,ab.
15.	likelihood ratio*.ti,ab.
16.	(roc curve* or auc).ti,ab.
17.	(diagnos* adj3 (performance* or accurac* or utilit* or value* or efficien* or effectiveness)).ti,ab.

18.	diagnostic accuracy/
19.	diagnostic test accuracy study/
20.	gold standard.ab.
21.	or/1-10

68 G.3.8 Observational studies (OBS)

69 **Medline search terms**

1.	epidemiologic studies/
2.	observational study/
3.	exp cohort studies/
4.	(cohort adj (study or studies or analys* or data)).ti,ab.
5.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
6.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
7.	controlled before-after studies/
8.	historically controlled study/
9.	interrupted time series analysis/
10.	(before adj2 after adj2 (study or studies or data)).ti,ab.
11.	or/1-10
12.	exp case control study/
13.	case control*.ti,ab.
14.	or/12-13
15.	cross-sectional studies/
16.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
17.	or/15-16
18.	11 or 14 or 17

70 **Embase search terms**

1.	clinical study/
2.	observational study/
3.	family study/
4.	longitudinal study/
5.	retrospective study/
6.	prospective study/
7.	cohort analysis/
8.	follow-up/
9.	cohort*.ti,ab.
10.	8 and 9
11.	(cohort adj (study or studies or analys* or data)).ti,ab.
12.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
13.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
14.	(before adj2 after adj2 (study or studies or data)).ti,ab.
15.	or/1-7,10-14

16.	exp case control study/
17.	case control*.ti,ab.
18.	or/16-17
19.	cross-sectional study/
20.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
21.	or/19-20
22.	15 or 18 or 21

71 G.3.9 Qualitative reviews (QUAL)

72 **Medline search terms**

1.	qualitative research/ or narration/ or exp interviews as topic/ or exp questionnaires/ or health care surveys/
2.	(qualitative or interview* or focus group* or theme* or questionnaire* or survey*).ti,ab.
3.	(metasynthes* or meta-synthes* or metasummar* or meta-summar* or metastud* or meta-stud* or metathem* or meta-them* or ethno* or emic or etic or phenomenolog* or grounded theory or constant compar* or (thematic* adj3 analys*) or theoretical sampl* or purposive sampl* or hermeneutic* or heidegger* or husserl* or colaizzi* or van kaam* or van manen* or giorgi* or glaser* or strauss* or ricoeur* or spiegelberg* or merleau*).ti,ab.
4.	or/1-3

73 **Embase search terms**

1.	health survey/ or exp questionnaire/ or exp interview/ or qualitative research/ or narrative/
2.	(qualitative or interview* or focus group* or theme* or questionnaire* or survey*).ti,ab.
3.	(metasynthes* or meta-synthes* or metasummar* or meta-summar* or metastud* or meta-stud* or metathem* or meta-them* or ethno* or emic or etic or phenomenolog* or grounded theory or constant compar* or (thematic* adj3 analys*) or theoretical sampl* or purposive sampl* or hermeneutic* or heidegger* or husserl* or colaizzi* or van kaam* or van manen* or giorgi* or glaser* or strauss* or ricoeur* or spiegelberg* or merleau*).ti,ab.
4.	or/1-3

74 **CINAHL search terms**

S1.	(mh "qualitative studies+")
S2.	(mh "qualitative validity+")
S3.	(mh "interviews+") or (mh "focus groups") or (mh "surveys") or (mh "questionnaires+")
S4.	(qualitative or interview* or focus group* or theme* or questionnaire* or survey*)
S5.	(metasynthes* or meta-synthes* or metasummar* or meta-summar* or metastud* or meta-stud* or metathem* or meta-them* or ethno* or emic or etic or phenomenolog* or grounded theory or constant compar* or (thematic* adj3 analys*) or theoretical sampl* or purposive sampl* or hermeneutic* or heidegger* or husserl* or colaizzi* or van kaam* or van manen* or giorgi* or glaser* or strauss* or ricoeur* or spiegelberg* or merleau*)
S6.	S1 or S2 or S3 or S4 or S5

75 **PsycINFO search terms**

1.	((su.exact.explode("qualitative research") or su.exact("narratives") or su.exact.explode("questionnaires") or su.exact.explode("interviews") or su.exact.explode("health care services") or ti,ab(qualitative or interview* or focus group* or theme* or questionnaire* or survey*) or ti,ab(metasynthes* or meta-synthes* or metasummar* or meta-summar* or metastud* or meta-stud* or metathem* or meta-them* or ethno* or emic or etic or phenomenolog* or grounded theory or constant compar* or (thematic* near/3 analys*) or theoretical-sampl* or purposive-sampl* or hermeneutic* or heidegger* or husserl* or colaizzi* or van kaam* or van manen* or giorgi* or glaser* or

	strauss* or ricoeur* or spiegelberg* or merleau*)))

G.4 Searches for specific questions

G.4.1 Suspected hearing loss

- Which groups of people are more likely than the general population to miss having hearing loss identified?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	exp dementia/
6.	exp alzheimer disease/
7.	exp primary progressive aphasia/
8.	exp dementia, vascular/
9.	lewy body disease/
10.	(alzheim* or biswanger* or cadasil or cerad or dement*).ti,ab.
11.	(ftld or ftd*).ti,ab.
12.	((fronto?temporal or cortico?basal or fronto temporal or cortico basal or frontal lobe) adj5 (degenerat*4 or dysfunction*)).ti,ab.
13.	(kluver adj5 bucy).ti,ab.
14.	((lew*2 adj5 bod*3) or dlbd).ti,ab.
15.	((lobar or lobe*) adj5 atroph*3 adj5 (brain or cerebr*2)).ti,ab.
16.	(mesulam adj5 syndrome*).ti,ab.
17.	(pick*2 adj5 (disease*1 or complex)).ti,ab.
18.	posterior cortic* atroph*.ti,ab.
19.	((primary or progressive) adj5 aphasi*).ti,ab.
20.	(sdat or sivd).ti,ab.
21.	((subcortic*3 or sub?cortic*3) adj5 (encephalopath*3 or leukoencephalopath*3)).ti,ab.
22.	(amentia or senil* or presenil*).ti,ab.
23.	cognitive dysfunctions/
24.	exp cognition disorders/
25.	exp memory disorders/
26.	((cognit* or memory* or mental*) adj2 (declin* or defect* or impair* or los* or deteriorat*)).ti,ab.
27.	((cognit* or behavio?r*) adj3 symptom*).ti,ab.
28.	(cognit* adj2 (abnormal* or disorder*)).ti,ab.
29.	(mci*1 or cind*1).ti,ab.
30.	exp learning disorders/
31.	developmental disabilities/
32.	(learn* adj3 (deficien* or difficult* or disab* or disorder* or handicap* or impair* or incapacit* or handicap* or sub?average or sub?norm*)).ti,ab.
33.	((subaverage or sub$1 average or subnormal or sub*1 normal*) adj3 (cognit* or intel*)).ti,ab.
34.	((develop* or neurodevelopment*) adj (deficien* or difficult* or disab* or disorder* or

	handicap* or impair* or incapacit* or handicap* or sub?average or sub?norm*)).ti,ab.
35.	or/5-34
36.	4 and 35
	Date parameters: 1946 - 12 July 2016

81 **Embase search terms**

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	exp *dementia/
6.	exp *alzheimers disease/
7.	exp *aphasia primary progressive/
8.	exp *vascular dementia/
9.	*lewy body/
10.	*delirium dementia amnestic cognitive disorders/
11.	(alzheim* or biswanger* or cadasil or cerad or dement*).ti,ab.
12.	(ftld or ftd*).ti,ab.
13.	((fronto?temporal or cortico?basal or fronto temporal or cortico basal or frontal lobe) adj5 (degenerat*4 or dysfunction*)).ti,ab.
14.	(kluver adj5 bucy).ti,ab.
15.	((lew*2 adj5 bod*3) or dlbd).ti,ab.
16.	((lobar or lobe*) adj5 atroph*3 adj5 (brain or cerebr*2)).ti,ab.
17.	(mesulam adj5 syndrome*).ti,ab.
18.	(pick*2 adj5 (disease*1 or complex)).ti,ab.
19.	posterior cortic* atroph*.ti,ab.
20.	((primary or progressive) adj5 aphasi*).ti,ab.
21.	(sdat or sivd).ti,ab.
22.	((subcortic*3 or sub?cortic*3) adj5 (encephalopath*3 or leukoencephalopath*3)).ti,ab.
23.	(amentia or senil* or presenil*).ti,ab.
24.	exp *intellectual impairment/
25.	exp *cognitive defect/
26.	exp *memory disorder/
27.	((cognit* or memory* or mental*) adj2 (declin* or defect* or impair* or los* or deteriorat*)).ti,ab.
28.	((cognit* or behavio?r*) adj3 symptom*).ti,ab.
29.	(cognit* adj2 (abnormal* or disorder*)).ti,ab.
30.	(mci*1 or cind*1).ti,ab.
31.	exp *learning disorder/
32.	*developmental disorder/
33.	(learn* adj3 (deficien* or difficult* or disab* or disorder* or handicap* or impair* or incapacit* or handicap* or sub?average or sub?norm*)).ti,ab.
34.	((subaverage or sub$1 average or subnormal or sub*1 normal*) adj3 (cognit* or intel*)).ti,ab.
35.	((develop* or neurodevelopment*) adj (deficien* or difficult* or disab* or disorder* or handicap* or impair* or incapacit* or handicap* or sub?average or sub?norm*)).ti,ab.
36.	or/5-35
37.	4 and 36

	Date parameters: 1974 - 12 July 2016

82 **Cochrane search terms**

#1.	Standard population [G.2.1]
#2.	MeSH descriptor: [dementia] explode all trees
#3.	MeSH descriptor: [alzheimer disease] explode all trees
#4.	MeSH descriptor: [aphasia, primary progressive] explode all trees
#5.	MeSH descriptor: [dementia, vascular] explode all trees
#6.	MeSH descriptor: [lewy body disease] explode all trees
#7.	(alzheim* or biswanger* or cadasil or cerad or dement*):ti,ab
#8.	(ftld or ftd*):ti,ab
#9.	((frontotemporal or corticobasal or fronto temporal or cortico basal or frontal lobe) near/5 (degenerat* or dysfunction*)):ti,ab
#10.	(kluver near/5 bucy):ti,ab
#11.	((lew* near/5 bod*) or dlbd):ti,ab
#12.	((lobar or lobe*) near/5 atroph* near/5 (brain or cerebr*)):ti,ab
#13.	(mesulam near/5 syndrome*):ti,ab
#14.	(pick* near/5 (disease* or complex)):ti,ab
#15.	posterior cortic* atroph*:ti,ab
#16.	((primary or progressive) near/5 aphasi*):ti,ab
#17.	(sdat or sivd):ti,ab
#18.	((subcortic*) near/5 (encephalopath* or leukoencephalopath*)):ti,ab
#19.	(amentia or senil* or presenil*):ti,ab
#20.	MeSH descriptor: [cognitive dysfunction] explode all trees
#21.	MeSH descriptor: [cognition disorders] explode all trees
#22.	MeSH descriptor: [memory disorders] explode all trees
#23.	((cognit* or memory* or mental*) near/2 (declin* or defect* or impair* or los* or deteriorat*)):ti,ab
#24.	((cognit* or behaviour* or behavior) near/3 symptom*):ti,ab
#25.	(cognit* near/2 (abnormal* or disorder*)):ti,ab
#26.	(mci* or cind*) ti,ab
#27.	MeSH descriptor: [learning disorders] explode all trees
#28.	MeSH descriptor: [developmental disabilities] explode all trees
#29.	(learn* near/3 (deficien* or difficult* or disab* or disorder* or handicap* or impair* or incapacit* or handicap* or subaverage or sub average or subnorm* or sub norm*)):ti,ab
#30.	((subaverage or sub average or subnormal or sub normal*) near/3 (cognit* or intel*)):ti,ab
#31.	(or #2-#30)
#32.	#1 and #31
	Date parameters: Inception – 12 July 2016

83 G.4.2 Signs and symptoms for urgent referral (red flags)

84 - What are the signs and symptoms that allow early recognition of hearing loss needing immediate
85 or urgent referral to a secondary care specialist?

86 **Medline search terms**

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]

3.	1 not 2
4.	Limit 3 to English language
5.	otitis externa/
6.	(malignan* or necrot*).ti,ab.
7.	5 and 6
8.	(otitis externa adj3 (malignan* or necrot*)).ti,ab.
9.	7 or 8
10.	exp otitis media/
11.	facial paralysis/
12.	facial nerve/
13.	otitis media.ti,ab.
14.	((facial or face) adj1 (nerve* or paralys* or palsy or swell* or swollen)).ti,ab.
15.	10 or 13
16.	11 or 12 or 14
17.	15 and 16
18.	nasopharyngeal neoplasms/
19.	((nasopharyn* or nasal-pharyn*) adj3 (cancer* or neoplasm* or carcinoma* or tumor* or tumour*)).ti,ab.
20.	18 or 19
21.	exp stroke/
22.	exp cerebral hemorrhage/
23.	(stroke or strokes or cva or apoplexy or "cerebrovascular accident").ti,ab.
24.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab.
25.	"brain attack*".ti,ab.
26.	or/21-25
27.	exp autoimmune diseases/
28.	(autoimmun* or auto-immun* or autoantibod* or auto-antibod*).ti,ab.
29.	27 or 28
30.	hearing loss, sudden/
31.	(sudden* adj2 (onset or sensorineural or loss)).ti,ab.
32.	30 or 31
33.	exp cholesteatoma/
34.	cholesteatoma*.ti,ab.
35.	33 or 34
36.	exp neuroma, acoustic/
37.	(acoustic adj2 (neuroma* or neurilemmoma* or neurinoma* or tumor* or tumour*)).ti,ab.
38.	((acoustic or vestibular) adj2 schwannoma*).ti,ab.
39.	or/36-38
40.	exp brain neoplasms/
41.	((brain or intracranial) adj3 (cancer* or neoplasm* or tumor* or tumour* or carcinoma*)).ti,ab.
42.	40 or 41
43.	((neurological or nerve*) adj3 (damag* or impair*)).ti,ab.
44.	9 or 17 or 20 or 26 or 29 or 32 or 35 or 39 or 42 or 43
45.	4 and 44

46.	Study Filters SR(0) or OBS(G.3.8) or DIAG(G.3.6)
47.	45 and 46
	Date Parameters: 1946 – 17 January 2017

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	external otitis/
6.	(malignan* or necrot*).ti,ab.
7.	5 and 6
8.	(otitis externa adj3 (malignan* or necrot*)).ti,ab.
9.	7 or 8
10.	exp otitis media/
11.	otitis media.ti,ab.
12.	10 or 11
13.	exp facial nerve paralysis/
14.	exp *facial nerve/
15.	((facial or face) adj1 (nerve* or paralys* or palsy or swell* or swollen)).ti,ab.
16.	or/13-15
17.	12 and 16
18.	exp nasopharynx tumor/
19.	((nasopharyn* or nasal-pharyn*) adj3 (cancer* or neoplasm* or carcinoma* or tumor* or tumour*)).ti,ab.
20.	18 or 19
21.	exp stroke/
22.	exp cerebrovascular accident/
23.	exp brain infarction/
24.	exp intracerebral hemorrhage/
25.	(stroke or strokes or cva or apoplexy or "cerebrovascular accident").ti,ab.
26.	((cerebro* or brain or brainstem or cerebral*) adj3 (infarct* or accident*)).ti,ab.
27.	"brain attack*".ti,ab.
28.	or/21-27
29.	exp autoimmune disease/
30.	(autoimmun* or auto-immun* or autoantibod* or auto-antibod*).ti,ab.
31.	29 or 30
32.	sudden deafness/
33.	(sudden* adj2 (onset or sensorineural or loss)).ti,ab.
34.	32 or 33
35.	cholesteatoma/
36.	cholesteatoma*.ti,ab.
37.	35 or 36
38.	exp acoustic neurinoma/

39.	(acoustic adj2 (neuroma* or neurilemmoma* or neurinoma* or tumor* or tumour*)).ti,ab.
40.	((acoustic or vestibular) adj2 schwannoma*).ti,ab.
41.	or/38-40
42.	exp brain tumor/
43.	((brain or intracranial) adj3 (cancer* or neoplasm* or tumor* or tumour* or carcinoma*)).ti,ab.
44.	42 or 43
45.	((neurological or nerve*) adj3 (damag* or impair*)).ti,ab.
46.	9 or 17 or 20 or 28 or 31 or 34 or 37 or 41 or 44 or 45
47.	4 and 46
48.	Study Filters SR(0) or OBS(G.3.8) or DIAG(G.3.6)
49.	47 and 48
	Date parameters: 1974 – 17 January 2017

89 **Cochrane search terms**

#1.	Standard population [G.2.1]
#2.	[mh ^"otitis externa"]
#3.	(malignan* or necrot*):ti,ab
#4.	#2 and #3
#5.	("otitis externa" near/3 (malignan* or necrot*)):ti,ab
#6.	#4 or #5
#7.	[mh "otitis media"]
#8.	otitis media:ti,ab
#9.	#7 or #8
#10.	[mh ^"facial paralysis"]
#11.	[mh ^"facial nerve"]
#12.	((facial or face) near/1 (nerve* or paralys* or palsy or swell* or swollen)) .ti,ab
#13.	#10 or #11 or #12
#14.	#9 and #13
#15.	[mh ^"nasopharyngeal neoplasms"]
#16.	((nasopharyn* or nasal-pharyn*) near/3 (cancer* or neoplasm* or carcinoma* or tumor* or tumour*)) .ti,ab
#17.	#15 or #16
#18.	[mh stroke]
#19.	[mh "cerebral hemorrhage"]
#20.	(stroke or strokes or cva or apoplexy or "cerebrovascular accident"):ti,ab
#21.	((cerebro* or brain or brainstem or cerebral*) near/3 (infarct* or accident*)):ti,ab
#22.	(brain next attack*):ti,ab
#23.	#18 or #19 or #20 or #21 or #22
#24.	[mh "autoimmune diseases"]
#25.	(autoimmun* or auto-immun* or autoantibod* or auto-antibod*):ti,ab
#26.	#24 or #25
#27.	[mh ^"hearing loss, sudden"]
#28.	(sudden* near/2 (onset or sensorineural or loss)):ti,ab
#29.	#27 or #28
#30.	[mh cholesteatoma]

#31.	cholesteatoma*:ti,ab
#32.	#30 or #31
#33.	[mh "neuroma, acoustic"]
#34.	(acoustic near/2 (neuroma* or neurilemmoma* or neurinoma* or tumor* or tumour*)):ti,ab
#35.	((acoustic or vestibular) near/2 schwannoma*):ti,ab
#36.	#33 or #34 or #35
#37.	[mh "brain neoplasms"]
#38.	((brain or intracranial) near/3 (cancer* or neoplasm* or tumor* or tumour* or carcinoma*)):ti,ab
#39.	#37 or #38
#40.	((neurological or nerve*) near/3 (damag* or impair*)):ti,ab
#41.	#6 or #14 or #17 or #23 or #26 or #29 or #32 or #36 or #39 or #40
#42.	#1 and #41
	Date parameters: Inception – 17 January 2017

G.4.3 Early versus delayed management

- What is the clinical and cost effectiveness of early versus delayed management of hearing loss on patient outcomes?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	((early or earlier or late or later or time or timing or delay*) adj3 (present* or manag* or intervention* or treat* or therap* or rehab* or identif* or refer* or screen* or diagnos* or prescri* or amplif* or assess*)).ti,ab.
6.	((mild or moderate or minimal) adj3 (hear* or deaf* or symptom* or loss* or impair* or difficult*)).ti,ab.
7.	(present* or manag* or intervention* or treat* or therap* or rehab* or identif* or refer* or screen* or diagnos* or prescri* or amplif*).ti,ab.
8.	6 and 7
9.	5 or 8
10.	4 and 9
11.	(exp child/ or exp pediatrics/ or exp infant/) not (exp adolescent/ or exp adult/ or exp middle age/ or exp aged/)
12.	10 not 11
	Date parameters: 1946 – 2 November 2016

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	early intervention/
6.	((early or earlier or late or later or time or timing or delay*) adj3 (present* or manag* or intervention* or treat* or therap* or rehab* or identif* or refer* or screen* or diagnos* or prescri* or amplif* or assess*)).ti,ab.

7.	((mild or moderate or minimal) adj3 (hear* or deaf* or symptom* or loss* or impair* or difficult*)).ti,ab.
8.	(present* or manag* or intervention* or treat* or therap* or rehab* or identif* or refer* or screen* or diagnos* or prescri* or amplif*).ti,ab.
9.	7 and 8
10.	5 or 6 or 9
11.	4 and 10
12.	(exp child/ or exp pediatrics/) not (exp adult/ or exp adolescent/)
13.	11 not 12
	Date parameters: 1974 – 2 November 2016

Cochrane search terms

#1.	Standard population [G.2.1]
#2.	((early or earlier or late or later or time or timing or delay*) near/3 (present* or manag* or intervention* or treat* or therap* or rehab* or identif* or refer* or screen* or diagnos* or prescri* or amplif* or assess*)):ti,ab
#3.	((mild or moderate or minimal) near/3 (hear* or deaf* or symptom* or loss* or impair* or difficult*)):ti,ab
#4.	(present* or manag* or intervention* or treat* or therap* or rehab* or identif* or refer* or screen* or diagnos* or prescri* or amplif*):ti,ab
#5.	#3 and #4
#6.	#2 or #5
#7.	#1 and #6
	Date parameters: Inception – 2 November 2016

G.4.4 Settings

- What is the most clinically and cost-effective setting for the identification and treatment of earwax?

Medline search terms

1.	cerumen/
2.	(cerumen or earwax or (ear* adj5 wax*)).ti,ab.
3.	1 or 2
4.	otitis media/
5.	otitis externa/
6.	(otitis adj (media or externa*)).ti,ab.
7.	myringitis.ti,ab.
8.	((ear or ears) adj3 infect*).ti,ab.
9.	or/4-8
10.	3 or 9
11.	limit 10 to English language
12.	audiology/
13.	audiolog*.ti,ab.
14.	12 or 13
15.	primary health care/
16.	practice patterns, physicians'/
17.	exp general practice/
18.	general practitioners/ or physicians, family/ or physicians, primary care/

19.	(family practi* or family doctor* or family physician* or gp* or general practi*).ti,ab.
20.	((primary or communit*) adj5 care).ti,ab.
21.	or/15-20
22.	14 or 21
23.	11 and 22
24.	Excluded study designs and publication types [G.3.1]
25.	23 not 24
26.	(exp child/ or exp pediatrics/ or exp infant/) not (exp adolescent/ or exp adult/ or exp middle age/ or exp aged/)
27.	25 not 26
28.	models, organizational/
29.	(commission* adj3 (support* or service* or model* or structur*)).ti,ab.
30.	((model* or deliver* or strateg* or system* or structur* or design*) adj3 (care or organi*)).ti,ab.
31.	(service* adj3 (deliver* or model* or structur* or design*)).ti,ab.
32.	or/28-31
33.	11 and 32
34.	33 not 24
35.	34 not 26
36.	35 or 27
	Date parameters: 1946 – 25 April 2017

100 **Embase search terms**

1.	cerumen/ or cerumen impaction/
2.	(cerumen or earwax or (ear* adj5 wax*)).ti,ab.
3.	1 or 2
4.	external otitis/ or exp otitis media/
5.	(otitis adj (media or externa*)).ti,ab.
6.	myringitis.ti,ab.
7.	((ear or ears) adj3 infect*).ti,ab.
8.	or/4-7
9.	3 or 8
10.	limit 9 to English language
11.	audiology/
12.	audiologist/
13.	audiolog*.ti,ab.
14.	or/11-13
15.	exp primary health care/
16.	professional practice/ or general practice/
17.	general practitioner/
18.	(family practi* or family doctor* or family physician* or gp* or general practi*).ti,ab.
19.	((primary or communit*) adj5 care).ti,ab.
20.	or/15-19
21.	14 or 20
22.	10 and 21
23.	Excluded study designs and publication types [G.3.1]

24.	22 not 23
25.	(exp child/ or exp pediatrics/) not (exp adult/ or exp adolescent/)
26.	24 not 25
27.	*health care delivery/
28.	(commission* adj3 (support* or service* or model* or structur*)).ti,ab.
29.	((model* or deliver* or strateg* or system* or structur* or design*) adj3 (care or organi*)).ti,ab.
30.	(service* adj3 (deliver* or model* or structur* or design*)).ti,ab.
31.	or/27-30
32.	10 and 31
33.	32 not 23
34.	33 not 25
35.	34 or 26
	Date parameters: 1974 – 25 April 2017

101 **Cochrane search terms**

#1.	[mh ^cerumen]
#2.	(cerumen or earwax or (ear* near/5 wax*)):ti,ab
#3.	#1 or #2
#4.	[mh ^"otitis media"]
#5.	[mh ^"otitis externa"]
#6.	(otitis next (media or externa*)):ti,ab
#7.	myringitis:ti,ab
#8.	((ear or ears) near/3 infect*):ti,ab
#9.	#4 or #5 or #6 or #7 or #8
#10.	#3 or #9
#11.	[mh ^audiology]
#12.	audiolog*:ti,ab
#13.	[mh ^"primary health care"]
#14.	[mh ^"practice patterns, physicians'"]
#15.	[mh "general practice"]
#16.	[mh ^"general practitioners"]
#17.	[mh ^"physicians, family"]
#18.	[mh ^"physicians, primary care"]
#19.	(family next practi* or family next doctor* or family next physician* or gp* or general next practi*):ti,ab
#20.	((primary or communit*) near/5 care):ti,ab
#21.	(or #11-#20)
#22.	[mh ^"models, organizational"]
#23.	(commission* near/3 (support* or service* or model* or structur*)):ti,ab
#24.	((model* or deliver* or strateg* or system* or structur* or design*) near/3 (care or organi*)):ti,ab
#25.	(service* near/3 (deliver* or model* or structur* or design*)):ti,ab
#26.	#22 or #23 or #24 or #25
#27.	#10 and #26
#28.	#21 or #27

	Date parameters: Inception – 25 April 2017

G.4.5 Signs and symptoms for non-urgent referral

- Who should be routinely referred to audiovestibular medicine or ear, nose and throat (ENT) surgery for medical assessment?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	(protocol* or criteria or refer* or algorithm* or checklist* or guideline* or guidance).ti,ab.
6.	((risk* adj3 (tool* or scor*)) or validat*).ti,ab.
7.	(stratif* or ((scor* or rate or rating) adj2 (system* or scale* or scheme*))).ti,ab.
8.	"referral and consultation"/
9.	clinical protocols/
10.	or/5-9
11.	4 and 10
12.	exp otolaryngology/
13.	(otolaryngolog* or otorhinolaryngolog* or otolog*).ti,ab.
14.	(ent or (ear* adj2 nose* adj2 throat*) or (audiovestibular adj (medicine or service* or physician*))).ti,ab.
15.	(medical adj3 (care or assess* or evaluat* or service*)).ti,ab.
16.	or/12-15
17.	11 and 16
	Date parameters: 1946 – 3 January 2017

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	(protocol* or criteria or refer* or algorithm* or checklist* or guideline* or guidance).ti,ab.
6.	((risk* adj3 (tool* or scor*)) or validat*).ti,ab.
7.	(stratif* or ((scor* or rate or rating) adj2 (system* or scale* or scheme*))).ti,ab.
8.	patient referral/
9.	clinical protocol/
10.	or/5-9
11.	4 and 10
12.	exp otorhinolaryngology/
13.	(otolaryngolog* or otorhinolaryngolog* or otolog*).ti,ab.
14.	(ent or (ear* adj2 nose* adj2 throat*) or (audiovestibular adj (medicine or service* or physician*))).ti,ab.
15.	(medical adj3 (care or assess* or evaluat* or service*)).ti,ab.
16.	or/12-15
17.	1 and 16
	Date parameters: 1974 – 3 January 2017

Cochrane search terms

#1.	Standard population [G.2.1]
#2.	(protocol* or criteria or refer* or algorithm* or checklist* or guideline* or guidance):ti,ab
#3.	((risk* near/3 (tool* or scor*)) or validat*):ti,ab
#4.	(stratif* or ((scor* or rate or rating) near/2 (system* or scale* or scheme*))):ti,ab
#5.	[mh ^"referral and consultation"]
#6.	[mh ^"clinical protocols"]
#7.	(or #2-#6)
#8.	#1 and #7
#9.	[mh otolaryngology]
#10.	(otolaryngolog* or otorhinolaryngolog* or otolog*):ti,ab
#11.	(ent or (ear* near/2 nose* near/2 throat*) or (audiovestibular next (medicine or service* or physician*))):ti,ab
#12.	(medical near/3 (care or assess* or evaluat* or service*)):ti,ab
#13.	(or #9-#12)
#14.	#8 and #13
	Date parameters: Inception – 3 January 2017

G.4.6 Communication needs

- What is the clinical and cost effectiveness of communication needs assessment in adults with hearing loss?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	("surveys and questionnaires"/ or self-assessment/) and speech perception/
6.	needs assessment/
7.	(communicat* adj5 (assess* or need* or measur* or abilit* or self-assess* or test* or survey* or inventor* or questionnaire* or score* or evaluat*)).ti,ab.
8.	((speech or hearing) adj3 noise adj3 (test* or assess* or perception or measur*)).ti,ab.
9.	(((speech adj1 (recognition or connected)) or nonsense syllable) adj1 test*).ti,ab.
10.	(speech adj (identification or perception or performance or intelligibility) adj3 (test* or measur* or scor* or survey* or questionnaire*)).ti,ab.
11.	((words or sentence* or recognition) adj ("in quiet" or "in noise")).ti,ab.
12.	patient care planning/
13.	((patient* or individual or management or care) adj2 (plan* or protocol*)).ti,ab.
14.	(client-oriented scale of improvement or cosi).ti,ab.
15.	((hearing handicap adj2 (inventor* or scor*)) or hhi*).ti,ab.
16.	((("hearing aid benefit" or communication or "hearing aid difference" or "aided loudness" or "hearing aid performance") adj2 profile*) or ghabp).ti,ab.
17.	(("attitudes towards loss of hearing" or "bern benefit single-sided deafness" or binaural hearing aid* or "environmental sounds" or "hearing aid performance" or hearing aid user* or "hearing attitudes in rehabilitation" or intervention) adj2 questionnaire*).ti,ab.
18.	(("client satisfaction" or "hearing ability" or "hearing aid satisfaction") adj2 survey*).ti,ab.
19.	("audiological rehabilitation" adj3 impression*).ti,ab.

20.	((client-oriented or communication or "device-oriented subjective outcome" or "effectiveness of auditory rehabilitation" or "predicting hearing aid use" or "hearing disability and handicap" or "hearing satisfaction" or "intelligibility rating improvement" or philadelphia or washington) adj2 scale*).ti,ab.
21.	(("glasgow benefit" or "hearing aid performance" or "hearing disability and aid benefit" or "hearing handicap and disability" or "hearing problem" or hearing aid* or "profound and severe loss" or "self-assessment") adj2 inventor*).ti,ab.
22.	("disabilities and handicaps associated with impaired auditory localization" or "expectations checklist" or "expected consequences of hearing aid ownership" or "hearing screen test for the elderly" or "negative reactions to hearing aids" or "own voice qualities" or "satisfaction with amplification in daily life").ti,ab.
23.	(speech adj spatial adj2 qualit*).ti,ab.
24.	or/5-23
25.	4 and 24
26.	Study filters: RCT(G.3.2) or SR(0) or OBS(G.3.8)
27.	25 and 26
	Date parameters: 1946 – 16 March 2017

112 **Embase search terms**

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	*needs assessment/
6.	(questionnaires/ or self evaluation/) and speech perception/
7.	*patient care planning/
8.	(communicat* adj5 (assess* or need* or measur* or abilit* or self-assess* or test* or survey* or inventor* or questionnaire* or score* or evaluat*)).ti,ab.
9.	((speech or hearing) adj3 noise adj3 (test* or assess* or perception or measur*)).ti,ab.
10.	(((speech adj1 (recognition or connected)) or nonsense syllable) adj1 test*).ti,ab.
11.	(speech adj (identification or perception or performance or intelligibility) adj3 (test* or measur* or scor* or survey* or questionnaire*)).ti,ab.
12.	((words or sentence* or recognition) adj ("in quiet" or "in noise")).ti,ab.
13.	((patient* or individual or management or care) adj2 (plan* or protocol*)).ti,ab.
14.	(client-oriented scale of improvement or cosi).ti,ab.
15.	((hearing handicap adj2 (inventor* or scor*)) or hhi*).ti,ab.
16.	((("hearing aid benefit" or communication or "hearing aid difference" or "aided loudness" or "hearing aid performance") adj2 profile*) or ghabp).ti,ab.
17.	(("attitudes towards loss of hearing" or "bern benefit single-sided deafness" or binaural hearing aid* or "environmental sounds" or "hearing aid performance" or hearing aid user* or "hearing attitudes in rehabilitation" or intervention) adj2 questionnaire*).ti,ab.
18.	(("client satisfaction" or "hearing ability" or "hearing aid satisfaction") adj2 survey*).ti,ab.
19.	("audiological rehabilitation" adj3 impression*).ti,ab.
20.	((client-oriented or communication or "device-oriented subjective outcome" or "effectiveness of auditory rehabilitation" or "predicting hearing aid use" or "hearing disability and handicap" or "hearing satisfaction" or "intelligibility rating improvement" or philadelphia or washington) adj2 scale*).ti,ab.
21.	(("glasgow benefit" or "hearing aid performance" or "hearing disability and aid benefit" or "hearing handicap and disability" or "hearing problem" or hearing aid* or "profound and

	severe loss" or "self-assessment") adj2 inventor*).ti,ab.
22.	("disabilities and handicaps associated with impaired auditory localization" or "expectations checklist" or "expected consequences of hearing aid ownership" or "hearing screen test for the elderly" or "negative reactions to hearing aids" or "own voice qualities" or "satisfaction with amplification in daily life").ti,ab.
23.	(speech adj spatial adj2 qualit*).ti,ab.
24.	or/5-23
25.	4 and 24
26.	Study filters: RCT(G.3.2) or SR(0) or OBS(G.3.8)
27.	25 and 26
	Date parameters: 1974 – 16 March 2017

113 **Cochrane search terms**

#1.	Standard population [G.2.1]
#2.	[mh ^"surveys and questionnaires"]
#3.	[mh ^self-assessment]
#4.	#2 or #3
#5.	[mh ^"speech perception"]
#6.	#4 and #5
#7.	[mh ^"needs assessment"]
#8.	(communicat* near/5 (assess* or need* or measur* or abilit* or self-assess* or test* or survey* or inventor* or questionnaire* or score* or evaluat*)):ti,ab
#9.	((speech or hearing) near/3 noise near/3 (test* or assess* or perception or measur*)):ti,ab
#10.	(((speech near/1 (recognition or connected)) or "nonsense syllable") near/1 test*):ti,ab
#11.	(speech next (identification or perception or performance or intelligibility) near/3 (test* or measur* or scor* or survey* or questionnaire*)):ti,ab
#12.	((words or sentence* or recognition) next ("in quiet" or "in noise")):ti,ab
#13.	[mh ^"patient care planning"]
#14.	((patient* or individual or management or care) near/2 (plan* or protocol*)):ti,ab
#15.	("client-oriented scale of improvement" or cosi):ti,ab
#16.	(("hearing handicap" near/2 (inventor* or scor*)) or hhi*):ti,ab
#17.	((("hearing aid benefit" or communication or "hearing aid difference" or "aided loudness" or "hearing aid performance") near/2 profile*) or ghabp):ti,ab
#18.	(("attitudes towards loss of hearing" or "bern benefit single-sided deafness" or "binaural hearing" next aid* or "environmental sounds" or "hearing aid performance" or "hearing aid" next user* or "hearing attitudes in rehabilitation" or intervention) near/2 questionnaire*):ti,ab
#19.	(("client satisfaction" or "hearing ability" or "hearing aid satisfaction") near/2 survey*):ti,ab
#20.	("audiological rehabilitation" near/3 impression*):ti,ab
#21.	((client-oriented or communication or "device-oriented subjective outcome" or "effectiveness of auditory rehabilitation" or "predicting hearing aid use" or "hearing disability and handicap" or "hearing satisfaction" or "intelligibility rating improvement" or philadelphia or washington) near/2 scale*):ti,ab
#22.	(("glasgow benefit" or "hearing aid performance" or "hearing disability and aid benefit" or "hearing handicap and disability" or "hearing problem" or hearing next aid* or "profound and severe loss" or "self-assessment") near/2 inventor*):ti,ab
#23.	("disabilities and handicaps associated with impaired auditory localization" or "expectations checklist" or "expected consequences of hearing aid ownership" or "hearing screen test for the elderly" or "negative reactions to hearing aids" or "own voice qualities" or "satisfaction with amplification in daily life"):ti,ab

#24.	(speech next spatial near/2 qualit*):ti,ab
#25.	(or #6-#24)
#26.	#1 and #25
	Date parameters: Inception – 16 March 2017

G.4.7 MRI imaging

- In people who have been referred to secondary care with sensorineural hearing loss, who needs MRI to assess the underlying cause of hearing loss?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	diagnostic imaging/ or exp magnetic resonance imaging/
6.	(imag* or "magnetic resonance" or mri or nmr*).ti,ab.
7.	5 or 6
8.	4 and 7
9.	(protocol* or criteria or refer* or algorithm* or checklist* or guideline* or guidance).ti,ab.
10.	((risk* adj3 (tool* or scor*)) or validat*).ti,ab.
11.	(stratif* or ((scor* or rate or rating) adj2 (system* or scale* or scheme*))).ti,ab.
12.	"referral and consultation"/
13.	clinical protocols/
14.	or/9-13
15.	8 and 14
	Date parameters: 1946 – 13 December 2016

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	nuclear magnetic resonance imaging/
6.	*diagnostic imaging/
7.	(imag* or "magnetic resonance" or mri or nmr*).ti,ab.
8.	or/5-7
9.	(protocol* or criteria or refer* or algorithm* or checklist* or guideline* or guidance).ti,ab.
10.	((risk* adj3 (tool* or scor*)) or validat*).ti,ab.
11.	(stratif* or ((scor* or rate or rating) adj2 (system* or scale* or scheme*))).ti,ab.
12.	patient referral/
13.	clinical protocol/
14.	or/9-13
15.	4 and 8
16.	14 and 15
	Date parameters: 1974 – 13 December 2016

Cochrane search terms

#1.	Standard population [G.2.1]
#2.	[mh ^"diagnostic imaging"]
#3.	[mh "magnetic resonance imaging"]
#4.	(imag* or "magnetic resonance" or MRI or NMR*):ti,ab
#5.	#2 or #3 or #4
#6.	#1 and #5
#7.	(protocol* or criteria or refer* or algorithm* or checklist* or guideline* or guidance):ti,ab
#8.	((risk* near/3 (tool* or scor*)) or validat*):ti,ab
#9.	(stratif* or ((scor* or rate or rating) near/2 (system* or scale* or scheme*))):ti,ab
#10.	[mh ^"Referral and Consultation"]
#11.	[mh ^"clinical protocols"]
#12.	(or #7-#11)
#13.	#6 and #12
	Date parameters: Inception – 13 December 2016

G.4.8 Earwax

- What is the most clinically and cost-effective method of removing ear wax?

Medline search terms

1.	Cerumen/
2.	(cerumen or earwax or (ear* adj5 wax*)).ti,ab.
3.	1 or 2
4.	Excluded study designs and publication types [G.3.1]
5.	3 not 4
6.	Limit 5 to English language
7.	Study filters: RCT(G.3.2) or SR(0) or OBS(G.3.8)
8.	6 and 7
	Date parameters: 1946 – 20 June 2017

Embase search terms

1.	cerumen/ or cerumen impaction/
2.	(cerumen or earwax or (ear* adj5 wax*)).ti,ab.
3.	1 or 2
4.	Excluded study designs and publication types [G.3.1]
5.	3 not 4
6.	Limit 5 to English language
7.	Study filters: RCT(G.3.2) or SR(0) or OBS(G.3.8)
8.	6 and 7
	Date parameters: 1974 – 20 June 2017

Cochrane search terms

#1.	[mh ^cerumen]
#2.	(cerumen or earwax or (ear* near/5 wax*)):ti,ab
#3.	#1 or #2
	Date parameters: Inception – 20 June 2017

G.4.9 Patient-centred decision tools

- What is the clinical and cost effectiveness of using patient-centred tools to help patients with hearing loss decide between different management strategies?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	decision support techniques/
6.	decision support systems, clinical/
7.	decision trees/
8.	informed consent/
9.	decision making/ or choice behavior/
10.	((decision* or decid*) adj4 (support* or aid* or tool* or instrument* or technolog* or technique* or system* or program* or algorithm* or process* or method* or intervention* or material* or making or share* or sharing)).ti,ab.
11.	(decision adj (board* or guide* or counseling)).ti,ab.
12.	decision-making computer assisted/
13.	interactive health communication*.ti,ab.
14.	(interactive adj (internet or online or graphic* or booklet*)).ti,ab.
15.	(interacti* adj4 tool*).ti,ab.
16.	(informed adj (choice* or decision*)).ti,ab.
17.	adaptive conjoint analys#s.ti,ab.
18.	motivational interviewing/
19.	(motivat* adj2 (tool* or interview*)).ti,ab.
20.	(patient-cent* adj3 (decision* or tool* or choice*)).ti,ab.
21.	option grid*.ti,ab.
22.	or/5-21
23.	4 and 22
	Date parameters: 1946 – 14 December 2016

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	exp decision support system/
6.	exp decision making/
7.	decision aid/
8.	"decision tree"/
9.	informed consent/
10.	((decision* or decid*) adj4 (support* or aid* or tool* or instrument* or technolog* or technique* or system* or program* or algorithm* or process* or method* or intervention* or material* or making or share* or sharing)).ti,ab.
11.	(decision adj (board* or guide* or counseling)).ti,ab.
12.	interactive health communication*.ti,ab.

13.	(interactive adj (internet or online or graphic* or booklet*)).ti,ab.
14.	(interacti* adj4 tool*).ti,ab.
15.	(informed adj (choice* or decision*)).ti,ab.
16.	adaptive conjoint analys#s.ti,ab.
17.	motivational interviewing/
18.	(motivat* adj2 (tool* or interview*)).ti,ab.
19.	(patient-cent* adj3 (decision* or tool* or choice*)).ti,ab.
20.	option grid*.ti,ab.
21.	or/5-20
22.	4 and 21
	Date parameters: 1974 – 14 December 2016

Cochrane search terms

#1.	Standard population [G.2.1]
#2.	[mh ^"decision support techniques"]
#3.	[mh ^"decision support systems, clinical"]
#4.	[mh ^"decision trees"]
#5.	[mh ^"informed consent"]
#6.	[mh ^"decision making"]
#7.	[mh ^"choice behavior"]
#8.	((decision* or decid*) near/4 (support* or aid* or tool* or instrument* or technolog* or technique* or system* or program* or algorithm* or process* or method* or intervention* or material* or making or share* or sharing)):ti,ab
#9.	(decision next (board* or guide* or counseling)):ti,ab
#10.	[mh ^"decision-making, computer assisted"]
#11.	("interactive health" next communication*) .ti,ab
#12.	(interactive next (internet or online or graphic* or booklet*)):ti,ab
#13.	(interacti* near/4 tool*):ti,ab
#14.	(informed next (choice* or decision*)):ti,ab
#15.	("adaptive conjoint" next analys*):ti,ab
#16.	[mh ^"motivational interviewing"]
#17.	(motivat* near/2 (tool* or interview*)):ti,ab
#18.	(patient-cent* near/3 (decision* or tool* or choice*)):ti,ab
#19.	option next grid*:ti,ab
#20.	(or #2-#19)
#21.	#1 and #20
	Date parameters: Inception – 14 December 2016

G.4.10 Microphones

- What is the clinical and cost effectiveness of directional versus omnidirectional microphones?

Medline search terms

1.	((direction* or omnidirection* or dual) adj2 microphone*).ti,ab.
2.	(multi-microphone* or multimicrophone*).ti,ab.
3.	1 or 2
4.	Excluded study designs and publication types [G.3.1]
5.	3 not 4

6.	Limit 5 to English language
	Date parameters: 1946 – 21 June 2017

134 **Embase search terms**

1.	((direction* or omnidirection* or dual) adj2 microphone*).ti,ab.
2.	(multi-microphone* or multimicrophone*).ti,ab.
3.	or/1-2
4.	Excluded study designs and publication types [G.3.1]
5.	3 not 4
6.	Limit 5 to English language
	Date parameters: 1974 – 21 June 2017

135 **Cochrane search terms**

#1.	((direction* or omnidirection* or dual) near/2 microphone*):ti,ab
#2.	(multi-microphone* or multimicrophone*):ti,ab
#3.	#1 or #2
	Date parameters: Inception – 21 June 2017

136 G.4.11 Noise reduction

137
- What is the clinical and cost effectiveness of noise reduction algorithms?

138 **Medline search terms**

1.	hearing aids/
2.	"correction of hearing impairment"/is [instrumentation]
3.	(hearing adj (aid* or instrument*)).ti,ab.
4.	(ear mold* or earmold* or ear mould* or earmould* or amplif*).ti,ab.
5.	or/1-4
6.	(noise adj1 reduc*).ti,ab.
7.	5 and 6
8.	Excluded study designs and publication types [G.3.1]
9.	7 not 8
10.	Limit 9 to English language
	Date parameters: 1946 – 21 June 2017

139 **Embase search terms**

1.	hearing aid/
2.	(hearing adj (aid* or instrument*)).ti,ab.
3.	(ear mold* or earmold* or ear mould* or earmould* or amplif*).ti,ab.
4.	or/1-3
5.	noise reduction/
6.	(noise adj1 reduc*).ti,ab.
7.	or/5-6
8.	4 and 7
9.	Excluded study designs and publication types [G.3.1]
10.	8 not 9
11.	Limit 10 to English language
	Date parameters: 1974 - 21 June 2017

Cochrane search terms

#1.	[mh ^"hearing aids"]
#2.	MeSH descriptor: [correction of hearing impairment] this term only and with qualifier(s): [instrumentation - is]
#3.	(hearing next (aid* or instrument*)):ti,ab
#4.	(ear next mold* or earmold* or ear next mould* or earmould* or amplif*):ti,ab
#5.	(or #1-#4)
#6.	(noise near/1 reduc*):ti,ab
#7.	#5 and #6
	Date parameters: Inception – 21 June 2017

G.4.12 Information, support and advice

- What are the information, support and advice needs of people with hearing difficulty and their families and carers?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	"patient acceptance of health care"/ or exp patient satisfaction/
6.	patient education as topic/
7.	((information* or advice or advising or advised or support*) adj3 (patient* or need* or requirement* or assess* or seek* or access* or disseminat*)).ti,ab.
8.	(information* adj2 support*).ti,ab.
9.	((client* or patient* or user* or carer* or consumer* or customer*) adj2 (attitud* or priorit* or perception* or preferen* or expectation* or choice* or perspective* or view* or satisfact* or inform* or experience or experiences or opinion*)).ti,ab.
10.	or/5-9
11.	Study filter: QUAL(G.3.9)
12.	4 and 10 and 11
	Date parameters: 1946 – 6 July 2016

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	patient attitude/ or patient preference/ or patient satisfaction/ or consumer attitude/
6.	patient information/ or consumer health information/
7.	patient education/
8.	((information* or advice or advising or advised or support*) adj3 (patient* or need* or requirement* or assess* or seek* or access* or disseminat*)).ti,ab.
9.	(information* adj2 support*).ti,ab.
10.	((client* or patient* or user* or carer* or consumer* or customer*) adj2 (attitud* or priorit* or perception* or preferen* or expectation* or choice* or perspective* or view* or satisfact*

	or inform* or experience or experiences or opinion*)).ti,ab.
11.	or/5-10
12.	Study filter: QUAL(G.3.9)
13.	4 and 11 and 12
	Date parameters: 1974 – 6 July 2016

CINAHL search terms

S1.	Standard population [G.2.1]
S2.	Excluded study designs and publication types [G.3.1]
S3.	S1 not S2
S4.	Limit S3 to English language
S5.	(mh "consumer satisfaction+") or (mh "patient education") or (mh "health education")
S6.	((information* or advice or advising or advised or support*) n3 (patient* or need* or requirement* or assess* or seek* or access* or disseminat*))
S7.	(information* n2 support*)
S8.	((client* or patient* or user* or carer* or consumer* or customer*) n2 (attitud* or priorit* or perception* or preferen* or expectation* or choice* or perspective* or view* or satisfact* or inform* or experience or experiences or opinion*))
S9.	S5 or S6 or S7 or S8
S10.	Study filter: QUAL(G.3.9)
S11.	S4 and S9 and S10
	Date parameters: 1981 – 6 July 2016

PsycINFO search terms

1.	Standard population [G.2.1]
2.	Limit 1 to English language
3.	su.exact("client education") or su.exact.explode("client attitudes") or ti,ab((information* or advice or advising or advised or support*) n/3 (patient* or need* or requirement* or assess* or seek* or access* or disseminat*)) or ti,ab(information* n/2 support*) or ti,ab((client* or patient* or user* or carer* or consumer* or customer*) n/2 (attitud* or priorit* or perception* or preferen* or expectation* or choice* or perspective* or view* or satisfact* or inform* or experience or experiences or opinion*))
4.	Study filter: QUAL(G.3.9)
5.	2 and 3 and 4
	Date parameters: 1806 – 6 July 2016

G.4.13 Unilateral versus bilateral hearing aids

- What is the clinical and cost effectiveness of fitting 1 hearing aid compared with fitting 2 hearing aids for people when both ears have an aidable hearing loss?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	hearing aids/
6.	"correction of hearing impairment"/is [instrumentation]
7.	(hearing adj (aid* or instrument*)).ti,ab.
8.	(ear mold* or earmold* or ear mould* or earmould* or amplif*).ti,ab.

9.	or/5-9
10.	(contralateral or bilateral* or binaural or unilateral* or monoaural or (bi adj3 lateral*) or (uni adj3 lateral*) or bimodal).ti,ab.
11.	((both or two or one or left or right or single or double) adj3 (side* or ear or ears or fitting*)).ti,ab.
12.	10 or 11
13.	9 and 12
14.	((both or two or one or left or right or single or double) adj3 (aid* or instrument*)).ti,ab.
15.	13 or 14
16.	4 and 15
17.	Study filters: RCT (G.3.2) or SR (0) or OBS (G.3.8]
18.	16 and 17
	Date parameters: 1946 – 7 October 2016

153 **Embase search terms**

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	hearing aid/
6.	(hearing adj (aid* or instrument*)).ti,ab.
7.	(ear mold* or earmold* or ear mould* or earmould* or amplif*).ti,ab.
8.	or/5-7
9.	(contralateral or bilateral* or binaural or unilateral* or monoaural or (bi adj3 lateral*) or (uni adj3 lateral*) or bimodal).ti,ab.
10.	((both or two or one or left or right or single or double) adj3 (side* or ear or ears or fitting*)).ti,ab.
11.	9 or 10
12.	8 and 11
13.	((both or two or one or left or right or single or double) adj3 (aid* or instrument*)).ti,ab.
14.	12 or 13
15.	4 and 14
16.	Study filters: RCT (G.3.2) or SR (0) or OBS (G.3.8]
17.	15 and 16
	Date parameters: 1974 – 7 October 2016

154 **Cochrane search terms**

#1.	Standard population [G.2.1]
#2.	[mh ^"hearing aids"]
#3.	MeSH descriptor: [correction of hearing impairment] this term only and with qualifier(s): [instrumentation - is]
#4.	(hearing next (aid* or instrument*)):ti,ab
#5.	(ear next mold* or earmold* or ear next mould* or earmould* or amplif*):ti,ab
#6.	(or #2-#5)
#7.	(contralateral or bilateral* or binaural or unilateral* or monoaural or (bi near/3 lateral*) or (uni near/3 lateral*) or bimodal):ti,ab
#8.	((both or two or one or left or right or single or double) near/3 (side* or ear or ears or fitting*)):ti,ab

#9.	#7 or #8
#10.	#6 and #9
#11.	((both or two or one or left or right or single or double) near/3 (aid* or instrument*)):ti,ab
#12.	#10 or #11
#13.	#1 and #12
	Date parameters: Inception – 7 October 2016

G.4.14 Idiopathic sudden sensorineural hearing loss

The following 2 questions were run with the same search strategy.

- What is the clinical and cost effectiveness of different routes of administration of steroids (for example oral or intratympanic) in the treatment of sudden sensorineural hearing loss (SSNHL)?
- What is the most clinically and cost-effective treatment for idiopathic sudden sensorineural hearing loss (SSNHL)?

Medline search terms

1.	(sshl or snhl or ishl or isshl or issnhl).ti,ab.
2.	hearing loss, sudden/
3.	hearing loss/ or deafness/ or exp hearing loss, sensorineural/
4.	(hearing adj2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral or bilateral)).ti,ab.
5.	deaf*.ti,ab.
6.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*).ti,ab.
7.	(sudden* or abrupt* or rapid* or acute*).ti,ab.
8.	or/3-6
9.	7 and 8
10.	1 or 2 or 9
11.	Excluded study designs and publication types [G.3.1]
12.	10 not 11
13.	Limit 12 to English language
14.	exp steroids/
15.	(steroid* or corticosteroid* or glucocorticosteroid* or glucocorticoid* or prednisolone or dexamethasone).ti,ab.
16.	exp antiviral agents/
17.	(antiviral* or anti-viral*).ti,ab.
18.	(aciclovir or acyclovir or amantadine or famciclovir or ganciclovir or gancyclovir or valaciclovir).ti,ab.
19.	or/14-18
20.	13 and 19
21.	Study filters: RCT (G.3.2) or SR (0)
22.	20 and 21
	Date parameters: 1946 – 19 June 2017

Embase search terms

1.	(sshl or snhl or ishl or isshl or issnhl).ti,ab.
2.	sudden deafness/
3.	*hearing impairment/ or exp perception deafness/
4.	(hearing adj2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish*

	or difficult* or disabilit* or hard or one side* or unilateral or bilateral)).ti,ab.
5.	deaf*.ti,ab.
6.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*).ti,ab.
7.	or/3-6
8.	(sudden* or abrupt* or rapid* or acute*).ti,ab.
9.	7 and 8
10.	1 or 2 or 9
11.	Excluded study designs and publication types [G.3.1]
12.	10 not 11
13.	Limit 12 to English language
14.	exp *steroid/
15.	(steroid* or corticosteroid* or glucocorticosteroid* or glucocorticoid* or prednisolone or dexamethasone).ti,ab.
16.	exp *antivirus agent/
17.	(antiviral* or anti-viral*).ti,ab.
18.	(aciclovir or acyclovir or amantadine or famciclovir or ganciclovir or gancyclovir or valaciclovir).ti,ab.
19.	or/14-18
20.	13 and 19
21.	Study filters: RCT (G.3.2) or SR (0)
22.	20 and 21
	Date parameters: 1974 - 19 June 2017

163 **Cochrane search terms**

#1.	(sshl or snhl or ishl or isshl or issnhl):ti,ab
#2.	[mh ^"hearing loss, sudden"]
#3.	[mh ^"hearing loss"]
#4.	[mh ^deafness]
#5.	[mh "hearing loss, sensorineural"]
#6.	(hearing near/2 (loss* or impair* or partial* or deficit* or deteriorat* or degenerat* or diminish* or difficult* or disabilit* or hard or one side* or unilateral or bilateral)):ti,ab
#7.	deaf*:ti,ab
#8.	(hypoacus* or presbycus* or presbyacus* or sociocus* or nosocus* or anacus*):ti,ab
#9.	(or #3-#8)
#10.	(sudden* or abrupt* or rapid* or acute*):ti,ab
#11.	#9 and #10
#12.	#1 or #2 or #11
#13.	[mh steroids]
#14.	(steroid* or corticosteroid* or glucocorticosteroid* or glucocorticoid* or prednisolone or dexamethasone):ti,ab
#15.	[mh "antiviral agents"]
#16.	(antiviral* or anti-viral*):ti,ab
#17.	(aciclovir or acyclovir or amantadine or famciclovir or ganciclovir or gancyclovir or valaciclovir):ti,ab
#18.	(or #13-#17)
#19.	#12 and #18
	Date parameters: Inception – 19 June 2017

G.4.15 Monitoring

The following 2 questions were run with the same search strategy.

- What is the most clinically and cost-effective method of delivery of monitoring and follow-up of people with hearing-related communication needs (including those with hearing aids)?
- When should people with hearing-related communication needs (including those with hearing aids) be monitored and followed up?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	monit*.ti,ab.
6.	monitoring, physiologic/
7.	((review* or follow-up or followed up or followup* or check-up* or assess*) adj3 (regular* or routine* or periodic* or frequent* or email* or e-mail* or telephone* or phone* or telemedicine* or telecare* or clinic or clinics or appoint* or online or survey* or questionnaire*)).ti,ab.
8.	(review* or follow-up or followed up or followup* or check-up* or assess*).ti,ab. and telemedicine/
9.	telemonitor*.ti,ab.
10.	or/5-9
11.	4 and 10
12.	Study filters: RCT (G.3.2) or SR (0) or OBS (G.3.8]
13.	11 and 12
	Date parameters: 1946 – 22 February 2017

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	monit*.ti,ab.
6.	*monitoring/ or exp *patient monitoring/
7.	((review* or follow-up or followed up or followup* or check-up* or assess*) adj3 (regular* or routine* or periodic* or frequent* or email* or e-mail* or telephone* or phone* or telemedicine* or telecare* or clinic or clinics or appoint* or online or survey* or questionnaire*)).ti,ab.
8.	(review* or follow-up or followed up or followup* or check-up* or assess*).ti,ab. and telemedicine/
9.	telemonitor*.ti,ab.
10.	or/5-9
11.	4 and 10
12.	Study filters: RCT (G.3.2) or SR (0) or OBS (G.3.8]
13.	11 and 12
	Date parameters: 1974 – 22 February 2017

Cochrane search terms

#1.	Standard population [G.2.1]
#2.	monit*:ti,ab
#3.	[mh ^"monitoring, physiologic"]
#4.	((review* or follow-up or "follow up" or "followed up" or followup* or check-up* or check next up* or assess*) near/3 (regular* or routine* or periodic* or frequent* or email* or e-mail* or telephone* or phone* or telemedicine* or telecare* or clinic or clinics or appoint* or online or survey* or questionnaire*)):ti,ab
#5.	(review* or follow-up or "follow up" or "followed up" or followup* or check-up* or check next up* or assess*):ti,ab
#6.	[mh ^telemedicine]
#7.	#5 and #6
#8.	telemonitor*:ti,ab
#9.	#2 or #3 or #4 or #7 or #8
#10.	#1 and #9
	Date parameters: Inception – 22 February 2017

G.4.16 Assistive listening devices

- What is the clinical and cost effectiveness of assistive listening devices (such as loops) to support communication?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	amplifiers, electronic/
6.	mobile applications/
7.	wireless technology/
8.	smartphone/
9.	bluetooth.ti,ab.
10.	((telephone* or phone* or television* or tv) adj3 amplif*).ti,ab.
11.	((doorbell* or door bell* or alarm* or smoke detector*) adj3 amplif*).ti,ab.
12.	(wireless* or wirefree or wire-less* or wire-free).ti,ab.
13.	(fm or frequency modulated or rf or radiofrequenc* or radio-frequenc* or radio or radios).ti,ab.
14.	(telecoil* or t-coil*).ti,ab.
15.	(loop or loops or t-loop*).ti,ab.
16.	(remote adj microphone*).ti,ab.
17.	(smartphone* or smart phone* or iphone*).ti,ab.
18.	((mobile or cell or cellphone or cellular) adj3 (app or apps or application* or software*)).ti,ab.
19.	(personal sound amplif* or psap*).ti,ab.
20.	((assist* or alternative*) adj2 (listen* or device*)).ti,ab.
21.	self-fitting.ti,ab.
22.	or/5-21
23.	4 and 22
	Date parameters: 1946 – 21 June 2017

178 **Embase search terms**

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	amplifier/
6.	mobile application/
7.	wireless communication/
8.	smartphone/
9.	bluetooth.ti,ab.
10.	((telephone* or phone* or television* or tv) adj3 amplif*).ti,ab.
11.	((doorbell* or door bell* or alarm* or smoke detector*) adj3 amplif*).ti,ab.
12.	(wireless* or wirefree or wire-less* or wire-free).ti,ab.
13.	(fm or frequency modulated or rf or radiofrequenc* or radio-frequenc* or radio or radios).ti,ab.
14.	(telecoil* or t-coil*).ti,ab.
15.	(loop or loops or t-loop*).ti,ab.
16.	(remote adj microphone*).ti,ab.
17.	(smartphone* or smart phone* or iphone*).ti,ab.
18.	((mobile or cell or cellphone or cellular) adj3 (app or apps or application* or software*)).ti,ab.
19.	(personal sound amplif* or psap*).ti,ab.
20.	((assist* or alternative*) adj2 (listen* or device*)).ti,ab.
21.	self-fitting.ti,ab.
22.	or/5-21
23.	4 and 22
	Date parameters: 1974 – 21 June 2017

179 **Cochrane search terms**

#1.	Standard population [G.2.1]
#2.	[mh ^"amplifiers, electronic"]
#3.	[mh ^"mobile applications"]
#4.	[mh ^"wireless technology"]
#5.	[mh ^smartphone]
#6.	bluetooth:ti,ab
#7.	((telephone* or phone* or television* or tv) near/3 amplif*):ti,ab
#8.	((doorbell* or door next bell* or alarm* or smoke next detector*) near/3 amplif*):ti,ab
#9.	(wireless* or wirefree or wire-less* or wire-free):ti,ab
#10.	(fm or frequency next modulated or rf or radiofrequenc* or radio-frequenc* or radio or radios):ti,ab
#11.	(telecoil* or t-coil*):ti,ab
#12.	(loop or loops or t-loop*):ti,ab
#13.	(remote next microphone*):ti,ab
#14.	(smartphone* or smart next phone* or iphone*):ti,ab
#15.	((mobile or cell or cellphone or cellular) near/3 (app or apps or application* or software*)):ti,ab
#16.	(personal next sound next amplif* or psap*):ti,ab

#17.	((assist* or alternative*) near/2 (listen* or device*)):ti,ab
#18.	self-fitting:ti,ab
#19.	(or #2-#18)
#20.	#1 and #19
	Date parameters: Inception - 21 June 2017

G.4.17 Aftercare

- What is the clinical and cost effectiveness of interventions to support continuing use of hearing aids?

Medline search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	hearing aids/
6.	prosthesis fitting/
7.	hearing aid*.ti,ab.
8.	("ear mold*" or earmold* or "ear mould*" or earmould* or amplif*).ti,ab.
9.	or/5-8
10.	4 and 9
11.	social support/
12.	(support* adj2 (social* or peer* or group*)).ti,ab.
13.	(aftercare or after care).ti,ab.
14.	(repair* or maintenance* or maintain* or batter*).ti,ab.
15.	or/11-14
16.	10 and 15
17.	Study filters: RCT (G.3.2) or SR (0)
18.	16 and 17
	Date parameters: 1946 – 3 October 2016

Embase search terms

1.	Standard population [G.2.1]
2.	Excluded study designs and publication types [G.3.1]
3.	1 not 2
4.	Limit 3 to English language
5.	hearing aid/
6.	exp prosthesis/
7.	hearing aid*.ti,ab.
8.	("ear mold*" or earmold* or "ear mould*" or earmould* or amplif*).ti,ab.
9.	or/5-8
10.	4 and 9
11.	social support/
12.	aftercare/
13.	electric battery/
14.	prosthetic repair/

15.	(support* adj2 (social* or peer* or group*)).ti,ab.
16.	(aftercare or after care).ti,ab.
17.	(repair* or maintenance* or maintain* or batter*).ti,ab.
18.	or/11-17
19.	10 and 18
20.	Study filters: RCT (G.3.2) or SR (0)
21.	19 and 20
	Date parameters: 1974 – 3 October 2016

185 **Cochrane search terms**

#1.	Standard population [G.2.1]
#2.	[mh ^"hearing aids"]
#3.	[mh ^"prosthesis fitting"]
#4.	hearing next aid*:ti,ab
#5.	("ear mold*" or earmold* or "ear mould*" or earmould* or amplif*):ti,ab
#6.	(or #2-#5)
#7.	#1 and #6
#8.	[mh ^"social support"]
#9.	(support* near/2 (social* or peer* or group*)):ti,ab
#10.	(aftercare or "after care"):ti,ab
#11.	(repair* or maintenance* or maintain* or batter*):ti,ab
#12.	(or #8-#11)
#13.	#7 and #12
	Date parameters: Inception - 3 October 2016

186 **PsycINFO search terms**

1.	Standard population [G.2.1]
2.	Limit 1 to English language
3.	su.exact("hearing aids") or ti,ab(hearing-aid*) or ti,ab(ear-mold* or earmold* or ear-mould* or earmould* or amplif*)
4.	su.exact("social support") or su.exact("peer counseling") or su.exact("aftercare") or ti,ab(support* n/2 (social* or peer* or group*)) or ti,ab(aftercare or after-care) or ti,ab(repair* or maintenance* or maintain* or batter*)
5.	Study filters: RCT (G.3.2) or SR (0)
6.	2 and 3 and 4 and 5
	Date parameters: 1806 - 3 October 2016

187 **CINAHL search terms**

S1.	Standard population [G.2.1]
S2.	Excluded study designs and publication types [G.3.1]
S3.	S1 not S2
S4.	Limit 3 to English language
S5.	(mh "hearing aids") or (mh "hearing aid fitting") or (mh "prosthetic fitting")
S6.	"hearing aid*" or "ear mold*" or earmold* or "ear mould*" or earmould* or amplif*
S7.	S5 or S6
S8.	S4 and S7
S9.	(mh "support, psychosocial+") or (mh "after care") or (mh "hearing aid care") or (mh

	"equipment maintenance")
S10.	(support* n2 (social* or peer* or group*))
S11.	aftercare or "after care"
S12.	repair* or maintenance* or maintain* or batter*
S13.	S9 or S10 or S11 or S12
S14.	S8 and S13
	Date parameters: 1981 - 3 October 2016

G.5 Health economics search terms

G.5.1 Health economic (HE) reviews

Economic searches were conducted in Medline, Embase and CRD.

Medline & Embase search terms

1.	#33. Standard population [G.2.1]
2.	#34. Excluded study designs and publication types [G.3.1]
3.	#35. 1 not 2
4.	#36. Limit 3 to English language
5.	#37. Study filter HE (0) or MOD(G.3.6)
6.	#38. 4 and 5
#39.	#40. Date parameters: 2014 – 16 February 2016

CRD search terms

#1.	Standard population [G.2.1]
	Date parameters: 2001-2016

G.5.1.1 Additional economic search for Wax question

- Run in Medline, Embase and CRD below without a population, just terms for wax.

Medline search terms

1.	#41. cerumen/
2.	#42. (cerumen or earwax or (ear* adj5 wax*)).ti,ab.
3.	#43. 1 or 2
4.	#44. Limit 3 to English language
5.	#45. Excluded study designs and publication types [G.3.1]
6.	#46. 4 not 5
7.	#47. Study filter HE (0)
8.	#48. 6 and 7
#49.	#50. Date parameters: Inception – 16 August 2017

Embase search terms

1.	#51. cerumen/ or cerumen impaction/
2.	#52. (cerumen or earwax or (ear* adj5 wax*)).ti,ab.
3.	#53. 1 or 2
4.	#54. Limit 3 to English language
5.	#55. Excluded study designs and publication types [G.3.1]
6.	#56. 4 not 5

7.	#57.	Study filter HE (0)
8.	#58.	6 and 7
#59.	#60.	Date parameters: Inception – 16 August 2017

CRD search terms

#1.	MeSH descriptor cerumen
#2.	((cerumen or earwax or (ear* adj5 wax*)))
#3.	#1 or #2 in NHSEED, HTA
	Date parameters: Inception – 16 August 2017

G.5.2 Quality of life (QoL) reviews

Quality of life searches were conducted in Medline and Embase only

Medline & Embase search terms

1.	#61.	Standard population [G.2.1]
2.	#62.	Excluded study designs and publication types [G.3.1]
3.	#63.	1 not 2
4.	#64.	Limit 3 to English language
5.	#65.	Study filter QOL (G.3.5)
6.	#66.	4 and 5
#67.	#68.	Date parameters: Inception – 16 February 2016

Appendix H: Clinical evidence tables

H.1 Urgent and routine referral

H.1.1 Urgent referral

None

H.1.2 Routine referral

None

H.2 MRI

Reference	**Cheng 2012**[95]
Study type	Diagnostic accuracy study (retrospective chart review; single-gated)
Study methodology	Data source: Electronic register of all ENT-referred MRI scans Recruitment: consecutive sample (September 2006 – October 2009)
Number of patients	n = 1751
Patient characteristics	**Age**: only given for acoustic tumour group (said to be comparable with other groups) – median 45 (range: 28-83 years)

Reference	**Cheng 2012**[95]
	Gender (male to female ratio): only given for acoustic tumour group – 1.52:1 **Ethnicity**: not stated **Setting**: ENT, audiology and radiology departments of tertiary-care hospital **Country**: UK **Inclusion criteria**: ENT-referred patients who had clinical consultation with audiometry suggestive of sensorineural hearing loss and MRI scan **Exclusion criteria**: Conductive hearing loss
Target condition(s)	Acoustic tumour: vestibular schwannoma or meningioma
Index test(s) and reference standard	Index test(s) Published audiometric protocols: **Protocol name** **Definition of ASHL** **Single-frequency comparison** DOH ≥20 dB at any single frequency between 0.5–4 kHz. Nashville ≥15 dB at any single frequency between 0.5–4 kHz. AMCLASS-B-Urben ≥15 dB at any single frequency. Rule 3000 ≥15 dB asymmetry at 3 kHz.

Reference	**Cheng 2012[95]**
	Rule 4000 ≥20 dB asymmetry at 4 kHz. **Two adjacent-frequency comparison** Sunderland ≥20 dB at two adjacent frequencies. AMCLASS-A-Urben ≥10 dB at two adjacent frequencies. Cueva ≥15 dB at two or more adjacent frequencies. **Averaged multiple-frequency comparison** AAO-HNS ≥ 15 dB between ears averaging 0.5–3 kHz. Oxford ≥ 15 dB between ears averaging 0.5–8 kHz. Seattle ≥ 15 dB between ears averaging 1–8 kHz. Mangham ≥ 10 dB between ears averaging 1–8 kHz. Schlauch and Levine ≥ 20 dB between ears averaging 1–8 kHz. Sheppard ≥ 15 dB between ears averaging 0.25–8 kHz. Obholzer ≥ 15 dB if better ear is ≤ 30 dB hearing loss average at frequencies 0.25–8 kHz; or ≥ 20 dB if better ear is >30 dB hearing loss average at frequencies 0.25–8 kHz. Reference standard High resolution non-enhanced FSE T2-weighted MRI (n=217)

Reference	**Cheng 2012[95]**				
	T1-weighted images with gadolinium enhancement (n=1672) Time between measurement of index test and reference standard: not stated				
Statistical measures	**Findings based on taking non-acoustic tumours and non-pathological cases as negatives**				
	Protocol name	**Sensitivity**	**Specificity**	**False negatives**	**False positives**
	Single-frequency comparison				
	DOH	83.2	62.6	22	606
	Nashville	87.9	52.1	16	776
	AMCLASS-B-Urben	87.9	44.7	16	896
	Rule 3000	87.9	57.3	16	692
	Rule 4000	82.1	62.6	23	606
	Two adjacent-frequency comparison				
	Sunderland	82.6	61.1	23	631
	AMCLASS-A-Urben	93.2	31.6	9	1108
	Cueva	85.8	48.7	19	832
	Averaged multiple-frequency comparison				
	AAO-HNS	87.4	65.4	17	561
	Oxford	85.8	61.1	19	631
	Seattle	86.3	60.0	18	648

Reference	Cheng 2012[95]				
	Mangham	91.6	44.2	11	903
	Schlauch and Levine	81.1	66.3	25	545
	Sheppard	86.8	60.1	17	646
	Obholzer	83.7	66.4	21	544
	Findings based on taking non-pathological cases as negatives				
	Protocol name	**Sensitivity**	**Specificity**		**False positives**
	Single-frequency comparison				
	DOH		63.7		439
	Nashville		53.9		558
	AMCLASS-B-Urben		46.9		643
	Rule 3000		59.0		497
	Rule 4000		63.7		439
	Two adjacent-frequency comparison				
	Sunderland		61.4		467
	AMCLASS-A-Urben		33.1		810
	Cueva		50.4		601
	Averaged multiple-frequency comparison				
	AAO-HNS		66.0		441

Reference	**Cheng 2012**[95]		
	Oxford	62.1	458
	Seattle	62.0	460
	Mangham	44.9	667
	Schlauch and Levine	68.2	385
	Sheppard	60.6	477
	Obholzer	68.0	388
Source of funding	None		
Limitations	Risk of bias: Not all patients included in analysis; 667 (including 2 with acoustic tumour) excluded due to having unreliable or unavailable results, or conductive hearing loss (majority due to incomplete results); unclear time interval between audiometry and MRI and unclear if audiometry results were known by those interpreting MRI scans; unclear if dedicated thin-section imaging was performed Indirectness: 409 non-acoustic tumours group patients treated as negative findings for sensitivity results, but these may be the underlying cause of hearing loss		
Comments	Sensitivity calculations based on taking non-acoustic tumours and non-pathological cases as negatives		

Reference	**Suzuki 2010**[532]

Reference	**Suzuki 2010**[532]
Study type	Diagnostic accuracy study (retrospective chart review; single-gated)
Study methodology	Data source: Medical records Recruitment: Screened records of new patients seen 1994-1999
Number of patients	n = 500
Patient characteristics	Age: not stated Gender (male to female ratio): not stated Ethnicity: not stated Setting: General hospital Country: Japan Inclusion criteria: New patients 15 years or older with asymmetric SNHL who had undergone MRI; PTA >15 dB hearing level difference between ears at any frequency from 0.5 to 4 kHz, and left and right air conductances that did not intersect at frequencies within this range. Exclusion criteria: [known?] SNHL cause other than acoustic neuroma (for example, temporal bone fracture, acoustic trauma, perilymphatic fistula, labyrinthitis, Hunt syndrome or functional hearing loss); previous diagnosis of acoustic neuroma.

Reference	**Suzuki 2010**[532]
Target condition(s)	Vestibular schwannoma (n=13)
Index test(s) and reference standard	<u>Index test(s)</u> Pure tone audiometry was carried out in 5 dB HL steps. Air conduction thresholds were measured at 0.125, 0.25, 0.500, 1, 2, 3, 4, 6 and 8 kHz with standard headphones. Bone conduction thresholds were measured at 0.25, 0.500, 1, 2, 3, and 4 kHz with a bone oscillator. **Normal hearing** was defined as 20 dB HL hearing level or better **Idiopathic sudden deafness** was defined as unilateral hearing impairment of at least 10 dB HL on PTA occurring suddenly or over a few days in at least 2 frequencies. Audiogram shapes were defined as: • **High frequency sloping loss:** normal threshold between 0.125 and 2 kHz with a downward curve into the high frequencies (4, 6 and 8 kHz) and a 10 dB HL difference between 2 consecutive frequencies • **High frequency steep loss:** normal threshold between 0.125 and 2 kHz with a loss of hearing of at least 40 dB HL at each measured high frequency (4, 6 and 8 kHz). • **Flat loss:** no difference of >20 dB HL between all frequencies • **Total deafness:** hearing loss of at least 90 dB HL at every frequency from 0.25 to 8 kHz. • **Low frequency loss:** threshold reduced by at least 25 dB HL at the low frequencies (0.125 and 0.25 kHz)with a rising curve into the speech range • **Basin-shaped loss:** good hearing at 0.125, 0.25, 0.5 and 8 kHz with elevated thresholds throughout the middle frequencies and >15 dB HL difference between lowest and highest hearing thresholds. • **Mountain-shaped loss:** at least 2 consecutive frequencies between 0.25 and 4 kHz that were better than 0.125 and 8 kHz • **Other**

Reference	**Suzuki 2010[532]**
	Reference standard MRI (without enhancement) using Signa horizon LX 1.5 Tesla CVi Time between measurement of index test and reference standard: not stated
Statistical measures	Basin-shaped loss (n=42) Sensitivity 23% Specificity 92% PPV 0.07 NPV 0.98 PLR 2.88 NLR 0.84 Flat loss (n=107) Sensitivity 38% Specificity 79% PPV 0.05 NPV 0.98

Reference	Suzuki 2010[532]
	PLR 1.84 NLR 0.78 <u>Total deafness (n=58)</u> Sensitivity 15% Specificity 89% PPV 0.03 NPV 0.98 PLR 1.34 NLR 0.96 <u>High-frequency sloping loss (n=34)</u> Sensitivity 8% Specificity 93% PPV 0.03 NPV 0.97 PLR 1.14 NLR 0.99

Reference	**Suzuki 2010[532]**
	High-frequency steep loss (n=81) Sensitivity 15% Specificity 84% PPV 0.02 NPV 0.97 PLR 0.95 NLR 1.01 Mountain-shaped loss (n=59) Sensitivity 0% Specificity 88% PPV 0.00 NPV 0.97 PLR 0.00 NLR 1.14 Low frequency loss (n=94) Sensitivity 0%

Reference	**Suzuki 2010[532]**
	Specificity 81% PPV 0.00 NPV 0.97 PLR 0.00 NLR 1.24 <u>Other (n=25)</u> Sensitivity 0% Specificity 95% PPV 0.00 NPV 0.97 PLR 0.00 NLR 1.05 <u>Idiopathic sudden deafness (n=179)</u> Sensitivity 38% Specificity 64% PPV 0.03

Reference	**Suzuki 2010**[532]
	NPV 0.98 PLR 1.08 NLR 0.96
Source of funding	Not stated
Limitations	Risk of bias: Excluded causes of SNHL other than acoustic neuroma, these may have been 'difficult to diagnose' cases; unclear time interval between audiometry and MRI and unclear if audiometry results were known by those interpreting MRI scans Indirectness: May have included children
Comments	

Reference	**Saliba 2011**[488]
Study type	Diagnostic accuracy study (retrospective chart review; single-gated)
Study methodology	Data source: Chart review Recruitment: November 2003 to December 2008

Reference	**Saliba 2011[488]**
Number of patients	n = 212 (84 with VS)
Patient characteristics	Age: Mean 41 years in non-VS group and 52 years in VS group Gender (male to female ratio): 32/68% Ethnicity: Not stated Setting: Referred tertiary care centre Country: Canada Inclusion criteria: Underwent audiometric assessment for cochleo-vestibular symptoms before first diagnostic MRI and were evaluated by posterior fossa MRI for asymmetric SNHL (defined as ≥10 dB loss at one or more frequencies or at least 15% asymmetry in speech discrimination scores). Exclusion criteria: not stated explicitly, but missing data for 3 kHz led to exclusion of 20 patients
Target condition(s)	Vestibular schwannoma
Index test(s) and reference standard	Index test(s) Published audiometric SNHL asymmetry definitions: **Protocol name** **Definition of ASNHL**

Reference	Saliba 2011[488]
	Single-frequency comparison DOH ≥20 dB at any single frequency between 0.5–4 kHz. Nashville ≥15 dB at any single frequency between 0.5–4 kHz. AMCLASS-B ≥15 dB at any single frequency. Rule 3000 ≥15 dB asymmetry at 3 kHz. **Two adjacent-frequency comparison** Sunderland ≥20 dB at two adjacent frequencies. AMCLASS-A ≥10 dB at two adjacent frequencies. Cueva ≥15 dB at two or more adjacent frequencies; or 15% difference between speech discrimination. **Averaged multiple-frequency comparison** AAO-HNS ≥ 15 dB between ears averaging 0.5–3 kHz. Oxford ≥ 15 dB between ears averaging 0.5–8 kHz. Seattle ≥ 15 dB between ears averaging 1–8 kHz. Reference standard Posterior fossa MRI [no further details] Time between measurement of index test and reference standard: not stated

<table>
<tr><td>Reference</td><td>Saliba 2011[488]</td></tr>
<tr><td>Statistical measures</td><td>
<table>
<tr><th>Protocol name</th><th>Sensitivity</th><th>Specificity</th><th>PPV</th><th>NPV</th><th>LR+</th><th>LR-</th></tr>
<tr><td>DOH</td><td>87.1</td><td>58.7</td><td>76.3</td><td>75.0</td><td>2.1</td><td>0.22</td></tr>
<tr><td>Oxford/Nashville</td><td>93.1</td><td>43.4</td><td>72.3</td><td>80.0</td><td>1.64</td><td>0.16</td></tr>
<tr><td>AMCLASS-A or B</td><td>93.2</td><td>25.2</td><td>66.0</td><td>67.4</td><td>2.03</td><td>0.32</td></tr>
<tr><td>Rule 3000</td><td>73.0</td><td>76.0</td><td>86.0</td><td>68.0</td><td>2.91</td><td>0.38</td></tr>
<tr><td>Sunderland</td><td>74.3</td><td>70.2</td><td>79.7</td><td>63.6</td><td>2.49</td><td>0.37</td></tr>
<tr><td>Cueva</td><td>80.6</td><td>60.4</td><td>75.3</td><td>67.4</td><td>2.03</td><td>0.32</td></tr>
<tr><td>AAO-HNS</td><td>90.1</td><td>54.3</td><td>75.3</td><td>78.1</td><td>1.97</td><td>0.18</td></tr>
<tr><td>Seattle</td><td>91.8</td><td>43.5</td><td>72.0</td><td>76.9</td><td>1.62</td><td>0.18</td></tr>
</table>
</td></tr>
<tr><td>Source of funding</td><td>Not stated</td></tr>
<tr><td>Limitations</td><td>Risk of bias: Excluded patients without data at 3 kHz; unclear if thin-section imaging was used; unclear time interval between audiometry and MRI and unclear if audiometry results were known by those interpreting MRI scans
Indirectness: Patients referred to tertiary care hospital after screening and scanning in primary care (may have had more prior testing than expected)</td></tr>
<tr><td>Comments</td><td></td></tr>
</table>

Reference	**Cueva 2004**[122]
Study type	Diagnostic accuracy study (prospective; single-gated)
Study methodology	Data source: Prospective multicentre study Recruitment: Unclear method
Number of patients	n = 316 (4 of whom withdrew before undertaking both tests)
Patient characteristics	Age: Mean 53.9 (range: 18-87) Gender (male to female ratio): 48%/52% Ethnicity: not stated Setting: not stated Country: USA multicentre Inclusion criteria: Age 18 or over with asymmetric SNHL (≥15 dB in 2 or more PTA thresholds or asymmetry ≥15% on speech discrimination scores) and no contraindication for MRI Exclusion criteria: Clear aetiology for the hearing loss (for example, trauma or iatrogenic), prior diagnosis of neurofibromatosis Type II, or hearing loss 70 dB or more between 2 and 4 kHz (precluding reliable ABR testing).
Target	Retrocochlear pathology and other abnormalities (‘causative lesions’).

<table>
<tr><th>Reference</th><th colspan="4">Cueva 2004[122]</th></tr>
<tr><td>condition(s)</td><td colspan="4">Those identified (n=31) were 24 vestibular schwannomas, 2 glomus jugulare tumours, 2 ectatic basilar arteries with cochlear nerve compression, 1 petrous apex cholesterol granuloma, 1 temporal –parietal lobe mass with associated oedema and 1 case of demyelinating disease.</td></tr>
<tr><td>Index test(s) and reference standard</td><td colspan="4"><u>Index test(s)</u>
Auditory brainstem response (ABR) testing; considered abnormal if IT5 inter-peak latency > 0.2 ms, abnormal absolute wave V latency, or absent/distorted waveform morphology.
Interpreted by audiologists with extensive experience in performing and reading ABR (blinded to other tests).
<u>Reference standard</u>
MRI with Gd-DPTA contrast; reviewed by a neuroradiologist (blinded to other tests).
Time between measurement of index test and reference standard: not stated</td></tr>
<tr><td>2×2 table</td><td></td><td>Reference standard +</td><td>Reference standard -</td><td>Total</td></tr>
<tr><td></td><td>Index test +</td><td>22</td><td>73</td><td>95</td></tr>
<tr><td></td><td>Index test -</td><td>9</td><td>208</td><td>217</td></tr>
<tr><td></td><td>Total</td><td>31</td><td>281</td><td>312</td></tr>
</table>

Reference	**Cueva 2004**[122]
Statistical measures	Index text: abnormal ABR Sensitivity 71% Specificity 74% PPV 0.23 NPV 0.96 PLR 2.73 NLR 0.39 Index text: abnormal ABR for vestibular schwannoma only Sensitivity 71% Index text: tinnitus present Sensitivity 71% Specificity 38% PPV 0.11 NPV 0.92 PLR 1.15

Reference	Cueva 2004[122]
	NLR 0.76 Index text: unilateral hearing loss (as opposed to asymmetric bilateral) Sensitivity 65% Specificity 58% PPV 0.14 NPV 0.94 PLR 1.54 NLR 0.61
Source of funding	Part funded by grant from Southern California Permanente Medical Group
Limitations	Risk of bias: unclear time interval between audiometry and MRI and unclear method of patient selection (for example, consecutive); lack of detail about ABR testing and unclear if dedicated thin-section imaging was performed. Indirectness: None
Comments	Of the 9 lesions not identified by ABR, 7 were vestibular schwannomas

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Reference	Rupa 2003[483]

Reference	**Rupa 2003[483]**
Study type	Diagnostic accuracy study (prospective; single-gated)
Study methodology	Data source: Prospective patient series Recruitment: Unclear
Number of patients	n = 90
Patient characteristics	Age range: 15-66 Gender (male to female ratio): 62%/58% Ethnicity: Not stated Setting: Medical college and hospital Country: India Inclusion criteria: Patients who presented to ENT with asymmetric auditory symptoms of hearing loss and tinnitus. Asymmetric hearing loss defined as a difference of >15 dB between the right and left ears at 2 or more frequencies between 0.25 and 8 kHz. Exclusion criteria: Not stated Presenting symptoms (most patients had >1): 1. Gradually progressive hearing loss: 68 2. Sudden hearing loss: 9

Reference	**Rupa 2003**[483]
	3. Tinnitus: 63 4. Vertigo: 42 Therefore, 13 (14%) did not present with hearing loss
Target condition(s)	Vestibular schwannoma
Index test(s) and reference standard	Index test(s) Auditory brainstem response testing: responses to 100µs click stimulus of 90 dB and/or 100 dB intensity delivered through headphones at a rate of 11.1/s. Contralateral broadband masking noise was provided. An active electrode was placed on the vertex, reference electrodes on the ipsilateral and contralateral mastoids, and ground electrode on the forehead. The filter settings were fixed at 0.150 to 3 kHz. Responses were classified as: 1. Normal 2. Cochlear pathology 3. **Retrocochlear pathology**: increased interpeak intervals (I–III of ≥2.5 ms, III–V of ≥2.3 ms, I–V of ≥4.4 ms), interaural latency difference of ≥0.3 ms, poor waveform morphology and replicability or absent response despite normal/mildly elevated audiometric thresholds 4. No response Reference standard Gadolinium-enhanced magnetic resonance imaging of the temporal bone and brain Time between measurement of index test and reference standard: not stated

Reference	**Rupa 2003**[483]			
2×2 table (for VS, excluding ABR no response)		Reference standard +	Reference standard -	**Total**
	Index test +	4	26	**30**
	Index test -	0	42	**42**
	Total	**4**	**68**	**72**
2×2 table (for VS, including ABR no response)		Reference standard +	Reference standard -	**Total**
	Index test +	4	26	**30**
	Index test -	2	58	**60**
	Total	**6**	**84**	**90**
2×2 table (for VS and CPA meningioma, excluding ABR no response)		Reference standard +	Reference standard -	**Total**
	Index test +	6	24	**30**
	Index test -	0	42	**42**

Reference	**Rupa 2003[483]**			
	Total	**6**	**66**	**72**
2×2 table (for all identified pathology, excluding ABR no response)		Reference standard +	Reference standard -	**Total**
	Index test +	8	22	**30**
	Index test -	2	40	**42**
	Total	**10**	**62**	**72**
Statistical measures	Index text: abnormal ABR for detecting VS only (excluding 'no responses') Sensitivity 100% Specificity 62% PPV 0.13 NPV 1.00 PLR 2.62 NLR 0.00 Index text: abnormal ABR for detecting VS only (including 'no responses')			

Reference	Rupa 2003[483]
	Sensitivity 67% Specificity 69% PPV 0.13 NPV 0.97 PLR 2.15 NLR 0.48 Index text: abnormal ABR for detecting any identified pathology (excluding 'no responses') Sensitivity 80% Specificity 65% PPV 0.27 NPV 0.95 PLR 2.25 NLR 0.31 Other identified lesions in the ABR positive group were 2 cerebellopontine angle meningioma, 1 tortuous vertebral artery indenting the cervicomedullary junction, and 1 giant cisterna magna. In the ABR negative group there was 1 case of frontoparietal meningioma and 1 patient with giant cisterna magna.

Reference	**Rupa 2003**[483]
Source of funding	Not stated
Limitations	Risk of bias: unclear study exclusion criteria; unclear time interval between audiometry and MRI; unclear if thin-section imaging was performed; unclear if assessors were blinded to other results Indirectness: 14% of sample did not have hearing loss at presentation
Comments	18 patients (2 with VS) excluded because they had no response on ABR due to severe to profound sensorineural hearing loss.

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Reference	**Kumar 2016**[294]
Study type	Diagnostic accuracy study (retrospective chart review; single-gated)
Study methodology	Data source: Chart review Recruitment: consecutive (September 2009 – December 2010)
Number of patients	n = 756
Patient	Age: not stated

Reference	**Kumar 2016**[294]
characteristics	Gender (male to female ratio): not stated Ethnicity: not stated Setting: District general hospital Country: UK Inclusion criteria: Patients who underwent MRI scan of internal acoustic meatus for suspected vestibular schwannoma. Exclusion criteria: Known vestibular schwannoma, neurofibromatosis or seen by non-otolaryngologist.

Presenting symptoms	**Negative scan (%)**	**Positive scan (%)**
Asymptomatic	12 (2%)	0
Unilateral tinnitus	260 (35%)	2 (25%)
Bilateral symmetrical tinnitus	71 (10%)	0
Bilateral asymmetrical tinnitus	15 (2%)	1 (13%)
Unilateral hearing loss	181 (24%)	4 (50%)
Bilateral symmetrical hearing loss	136 (18%)	0
Bilateral asymmetrical hearing loss	71 (10%)	3 (38%)
Vertigo	199 (27%)	1 (13%)
Meniere’s triad	31 (4%)	0
Sudden-onset unilateral SNHL	34 (5%)	1 (13%)
Sudden-onset bilateral SNHL	1 (0%)	0
Facial nerve palsy	35 (5%)	0

Reference	Kumar 2016[294]
	Other 23 (3%) 1 (0%) Of the sample, 94 had normal audiogram, 58 had no audiogram, and 234 had asymmetric audiograms that did not meet any of the 4 protocols. None of these patients had VS. Other pathologies identified on MRI thought not to be related to presenting symptoms were: ischaemic changes (67), arachnoid cysts (13), vascular loop (12), tumour (10), encephalomalacia (5), cyst or granuloma (4).
Target condition(s)	Vestibular schwannoma
Index test(s) and reference standard	<u>Index test(s)</u> Published audiometric SNHL asymmetry definitions: 1. ≥20 dB at two adjacent frequencies; or ≤ 20 dB with neurological signs. 2. ≥15 dB between average of 0.5–8 kHz. 3. ≥20 dB at any single frequency between 0.5–4 kHz. 4. ≥15 dB at any single frequency between 0.5–4 kHz. <u>Reference standard</u> MRI of the internal auditory meatus Time between measurement of index test and reference standard: not stated

Reference	**Kumar 2016[294]**			
2×2 table – protocol 1		Reference standard +	Reference standard -	Total
	Index test +	7	154	161
	Index test -	1	594	595
	Total	8	748	756
2×2 table – protocol 2		Reference standard +	Reference standard -	Total
	Index test +	7	164	171
	Index test -	1	584	585
	Total	8	748	756
2×2 table – protocol 3		Reference standard +	Reference standard -	Total
	Index test +	8	274	282
	Index test -	0	474	474

Reference	**Kumar 2016[294]**			
	Total	8	748	756
2×2 table – protocol 4		Reference standard +	Reference standard -	Total
	Index test +	8	353	361
	Index test -	0	395	395
	Total	8	748	756
Statistical measures	Index text 1 Sensitivity 88% Specificity 79% PPV 0.04 NPV 1.00 PLR 4.25 NLR 0.16 Index text 2			

Reference	**Kumar 2016[294]**
	Sensitivity 88% Specificity 78% PPV 0.04 NPV 1.00 PLR 3.99 NLR 0.16 <u>Index text 3</u> Sensitivity 100% Specificity 63% PPV 0.03 NPV 1.00 PLR 2.73 NLR 0.00 <u>Index text 4</u> Sensitivity 100% Specificity 53%

Reference	**Kumar 2016**[294]
	PPV 0.02 NPV 1.00 PLR 2.12 NLR 0.00
Source of funding	None
Limitations	Risk of bias: unclear time interval between audiometry and MRI; unclear if thin-section imaging was performed; unclear if assessors were blinded to other results Indirectness: 13-19% of sample did not have hearing loss at presentation
Comments	No patient ultimately diagnosed with vestibular schwannoma presented with bilateral symptoms or asymptomatically, nor did they have a normal audiogram, or asymmetrical audiogram not matching any of the 4 protocols

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Reference	**Mandala 2013**[358]
Study type	Diagnostic accuracy study (prospective; two-gated/case–control)
Study	Data source: Prospective patient series

Reference	Mandala 2013[358]
methodology	Recruitment: January 2008 – December 2010; consecutive VS cases and selected, matched non-VS controls
Number of patients	n = 49 with VS; 53 without VS
Patient characteristics	Age: Mean (SD) 57.2 years (±18.2 months) Gender (male to female ratio): 0.9 Ethnicity: not stated Setting: Tertiary referral hospitals Country: Italy Inclusion criteria: Confirmed vestibular schwannoma cases or controls referred for MRI assessment of unilateral sensorineural hearing loss Exclusion criteria: Meniere's disease, congenital hearing loss, cerebellopontine angle tumours or central nervous system lesions confirmed by MRI Control subjects matched for age, sex and PTA outcomes
Target condition(s)	Vestibular schwannoma
Index test(s) and reference	Index test(s)

Reference	**Mandala 2013**[358]			
standard	Hyperventilation test: using Frenzel glasses with subjects sitting in a weakly lit room, instructed to hyperventilate deeply for 40s, taking about 1 breath per second. Hyperventilation nystagmus was evaluated during hyperventilation until it disappeared. Caloric irrigation: with hot, cold and iced water. PTA: average thresholds at 0.5, 1.0, 2.0 and 4.0 kHz. PTA <21 dB HL considered normal. PTA averages of 21-40, 41-70 and >70 dB defined as mild, moderate, severe and profound hearing loss respectively. ABR: 3 electrodes positioned on the vertex (+), ipsilateral tragus (-) and forehead (ground). Filtered through a 0.1-Hz to 2-Hz bandpass filter and averaged over 1000 repetitions. Alt clicks from 110 dB HL to threshold. Positive result defined as significantly increased interpeak I-III and/or I-V latencies. <u>Reference standard</u> Gadolinium-enhanced brain MRI of the cerebellopontine angle Time between measurement of index test and reference standard: not stated			
2×2 table **Hyperventilation tests**		Reference standard +	Reference standard -	Total
	Index test +	32	1	33
	Index test -	17	52	69
	Total	49	53	102

Reference	**Mandala 2013[358]**			
2×2 table **Caloric irrigation**		Reference standard +	Reference standard -	Total
	Index test +	21	5	26
	Index test -	28	48	76
	Total	49	53	102
2×2 table **ABR**		Reference standard +	Reference standard -	Total
	Index test +	18	2	20
	Index test -	31	51	82
	Total	49	53	102
Statistical measures	<u>Hyperventilation text (positive)</u> Sensitivity 65.3% Specificity 98.1%			

Reference	**Mandala 2013[358]**
	PPV 0.97 NPV 0.75 PLR 34.6 NLR 0.35 Caloric deficit (paralysis or paresis) Sensitivity 43% Specificity 91% PPV 0.81 NPV 0.63 PLR 4.54 NLR 0.63 ABR Sensitivity 37% Specificity 96% PPV 0.90 NPV 0.62

Reference	**Mandala 2013[358]**
	PLR 9.73 NLR 0.66 Head shaking test Sensitivity 40.8% Head thrust test Sensitivity 36.7% Head heave test Sensitivity 24.5% Mastoid vibration test Sensitivity 34.7%
Source of funding	Not stated
Limitations	Risk of bias: unclear time interval between audiometry and MRI; unclear if thin-section imaging was performed; unclear if assessors were blinded to other results; case–control and excluded possible differential diagnoses, which could inflate diagnostic accuracy Indirectness: 8.1% in VS group presented with vestibular symptoms only

Reference	**Mandala 2013[358]**
Comments	

H.3 Subgroups

None

H.4 Early versus delayed management of hearing loss

Study	**Health Technology Assessment study: Davis 2007[129]**
Study type	Case control study
Number of studies (number of participants)	1 (n=150)
Countries and setting	Conducted in United Kingdom; Setting: Identified from GP databases
Line of therapy	Not applicable
Duration of study	Follow-up (post intervention): 12 years in screening group; 4 years in control group 1 and 3 months for control group 2
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Hearing level >30 dB in worse hearing ear
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Hearing aids fitted after early screening (Hearing level >30 dB in worse hearing ear). Unilateral or bilateral hearing aids.
Exclusion criteria	No longer using hearing aid fitted after screening (n=66/116 traced)
Recruitment/selection of patients	Screening group sampled from early aiding studies targeting all 50-65 years olds on the GP register in these areas; these were based in 3 areas (Cardiff, and 2 villages in the Afan valley). Those with hearing loss were identified by either postal questionnaires or home visit (where audiometry was performed). There was an average response rate of

Study	Health Technology Assessment study: Davis 2007[129]
	76% (much higher in the villages, where up to 3 postings were made to follow-up non-responders and personal contact if still no response, whereas no follow-up of non-response was made in the Cardiff area). The questionnaires used in Cardiff and Glyncorrwg were the same both based on the closed set approach of the Institute of Hearing Research Questionnaire, but a simplified version was used in Blaengwynfi developed by the Welsh Hearing Institute and based on an open set of questions. Not all of those offered a hearing aid accepted but hearing aid use increased approximately 3 times in all areas (from 3% to 9% in Cardiff and from 7% to 23% in the villages) Of the 176 people who were fitted after screening, 116 were traced and followed up; 27 had died and 33 had moved to unknown addresses. 50 of those traced were using hearing aids at follow-up. Pure tone hearing levels were measured by air conduction averaged over 0.5, 1, 2 and 4 kHz.
Age, gender and ethnicity	Age - Median (range): At follow-up Screening group: 70 (61-82); control group 1: 72.5 (62-83); control group 2: 69 (62-83). At fitting Screening group: 58 (50-66); control group 1: 69 (59-79); control group 2: 69 (62-83). Gender (M:F): 74/26%. Ethnicity: Not stated
Further population details	1. Hearing aid : hearing aid user
Extra comments	Early screening aimed to detect hearing loss while still minimal. Best ear hearing level (dB) Screening group: 43 (20-72); control group 1: 45 (24-75); control group 2: 45.5 (20-89). Worst ear hearing level (dB) Screening group: 55 (32-130); control group 1: 55 (31-130); control group 2: 51 (29-89).
Indirectness of population	Serious indirectness: Early intervention group identified by screening
Interventions	(n=50) Intervention 1: Early management - Other. Hearing aid fitted following early screening among 50-65 year olds. Fitted by NHS clinicians and audiologists in an NHS clinic or GP practice. Duration Median follow-up 12 years. Concurrent medication/care: N/A (n=50) Intervention 2: Delayed management - Other. Hearing aid users from MRC IHR Scottish section database who had been referred to NHS hearing aid clinic through standard NHS channels. Many fitted with digital hearing aids but some using standard NHS hearing aids. Duration Median follow-up 4 years. Concurrent medication/care: N/A (n=50) Intervention 3: Delayed management - Other. Standard NHS hearing aids (BE series) fitted at NHS hearing aid clinic. Referred by GP to NHS clinics drawn from another database of MRC IHR. Duration Follow-up approximately 3 months post-fitting. Concurrent medication/care: N/A
Funding	Academic or government funding
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: EARLY SCREENING versus CONTROL GROUP 1 and versus CONTROL GROUP 2	

Study	**Health Technology Assessment study: Davis 2007[129]**
Protocol outcome 1: Health related quality of life at follow-up - Actual outcome: EuroQol thermometer at follow-up; Screening group Median: 67.5; IQR: 50-80; n=50; Control group 1 Median: 70; IQR: 50-80; n=50; Control group 2 Median: 60; IQR: 50-70; n=50; Scale 0-100 (high is good outcome); Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 2: Hearing-specific health related quality of life at follow-up - Actual outcome: SSHI at follow-up; Screening group Median: 22; IQR: 19-28; n=49; Control group 1 Median: 26.5; IQR: 21-31; n=50; Scale 0-42 (high is poor outcome); Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: GHSI total at follow-up; Screening group Median: 54; IQR: 45-63.5; n=50; Control group 1 Median: 48; IQR: 35-59; n=50; Control group 2 Median: 42; IQR: 32-51; n=50; Scale 0-100 (high is good outcome); Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: ERS at follow-up; Screening group Median: 3; IQR: 1-6; n=49; Control group 1 Median: 4; IQR: 1-8; n=50; Scale 0-10 (high is poor outcome) Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 3: Hearing aid use at follow-up - Actual outcome: GHABP use at follow-up; Screening group Median: 67; IQR: 35.5-100; n=49; Control group 1 Median: 38; IQR: 19-64; n=50; Control group 2 Median: 48.5; IQR: 34-61.5; n=50; Scale 0-100 (high is good outcome); Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: GHABP benefit at follow-up; Screening group Median: 56; IQR: 38-75; n=49; Control group 1 Median: 38; IQR: 25-51.5; n=50; Control group 2 Median: 42.5; IQR: 24-47; n=50; Scale 0-100 (high is good outcome); Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: GHABP residual disability at follow-up; Screening group Median: 25; IQR: 13-38; n=49; Control group 1 Median: 28; IQR: 13-39.5; n=50; Control group 2 Median: 34.5; IQR: 21-45; n=50; Scale 0-100 (high is poor outcome) Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: GHABP residual satisfaction at follow-up; Screening group Median: 63; IQR: 44-75; n=49; Control group 1 Median: 40; IQR: 25-50; n=50; Control group 2 Median: 39; IQR: 28-50; n=50; Scale 0-100 (high is good outcome); Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life-related carer-reported outcomes; Annoyance scale in patient-reported outcome measures; Sound localisation as measured by laboratory test; Speech-in-noise detection as measured by laboratory tests; Change in cognitive function; Social functioning/employment; Listening ability

H.5 Communication needs

None

H.6 Management of earwax

H.6.1 Treatment

Study	**Caballero 2009**[80]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=89)
Countries and setting	Conducted in Spain; Setting: ENT primary care clinic
Line of therapy	1st line
Duration of study	Intervention time: 15 minutes
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Symptoms and confirmation of complete cerumen obstruction as evaluated at ENT primary care clinic
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Pts referred to ENT clinic due to symptoms of cerumen. Impossible for physician to visualise any part of the tympanic membrane due to cerumen.
Exclusion criteria	Otitis externa, presence of ventilation tubes, suspected perforation, prior complications from irrigation of the ear.
Recruitment/selection of patients	“Large sample” of patients referred.
Age, gender and ethnicity	Age - Mean (SD): 57.8 (13.4). Gender (M:F): 39/50. Ethnicity: NS
Further population details	1. Hearing aid : Not applicable / Not stated / Unclear (Not stated).
Extra comments	Age 19-78
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Earwax softeners - Oil based (including olive oil). Chlorobutanol (Brand: Otocerum, containing chlorobutanol 50mg/ml phenol 10mg/ml, turpentine essence 0.15ml/ml in ethyl alcohol). 1ml instilled as an immediate softener. Duration 15 minutes. Concurrent medication/care: Followed by irrigation if still needed Further details: 1. Administration: HCP administered (n=29) Intervention 2: Earwax softeners - Oil based (including olive oil). Potassium carbonate (Brand: Taponoto, contains potassium carbonate 20mg/ml, ethyl alcohol, glycerol 480, thymol 0.4) around 1ml instilled for immediate softening.

	Duration 15 minutes. Concurrent medication/care: Followed by irrigation if still needed Further details: 1. Administration: HCP administered Comments: Preparation not normally used in UK, therefore results not given (n=28) Intervention 3: Earwax softeners - Water based (including sodium bicarbonate). Sodium chloride (generic sterile saline, 0.9%) around 1ml instilled for immediate softening. Duration 15 minutes. Concurrent medication/care: Followed by irrigation if still needed Further details: 1. Administration: HCP administered
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CHLOROBUTANOL versus SODIUM CHLORIDE Protocol outcome 1: Adverse events - Actual outcome: Patients were asked to indicate the presence of pruritus, pain, unsteadiness or any other adverse outcome at 15 minutes after softening agent applied; Group 1: 0/32, Group 2: 0/28; Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 2: Wax related - Actual outcome: Success - Complete visualisation of tympanic membrane after up to two 50mL syringing attempts at 15 minutes after softening agent applied; Group 1: 21/32, Group 2: 12/28; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health related quality of life; Global impression of treatment efficacy; Pure tone audiometry

Study (subsidiary papers)	**Coppin 2008[116] (Coppin 2011[117])**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=237)
Countries and setting	Conducted in United Kingdom; Setting: Seven GP practices in South England
Line of therapy	1st line
Duration of study	Intervention + follow-up: Results at 1 to 2 weeks and after 2 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: symptoms and examination

Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Adults with symptoms suggestive of occluding earwax and at least one ear canal occluded with wax and eligible for irrigation
Exclusion criteria	Not eligible
Recruitment/selection of patients	Sequential presentations at GP practices
Age, gender and ethnicity	Age - Mean (SD): intervention arm 57 (14), control arm 55 (16). Gender (M:F): 78/118. Ethnicity: Not stated
Further population details	1. Hearing aid : Not applicable / Not stated / Unclear (Not stated).
Extra comments	Two groups similar symptom severity at baseline, with around 65% complete occlusion
Indirectness of population	No indirectness
Interventions	(n=118) Intervention 1: Aural toilet - Syringing (self-administered). Provided with bicarbonate ear drops, bulb syringe and instructions on its use. Duration one to two weeks. Concurrent medication/care: nurse-administered irrigation could be provided at follow-up if needed Further details: 1. Administration: self-administered (n=119) Intervention 2: Aural toilet - Ear irrigation using pump. Provided with ear-drops (no bulb alone and advice on usual management (no syringe)). Instructions to use the bicarbonate ear drops for two days then return for irrigation in clinic. Duration two days ear drops, irrigation on day three, follow-up at one to two weeks. Concurrent medication/care: Both arms used sodium bicarbonate ear drops Further details: 1. Administration: HCP administered (ear drops self-administered, irrigation delivered in GP surgery).
Funding	Academic or government funding (RCGP Scientific Foundation Trust)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SYRINGING (SELF ADMINISTERED) versus CONTROL

Protocol outcome 1: Adverse events
- Actual outcome: Infection - otitis externa at 1 week; Group 1: 1/97, Group 2: 1/94; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome: Perforation at 1 week; Group 1: 1/97, Group 2: 1/94; Risk of bias: High; Indirectness of outcome: Very serious indirectness
- Actual outcome: Discomfort during treatment at 1 week; Group 1: 43/110, Group 2: 35/108; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome: Dizziness at 1 week; Group 1: 14/110, Group 2: 14/108; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related - Actual outcome: Success - Wax clearance (tympanic membrane easily visible) at follow-up at 1 week; Group 1: 50/104, Group 2: 64/102; Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome: Consulted again for earwax at 2 years; Group 1: 70/117, Group 2: 85/117; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health related quality of life; Global impression of treatment efficacy; Pure tone audiometry

Study	**Eekhof 2001**[151]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=42)
Countries and setting	Conducted in Netherlands; Setting: GP practice in the Netherlands
Line of therapy	2nd line
Duration of study	Intervention time: 15 minutes or three days
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: GP assessment
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Complaints resulting from earwax where irrigation had failed to clear at least 25% obstruction (5 attempts at syringing)
Exclusion criteria	Obstruction cleared (≥25%) after irrigation, or irrigation not offered due to tympanic perforation, middle ear operations, otitis externa, swimming within the last 72h or using cerumenolytics in the last 72h
Recruitment/selection of patients	All patients presenting within the recruitment period, of which 130 were suitable for irrigation
Age, gender and ethnicity	Age - Mean (SD): 51 (16). Gender (M:F): 20/22. Ethnicity: Not stated
Further population details	1. Hearing aid: Not applicable / Not stated / Unclear (Not stated).
Extra comments	Not specified that excludes children. Population is subset with 'persistent' earwax
Indirectness of population	Serious indirectness: Subgroup of population, and may include children
Interventions	(n=22) Intervention 1: Earwax softeners - Water. Warm water applied to ear immediately prior to repeat irrigation. Duration 15 minutes. Concurrent medication/care: Syringing re-tried after 15 minutes Further details: 1. Administration: HCP administered

	(n=20) Intervention 2: Earwax softeners - Oil based (including olive oil). Oil (detail not specified) applied to ear each night. Duration Three days. Concurrent medication/care: Irrigation re-tried after three days Further details: 1. Administration : self-administration
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WATER versus OIL BASED (INCLUDING OLIVE OIL)

Protocol outcome 1: Wax related
- Actual outcome: Success - second irrigation removes wax at 15 minutes or three days; Group 1: 21/22, Group 2: 20/20; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome: Number of syringing attempts needed for second irrigation at 15 minutes or three days; Group 1: mean 3 (SD 1.44); n=22, Group 2: mean 2.4 (SD 1.6); n=20; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Health related quality of life; Pure tone audiometry; Global impression of treatment efficacy; Adverse events

Study	**Fraser 1970**[174]
Study type	RCT (Ear randomised; Parallel)
Number of studies (number of participants)	1 (n=142 patients, 284 ears)
Countries and setting	Conducted in United Kingdom
Line of therapy	1st line
Duration of study	Intervention time: 3 days
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Examination
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Found to have bilateral hard wax occluding both ears
Exclusion criteria	Nil stated

Recruitment/selection of patients	Eight-hundred patients were screened, (18% positive)
Age, gender and ethnicity	Age - Other: Older adults. Gender (M:F): Not stated. Ethnicity: Not stated
Further population details	1. Hearing aid: Not applicable / Not stated / Unclear (Not stated).
Extra comments	Inpatients on geriatric wards in six hospitals
Indirectness of population	No indirectness: Not complaining of symptoms - but all had bilateral occluding wax.
Interventions	(n=124) Intervention 1: Earwax softeners - Water based (including sodium bicarbonate). Sodium bicarbonate ear drops used as control, instilled for 15 minutes to one ear, once a day for three days. Duration 3 days. Concurrent medication/care: Syringing took place after three days Further details: 1. Administration: HCP administered (inpatients). (n=24) Intervention 2: Earwax softeners - Oil based (including olive oil). Cerumol brand ear drops containing 10% Turpentine applied for 15 minutes to one ear, once a day for three days. Duration 3 days. Concurrent medication/care: Syringing took place after the third day Further details: 1. Administration: HCP administered Comments: 24 ears, 24 people (n=25) Intervention 3: Earwax softeners - Oil based (including olive oil). Olive oil, applied to one ear for 15 minutes, once a day for three days. Duration 3 days. Concurrent medication/care: Syringed after the third day Further details: 1. Administration: HCP administered (inpatients). (n=26) Intervention 4: Earwax softeners - Water based (including sodium bicarbonate). Dioctyl sodium sulphosuccinate / Docusate (brand: Waxsol) applied for 15 minutes to one ear once a day for three days. Duration 3 days. Concurrent medication/care: Syringing after third day Further details: 1. Administration: HCP administered Comments: 26 ears in 26 people (n=24) Intervention 5: Earwax softeners - Water based (including sodium bicarbonate). Triethyanolamine polypeptide oleate condensate (brand:Xerumenex) applied to the ear for 15 minutes immediately prior to syringing. Duration 15 minutes. Concurrent medication/care: Syringing after 15 minutes Further details: 1. Administration: HCP administered Comments: Not normally used in the UK, therefore results not extracted. (n=25) Intervention 6: Earwax softeners - Oil based (including olive oil). Dioctyl sodium sulphosuccinate ear capsules (docusate in oily base), applied for 15 minutes to one ear, once a day for three days. Duration 3 days. Concurrent

	medication/care: Syringing after third day Further details: 1. Administration: HCP administered (inpatients). Comments: 25 ears in 25 people
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SODIUM BICARB versus OLIVE OIL Protocol outcome 1: Adverse events - Actual outcome: Otitis externa (unilateral only) at 3 days; Group 1: 3/124, Group 2: 0/25; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 2: Wax related - Actual outcome: Successful syringing at 3 days; Group 1: 105/124, Group 2: 23/25; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome: Ease of syringing scored at 3 days; MD +24; Risk of bias: Low; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SODIUM BICARB versus DOCUSATE Protocol outcome 1: Adverse events - Actual outcome: Otitis externa (unilateral only) at 3 days; Group 1: 3/124, Group 2: 2/26; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 2: Wax related - Actual outcome: Successful syringing at 3 days; Group 1: 105/124, Group 2: 23/25; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome: Ease of syringing scored at 3 days; MD +18; Risk of bias: Low; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: OLIVE OIL versus DOCUSATE Protocol outcome 1: Adverse events - Actual outcome: Otitis externa (unilateral only) at 3 days; Group 1: 0/25, Group 2: 2/26; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 2: Wax related - Actual outcome: Successful syringing at 3 days; Group 1: 23/25, Group 2: 23/26; Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome: Ease of syringing scored at 3 days; MD +6; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health related quality of life; Global impression of treatment efficacy; Pure tone audiometry

Study	**Hinchcliffe 1955[226]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=185)
Countries and setting	Conducted in United Kingdom; Setting: General medical examination
Line of therapy	1st line
Duration of study	Intervention time: 30 minutes
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis: Examined by doctor, thought to have hard wax
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Found to have wax which obscured the view of the tympanic membrane and was felt to be hard
Exclusion criteria	Nil stated
Recruitment/selection of patients	Screening for wax occlusion
Age, gender and ethnicity	Age - Other: Entrants to RAF training. Gender (M:F): 185 male. Ethnicity: Not stated
Further population details	1. Hearing aid: hearing aid non user (Unlikely to have known permanent hearing impairment in this setting).
Extra comments	Entrants to RAF training
Indirectness of population	No indirectness
Interventions	(n=37) Intervention 1: Earwax softeners - Water based (including sodium bicarbonate). Sodium bicarbonate ear drops, five drops placed in the ear, followed by syringing after 30 minutes. Duration 30 minutes. Concurrent medication/care: Attempt to irrigate ear after drops Further details: 1. Administration: HCP administered (n=37) Intervention 2: Earwax softeners - Other. Hydrogen peroxide solution ear drops, five drops to the ear for 30 minutes followed immediately by syringing. Duration 30 minutes. Concurrent medication/care: Attempt made to irrigate ear after ear drops Further details: 1. Administration: HCP administered (n=37) Intervention 3: Earwax softeners - Oil based (including olive oil). Olive oil ear drops, five drops in each ear for 30 minutes followed immediately by syringing. Duration 30 minutes. Concurrent medication/care: Attempt to irrigate the

	ear following ear drops Further details: 1. Administration: HCP administered (n=37) Intervention 4: No treatment. Ears syringed without preceding ear drops. Duration 30 minute. Concurrent medication/care: Attempt to irrigate ear Further details: 1. Administration: HCP administered (n=37) Intervention 5: Earwax softeners - Other. Cerumol ear drops, composition not given. Duration 30 minutes. Concurrent medication/care: Irrigation Further details: 1. Administration : Comments: Since composition not detailed, and Cerumol composition has changed over time, considered that this was unlikely to be chlorobutanol solution ear drops, therefore results excluded
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SODIUM BICARBONATE versus OLIVE OIL

Protocol outcome 1: Adverse events
- Actual outcome: Symptoms of discomfort (prior to syringing) at 30 minutes; Group 1: 4/37, Group 2: 4/37; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Success - meatus cleared by irrigation at 5 minutes; Group 1: 31/37, Group 2: 35/37; Risk of bias: High; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SODIUM BICARBONATE versus DRY

Protocol outcome 1: Adverse events
- Actual outcome: Symptoms of discomfort (prior to syringing) at 30 minutes; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Success - meatus cleared by irrigation at 5 minutes; Group 1: 31/37, Group 2: 28/37; Risk of bias: High; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PEROXIDE versus SODIUM BICARBONATE

Protocol outcome 1: Adverse events
- Actual outcome: Symptoms of discomfort (prior to syringing) at 30 minutes; Group 1: 6/37, Group 2: 4/37; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Success - meatus cleared by irrigation at 5 minutes; Group 1: 33/37, Group 2: 31/37; Risk of bias: High; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PEROXIDE versus OLIVE OIL

Protocol outcome 1: Adverse events
- Actual outcome: Symptoms of discomfort (prior to syringing) at 30 minutes; Group 1: 6/37, Group 2: 4/37; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Success - meatus cleared by irrigation at 5 minutes; Group 1: 33/37, Group 2: 35/37; Risk of bias: High; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PEROXIDE versus DRY

Protocol outcome 1: Adverse events
- Actual outcome: Symptoms of discomfort (prior to syringing) at 30 minutes; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Success - meatus cleared by irrigation at 5 minutes; Group 1: 33/37, Group 2: 28/37; Risk of bias: High; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: OLIVE OIL versus DRY

Protocol outcome 1: Adverse events
- Actual outcome: Symptoms of discomfort (prior to syringing) at 30 minutes; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Success - meatus cleared by irrigation at 5 minutes; Group 1: 35/37, Group 2: 28/37; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Health related quality of life ; Global impression of treatment efficacy ; Pure tone audiometry

Study	**Keane 1995**[261]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=97 patients, 155 ears)

Countries and setting	Conducted in Irish Republic; Setting: Not stated
Line of therapy	1st line
Duration of study	Intervention time: 5 days
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: inspection of ear canal
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Impacted ears
Exclusion criteria	Known pathology of the ear canal and/or tympanic membrane, or existing use of ear drops
Recruitment/selection of patients	Appears to have been proactive screening
Age, gender and ethnicity	Age - Other: not stated. Gender (M:F): not stated. Ethnicity: Not stated
Further population details	1. Hearing aid : Not applicable / Not stated / Unclear (Not stated).
Indirectness of population	Serious indirectness: population not clearly defined in terms of age, baseline wax
Interventions	(n=38) Intervention 1: Earwax softeners - Water. Sterile water, 4 drops twice daily. Duration 5 days. Concurrent medication/care: Nil Further details: 1. Administration: HCP administered (n=39) Intervention 2: Earwax softeners - Water based (including sodium bicarbonate). Sodium bicarbonate ear drops 4 drops twice a day. Duration 5 days. Concurrent medication/care: Nil Further details: 1. Administration: HCP administered (n=40) Intervention 3: Earwax softeners - Oil based (including olive oil). Chlorobutanol solution ear drops (Brand Cerumol) 4 drops twice a day. Duration 5 days. Concurrent medication/care: nil Further details: 1. Administration: HCP administered (n=38) Intervention 4: No treatment. No ear drops. Duration 5 days. Concurrent medication/care: nil Further details: 1. Administration:
Funding	No funding
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WATER versus NO TREATMENT	

Protocol outcome 1: Wax related - Actual outcome: No longer impacted at 5 days; Group 1: 20/38, Group 2: 12/38; Risk of bias: ; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SODIUM BICARBONATE versus WATER Protocol outcome 1: Wax related - Actual outcome: No longer impacted at 5 days; Group 1: 18/39, Group 2: 20/38; Risk of bias: ; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CHLOROBUTANOL versus WATER Protocol outcome 1: Wax related - Actual outcome: No longer impacted at 5 days; Group 1: 24/40, Group 2: 20/38; Risk of bias: ; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CHLOROBUTANOL versus SODIUM BICARBONATE Protocol outcome 1: Wax related - Actual outcome: No longer impacted at 5 days; Group 1: 24/40, Group 2: 18/39; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health related quality of life ; Pure tone audiometry ; Global impression of treatment efficacy; Adverse events

Study	**Memel 2002**[371]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=116)
Countries and setting	Conducted in United Kingdom; Setting: Three GP practices in Bristol
Line of therapy	1st line
Duration of study	Intervention time: Not stated, likely less than 15 minutes. Ear drops needed for three days prior
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: attempted visualisation of the tympanic membrane
Stratum	Overall
Subgroup analysis within study	Not applicable

Inclusion criteria	Ear drum completely obscured by wax and used generic oily ear drops for three days prior
Exclusion criteria	Unsuitable for syringing.
Recruitment/selection of patients	Consecutive patients at primary care irrigation clinic when both nurse and audiologist were in attendance
Age, gender and ethnicity	Age - Median (IQR): 63 (42-71) in intervention arm 62 (57-77) in control arm. Gender (M:F): 61/53. Ethnicity: Not stated
Further population details	1. Hearing aid: Not applicable / Not stated / Unclear (90% pts used hearing aid always or sometimes, differential results not given).
Extra comments	44 had one ear syringed, 70 had both ears syringed. At baseline average PTA was 30 dB HL and 65% have trouble hearing in noise. Hearing before and after given.
Indirectness of population	No indirectness
Interventions	(n=55) Intervention 1: Aural toilet - Ear irrigation using pump. Syringing according to practice guidelines. Duration 3 days. Concurrent medication/care: Ear drops for three days prior Further details: 1. Administration: HCP administered (n=61) Intervention 2: No treatment. Syringing delayed. Duration 3 days. Concurrent medication/care: Ear drops for three days prior Further details: 1. Administration: HCP administered
Funding	Academic or government funding (Royal College of General Practitioners and NHS R&D)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: IRRIGATION versus NO TREATMENT Protocol outcome 1: Pure tone audiometry - Actual outcome: Proportion showing increased hearing thresholds of at least 10 dB HL in at least one ear at 3 days; Group 1: 18/53, Group 2: 1/61; Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome: Average difference in PTA between hearing tests at 3 days; MD 6.9 (95%CI 3.8 to 10.1); Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health related quality of life; Wax related; Global impression of treatment efficacy; Adverse events

Study	**Oron 2011**[426]

Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=41 patients 76 ears)
Countries and setting	Conducted in Israel; Setting: Rehabilitation department of a geriatric hospital
Line of therapy	1st line
Duration of study	Intervention time:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: otoscopy
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Cerumen impaction
Exclusion criteria	Not able to cooperate with testing, about to be discharged / moved
Recruitment/selection of patients	"Routine screening otoscopy done in most [participants]"
Age, gender and ethnicity	Age - Mean (range): 78 (67-92). Gender (M:F): 22/16. Ethnicity: Not stated
Further population details	1. Hearing aid : Not applicable / Not stated / Unclear
Extra comments	9 participants complained of hearing loss on questioning.
Indirectness of population	No indirectness
Interventions	(n=24) Intervention 1: Earwax softeners - Other. Auro ear drops containing carbamide peroxide, three drops, three times a day in each ear for a week. Duration 1 week. Concurrent medication/care: Earwax removed mechanically after a week if needed Further details: 1. Administration: HCP administered (inpatient). (n=26) Intervention 2: Earwax softeners - Oil based (including olive oil). Cerumol ear drops containing chlorambutanol solution, thee drops, three times a day for a week. Duration 1 week. Concurrent medication/care: Earwax mechanically removed after a week if necessary Further details: 1. Administration: HCP administered (inpatient). (n=26) Intervention 3: Earwax softeners - Oil based (including olive oil). ClearEars ear spray, containing squalane and mineral oil (paraffin), three puffs, three times a day for a week. Duration 1 week. Concurrent medication/care: Mechanical removal after a week if necessary Further details: 1. Administration: HCP administered (inpatients).

Funding	Funding not stated (but appears to be industry, representing CleanEars)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PEROXIDE versus CLORAMBUTANOL

Protocol outcome 1: Adverse events
- Actual outcome: Participant reported side-effects (and continued treatment) at 1 week; Group 1: 0/24, Group 2: 2/26; Risk of bias: Very high; Indirectness of outcome: Serious indirectness

Protocol outcome 2: Wax related
- Actual outcome: Ear has no occlusive wax, does not need further management at 1 week; Group 1: 10/24, Group 2: 10/24; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome: Time to remove remaining cerumen at 1 week; Mean Peroxide: 1.58, Cerumol: 2.46 Keyed average duration of treatment 1-3 Top=High is poor outcome; Risk of bias: ; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Health related quality of life ; Global impression of treatment efficacy ; Pure tone audiometry

Study	**Pavlidis 2005**[434]
Study type	RCT (Ear randomised; Parallel)
Number of studies (number of participants)	1 (n=39)
Countries and setting	Conducted in Australia; Setting: Single GP practice
Line of therapy	1st line
Duration of study	Intervention time: 15 minutes
Method of assessment of guideline condition	Method of assessment /diagnosis not stated: GP assessment
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Presents with symptoms, and GP would normally syringe due to one or both ear canals partially or totally occluded. Able to lie on side for 15 minutes.
Exclusion criteria	No actual or suspected perforation, previous ear surgery, otitis media or otitis externa, not swum or used ear drops in

	last three days.
Recruitment/selection of patients	Sequential presentations
Age, gender and ethnicity	Age - Mean (SD): 63 (8) in active group, 65 (20) in control group. Gender (M:F): 26/13. Ethnicity: Not stated
Further population details	1. Hearing aid : Not applicable / Not stated / Unclear (Not stated).
Extra comments	39 ears in 26 patients. Ave duration of symptoms 275 days.
Indirectness of population	No indirectness
Interventions	(n=22) Intervention 1: Earwax softeners - Water. Warm tap water instilled to fill the ear for 15 minutes. Duration 15 minutes. Concurrent medication/care: Followed by irrigation of ear Further details: 1. Administration: HCP administered (n=17) Intervention 2: No treatment. Nothing in the ear prior to irrigation. Duration 0 minutes. Concurrent medication/care: Irrigation on 'dry' ear Further details: 1. Administration: HCP administered
Funding	Academic or government funding (Australian General Practice research fund)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: WATER versus NO TREATMENT Protocol outcome 1: Adverse events - Actual outcome: Adverse effect at 15 minutes; Group 1: 1/22, Group 2: 1/17; Risk of bias: Very high; Indirectness of outcome: Serious indirectness Protocol outcome 2: Wax related - Actual outcome: Attempts to syringe (25ml at a time) until visibly clear of wax at 15 minutes; Group 1: mean 7.5 (SD 7.3); n=22, Group 2: mean 25.4 (SD 39.4); n=17; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health related quality of life ; Global impression of treatment efficacy ; Pure tone audiometry

Study	**Roland 2004**[480]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=74)

Countries and setting	Conducted in USA; Setting: Research centre and independent physician
Line of therapy	1st line
Duration of study	Intervention time: up to 30 minutes
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Excessive or impacted cerumen on screening
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Aged over 18 and found to have excessive or impacted cerumen on screening (mild, moderate or severe on occlusion scale)
Exclusion criteria	Ear anomalies, diabetes, allergies to study medicines, pregnant or nursing, had instilled anything but water in their ears in the previous 72 hours
Recruitment/selection of patients	74 of 230 volunteers screened positive
Age, gender and ethnicity	Age - Mean (range): 45 (22-66). Gender (M:F): 51/23. Ethnicity: Not stated
Further population details	1. Hearing aid: Not applicable / Not stated / Unclear (Not stated).
Extra comments	Baseline occlusion levels were mild (n = 10), moderate (n = 26), or complete (n = 38). Occlusion classified by 4-point scale from 0 (no occlusion) to 3 (complete occlusion)
Indirectness of population	No indirectness: Volunteers - nb includes from mild occlusion (most studies include moderate and severe)
Interventions	(n=24) Intervention 1: Earwax softeners - Water based (including sodium bicarbonate). Triethanolamine polypeptide oleate-condensate (Brand: Cerumenex 10%) used as softening agent for 15 minutes. Duration 15 minutes. Concurrent medication/care: Irrigation after 15 minutes if still needed, up to twice x 50mL warm water Further details: 1. Administration: HCP administered TPO not typically used in the UK, therefore this arm not extracted. (n=26) Intervention 2: Earwax softeners - Water based (including sodium bicarbonate). Carbomide peroxide aka. Hydrogen Peroxide Urea solution (Brand: Murine 6.5%) used as a softening agent for 15 minutes. Duration 15 minutes. Concurrent medication/care: Irrigation carried out after 15 minutes as needed up to twice x 50mL Further details: 1. Administration: HCP administered Comments: Brand different from typical in UK (Otex) (n=24) Intervention 3: Earwax softeners - Water based (including sodium bicarbonate). Saline (sterile saline solution with sodium chloride 0.64% and physiologic concentrations of multiple electrolytes) instillation for 15 minutes as softener.

	Duration 15 minutes. Concurrent medication/care: Irrigation after 15 minutes if required up to twice x 50mL Further details: 1. Administration: HCP administered Comments: Referred to as "placebo" in trial
Funding	Study funded by industry (Alcon Research Limited (now affiliated to Novartis))

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PEROXIDE versus SODIUM CHLORIDE

Protocol outcome 1: Adverse events
- Actual outcome: Subject reported adverse events at 15 minutes; Group 1: 2/26, Group 2: 1/24; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Complete visualisation of tympanic membrane after first application and irrigation at 15 minutes; Group 1: 3/26, Group 2: 2/24; Risk of bias: Low; Indirectness of outcome: No indirectness. Used as primary outcome
- Actual outcome: Complete visualisation of tympanic membrane after up to two applications and irrigation at 30 minutes; Group 1: 4/26, Group 2: 10/24; Risk of bias: High; Indirectness of outcome: Serious indirectness. Not used as primary outcome, as not reported in other studies

Protocol outcomes not reported by the study	Health related quality of life ; Global impression of treatment efficacy ; Pure tone audiometry

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Study	**Vanlierde 1991**[562]
Study type	RCT (Ear randomised; Parallel)
Number of studies (number of participants)	1 (n=69 ears (41 people))
Countries and setting	Conducted in South Africa; Setting: Geriatric ward
Line of therapy	1st line
Duration of study	Intervention time: 5 days
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Examination only
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Stable patients in geriatric with earwax graded as being excessive or occluding

Exclusion criteria	None stated
Recruitment/selection of patients	132 inpatients screened for earwax (41 positive)
Age, gender and ethnicity	Age - Other: "geriatric". Gender (M:F): Not stated. Ethnicity: Not stated
Further population details	1. Hearing aid: Not applicable / Not stated / Unclear (Not stated).
Extra comments	30 bilateral excessive wax, 11 unilateral
Indirectness of population	Serious indirectness: Not presenting with symptoms
Interventions	(n=35) Intervention 1: Earwax softeners - Oil based (including olive oil). Cerumol ear drops five drops twice a day. Duration five days. Concurrent medication/care: Continued management for other conditions Further details: 1. Administration: HCP administered (inpatients on geriatric ward). Comments: 35 ears. (n=34) Intervention 2: Earwax softeners - Oil based (including olive oil). Almond oil (generic), five drops twice a day. Duration five days. Concurrent medication/care: Usual care Further details: 1. Administration: HCP administered
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CHLORAMBUTANOL versus ALMOND OIL

Protocol outcome 1: Adverse events
- Actual outcome: Discontinued due to adverse effects at five days; Group 1: 1/35, Group 2: 0/34; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcome 2: Wax related
- Actual outcome: Wax not excessive or occlusive (significantly reduced) at five days; Group 1: 13/35, Group 2: 7/34; Risk of bias: High; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study	Health related quality of life ; Global impression of treatment efficacy ; Pure tone audiometry

H.6.2 Settings

None

H.7 Sudden sensorineural hearing loss

H.7.1 Treatment

Study	**Ahn 2008[9]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=120)
Countries and setting	Conducted in South Korea; Setting: Initial 5 days the patients were hospitalised.
Line of therapy	1st line
Duration of study	Intervention + follow-up: 14 days of treatment, 3 months follow-up
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis: Does not state in the methods that underlying medical reasons for the sudden hearing loss were ruled out prior to inclusion. Only describes 'the diagnostic criteria for SSNHL were the acute onset of HL of 30 dB in three contiguous frequencies, which may have occurred instantaneously or progressively over several days".
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Diagnosed with SSNHL between February 2005 and March 2007. Diagnostic criteria: acute onset of HL of

	30 dB in three contiguous frequencies, which may have occurred instantaneously or progressively over several days.
Exclusion criteria	Subjects with medical or central nervous system conditions, including diabetes, hypertension, connective vascular disease, vestibular schwannoma and other conditions that could affect hearing recovery or selection of therapeutic methods. Subjects with true vertigo with whirling type were also excluded.
Recruitment/selection of patients	February 2005 to March 2007.
Age, gender and ethnicity	Age - Mean (SD): No age restriction given in inclusion criteria. ITD group 48.6 (15.4) years, Control 45.9 (14.7) years. Gender (M:F): ITD group 33/27, Control group 31/29. Ethnicity: Not reported.
Further population details	1. Bilateral SSNHL: Unilateral (Not directly stated, but in the baseline demographics it shows the number of people with left and right sided hearing loss, the total of which adds up to the number randomised.).
Indirectness of population	Serious indirectness: Risk that children were included as it wasn't stated that they were excluded.
Interventions	(n=60) Intervention 1: Steroids - Prednisolone. Methylprednisolone (oral) 48mg for 9 days, followed by tapering over 5 days as well as other medications, including vitamins and lipo-prostaglandin E1. Hospitalised for first 5 days, where they were fed a low salt diet. Duration 14 days of treatment, 3 month follow-up. Concurrent medication/care: Not described, only 'other medications, including vitamins and lip-prostaglandin E1'. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (oral steroids). 3. Specific drug within class: See intervention (Methylprednisolone). (n=60) Intervention 2: Steroid + steroid - Prednisolone + dexamethasone. Methylprednisolone 48mg (oral) for 9 days, followed by tapering over 5 days as well as other medications, including vitamins and lipo-prostaglandin E1. Hospitalised for first 5 days, where they were fed a low salt diet. Confirmed intact tympanic membrane and middle ear status, local anaesthesia (cotton wool ball soaked in lidocaine 10% pump spray), applied to tympanic membrane for approximately 10 minutes. Patient lay supine, head tilted 45 degrees to the healthy side, 25 gauge spinal needle introduced into the anterosuperior portion of the tympanic membrane and 0.3-0.4 ml of 5mg/l dexamethasone given

	intratympanically on Day 1, Day 3 and Day 5. Patients were instructed to avoid swallowing or moving for 30 minutes. Duration 14 days of treatment, 3 months follow-up. Concurrent medication/care: Also took 'other medications, including vitamins and lipo-prostaglandin E1' and were on a low salt diet. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (Systemic and transtympanic). 3. Specific drug within class: See intervention
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: METHYLPREDNISOLONE (ORAL) versus METHYLPREDNISOLONE (ORAL) + DEXAMETHASONE (IT) Protocol outcome 1: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (final hearing better than 25 dB) at 3 months; Group 1: 16/60, Group 2: 15/60; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome for Treatment-naïve patients at first presentation: Slight hearing improvement or better (>15 dB gain and final hearing poorer than 45 dB) at 3 months; Group 1: 42/60, Group 2: 44/60; Risk of bias: Very high; Indirectness of outcome: Serious indirectness	
Protocol outcomes not reported by the study	Health-related quality of life ; Speech discrimination ; Hearing-specific health-related quality of life ; Adverse events

Study	**Battaglia 2008**[51]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=51)
Countries and setting	Conducted in USA; Setting: The patients were observed in Kaiser clinics in Fontana (8 patients), LA (1 patient), Panorama City (3 patients), Riverside (3 patients), San Diego (36 patients).
Line of therapy	Unclear
Duration of study	Not clear: Stated to be a 2 year study. Capsules taken for 2 weeks, transtympanic injections over 3 weeks, audiogram stated to have been taken 4 weeks after the final injection. Also describes a 3 month follow-up after the last patient enrolled.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: 'Audiometry, history, and physical examination were performed to confirm the diagnosis of ISSNHL as previously defined'. Unclear definition, assume they use the definition 'commonly defined as greater than 20 dB of hearing loss in at least 3 audiometric frequencies occurring within 3 days or less' as written in their introduction. Patients with no identifiable cause of sudden hearing loss were considered to have ISSNHL.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients observed within 6 weeks of the onset of ISSNHL
Exclusion criteria	Pregnant patients and those who had received previous treatment. Those with recognized causes of sensorineural hearing loss such as Meniere's disease or autoimmune hearing loss.
Recruitment/selection of patients	Kaiser clinics in the USA.

Age, gender and ethnicity	Age - Mean (SD): No standard deviations were reported. Placebo taper + IT-Dex 60 years, HDPT + IT saline 54 years, HDPT + IT Dex 57 years. Gender (M:F): Not described. Ethnicity: Not described.
Further population details	1. Bilateral SSNHL: Not stated / Unclear
Extra comments	For Placebo taper + IT-Dex, HDPT + IT saline and HDPT + IT Dex respectively; Mean no. days between onset and treatment (SD); 11 (14), 7 (6), 4 (3), mean pre-treatment discrimination % (SD); 24 (38), 34 (40), 41 (40), mean pre-treatment PTA dB (SD); 82 (28), 80 (27), 75 (23). It was reported that there was no statistically significant differences between the treatment groups. Documentation made of: preceding upper respiratory infection or pre-existent hearing loss, whether the current hearing loss was sudden or progressive, age, history of hearing fluctuation, recent ear infection, surgery or hospitalization, exposure to ototoxins, trauma, drainage, tinnitus, pain, vertigo or family history of hearing loss. Medical conditions associated with hearing loss, for example, diabetes, syphilis, chronic renal disease and cardiovascular disease.
Indirectness of population	Serious indirectness: No age inclusion or ranges given. Risk of the inclusion of children.
Interventions	(n=19) Intervention 1: Steroid + steroid - Prednisolone + dexamethasone. All patients were given 66 capsules (10mg prednisolone), 6 capsules each morning with food for 7 days, then to take 5 capsules for 2 days, 4 for 2 days, then 1 less capsule per day until finished. Counselled on potential side effects. Additionally once a week for 3 weeks, patients were administered a transtympanic injection (0.5-0.7ml) of 12mg/ml dexamethasone in a buffered solution. The patient was left supine for 20 minutes, with the head positioned to pool the injected fluid in the round window region. Duration 14 days of oral treatment, 3 weeks IT injections. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic (Systemic oral prednisolone, transtympanic dexamethasone). 3. Specific drug within class: See intervention (n=20) Intervention 2: Steroid + placebo - Prednisolone + placebo (oral). All patients were given 66 capsules (10mg prednisolone), 6 capsules each morning with food for 7 days, then to take 5 capsules for 2 days, 4 for 2 days, then 1 less capsule per day until finished. Counselled on potential side effects. Additionally once a week for 3 weeks, patients were administered a transtympanic injection (0.5-0.7ml) of Saline in a buffered solution. The patient was left supine for 20 minutes, with the head positioned to pool the injected fluid in

	the round window region. Duration 14 days of oral treatment, 3 weeks IT injections. Concurrent medication/care: None described Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic (Prednisolone systemic + saline given transtympanically). 3. Specific drug within class: See intervention (n=21) Intervention 3: Steroid + placebo - Dexamethasone + placebo (transtympanic). All patients were given 66 capsules (placebo), 6 capsules each morning with food for 7 days, then to take 5 capsules for 2 days, 4 for 2 days, then 1 less capsule per day until finished. Counselled on potential side effects. Additionally once a week for 3 weeks, patients were administered a transtympanic injection (0.5-0.7ml) of 12mg/ml dexamethasone in a buffered solution. The patient was left supine for 20 minutes, with the head positioned to pool the injected fluid in the round window region. Duration 14 days of oral treatment, 3 weeks IT injections. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic (Systemic placebo + transtympanic dexamethasone). 3. Specific drug within class: See intervention
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) + DEXAMETHASONE (TRANSTYMPANIC) versus PREDNISOLONE (ORAL) + PLACEBO (TRANSTYMPANIC) Protocol outcome 1: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: PTA (3 frequency average of the threshold value at 0.5, 1 and 2 kHz) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 35 dB (SD 21); n=16, Group 2: mean 59 dB (SD 33); n=18; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome for Treatment-naïve patients at first presentation: Significant improvement in PTA (post hoc definition of an improvement of ≥15 dB) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 14/16, Group 2: 8/18; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (recovery of hearing to within 5 percentage points of the contralateral speech discrimination score (SDS) or within 5 dB of the contralateral PTA) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1:	

10/16, Group 2: 3/18; Risk of bias: High; Indirectness of outcome: Serious indirectness

Protocol outcome 2: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score (SDS, tested phonetically balanced maximum levels and 25 word lists) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 85 % (SD 23); n=16, Group 2: mean 54 % (SD 44); n=18; Risk of bias: High; Indirectness of outcome: Serious indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) + DEXAMETHASONE (TRANSTYMPANIC) versus PLACEBO (ORAL) + DEXAMETHASONE (TRANSTYMPANIC)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (recovery of hearing to within 5 percentage points of the contralateral speech discrimination score (SDS) or within 5 dB of the contralateral PTA) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 10/16, Group 2: 5/17; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome for Treatment-naïve patients at first presentation: PTA (3 frequency average of the threshold value at 0.5, 1 and 2 kHz) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 35 dB (SD 21); n=16, Group 2: mean 51 dB (SD 25); n=17; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Significant improvement in PTA (post hoc definition of an improvement of ≥15 dB) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 14/16, Group 2: 12/17; Risk of bias: Very high; Indirectness of outcome: Serious indirectness

Protocol outcome 2: Speech discrimination score
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score (SDS, tested phonetically balanced maximum levels and 25 word lists) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 85 % (SD 23); n=16, Group 2: mean 60 % (SD 37); n=17; Risk of bias: High; Indirectness of outcome: Serious indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) + PLACEBO (TRANSTYMPANIC) versus PLACEBO (ORAL) + DEXAMETHASONE (TRANSTYMPANIC)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (recovery of hearing to within 5 percentage points of the contralateral speech discrimination score (SDS) or within 5 dB of the contralateral PTA) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 3/18, Group 2: 5/17; Risk of bias: High; Indirectness of outcome: Serious indirectness

- Actual outcome for Treatment-naïve patients at first presentation: PTA (3 frequency average of the threshold value at 0.5, 1 and 2 kHz) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 59 dB (SD 33); n=18, Group 2: mean 51 dB (SD 25); n=17; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome for Treatment-naïve patients at first presentation: Significant improvement in PTA (post hoc definition of an improvement of ≥15 dB) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 8/18, Group 2: 12/17; Risk of bias: Very high; Indirectness of outcome: Serious indirectness Protocol outcome 2: Speech discrimination - Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score (SDS, tested phonetically balanced maximum levels and 25 word lists) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 54 % (SD 44); n=18, Group 2: mean 60 % (SD 37); n=17; Risk of bias: High; Indirectness of outcome: Serious indirectness	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Adverse events

Study	**Filipo 2013**[170]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=50)
Countries and setting	Conducted in Italy; Setting: IT treatment was carried out in an outpatient setting.
Line of therapy	1st line
Duration of study	Intervention + follow-up: 3 days of intervention, follow-up at 1 month.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Presented with moderate ISSNHL (Idiopathic sudden sensorineural hearing loss) involving all the frequencies from 0.25 kHz to 8 kHz (a flat audiogram). They all underwent routine serological tests, high resolution CT of the temporal bone and MRI of the brain specifically of the cerebello-pontine angle with gadolinium.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Diagnosed ISSNHL within 3 days from the onset, no previous therapy for ISSNHL and age between 15 and 85 years.
Exclusion criteria	Hypertension and diabetes in a non-compensated status, history of ischemic disorders (stroke, heart attack), Meniere's disease, retrocochlear diseases, autoimmune hearing loss (HL), trauma, fluctuating HL, radiation induced HL, noise induced HL or any other identifiable aetiology responsible or triggering sudden HL.
Recruitment/selection of patients	Recruited from the ENT emergency room of the Department of Sensory Organs, "Sapienza" University of Rome, or were sent by four private ENT practitioners between August 2011 and March 2012.
Age, gender and ethnicity	Age - Mean (SD): For the IT prednisolone group 49.9 (12.6) and IT saline group 50.8 (14.7) years. Gender

	(M:F): For the IT prednisolone group 14/11 and IT saline group 16/9. Ethnicity: NR
Further population details	1. Bilateral SSNHL: Not stated / Unclear
Indirectness of population	Serious indirectness: Inclusion criteria is 15-85 years. Unclear how many children are included in the study.
Interventions	(n=25) Intervention 1: Steroids - Prednisolone (transtympanic). Intratympanic administration of 0.3ml of prednisolone (Deltacortene Sol) at a dose of 62.5mg/ml once a day for 3 consecutive days. Tympanic membrane checked with a microscope. Local anaesthesia with a cotton sponge soaked with 10% lidocaine solution placed on the tympanic membrane. Removal of the sponge 20 minutes later, external canal cleared of remaining fluid. Supine position, 40-45 degree head tilt to the healthy side, 25 gauge spinal needle introduced in the posterior inferior tympanic membrane. Steroid was perfused into the middle ear. patients asked to avoid moving their head, speaking or swallowing for 30 minutes. After a week, if no complete recovery patients were given oral prednisone for 8 days (62.5mg per day for 4 days, followed by 37.5mg for 2 days and 25mg for the last 2 days). Duration 3 days . Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic (Systemic after day 7 in those who did not have a complete recovery). 3. Specific drug within class: See intervention (n=25) Intervention 2: Placebo. Intratympanic administration of saline once a day for 3 consecutive days. Tympanic membrane checked with a microscope. Local anaesthesia with a cotton sponge soaked with 10% lidocaine solution placed on the tympanic membrane. Removal of the sponge 20 minutes later, external canal cleared of remaining fluid. Supine position, 40-45 degree head tilt to the healthy side, 25 gauge spinal needle introduced in the posterior inferior tympanic membrane. Saline was perfused into the middle ear. patients asked to avoid moving their head, speaking or swallowing for 30 minutes. After a week, if no complete recovery patients were given oral prednisone for 8 days (62.5mg per day for 4 days, followed by 37.5mg for 2 days and 25mg for the last 2 days). Duration 3 days. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic (If no complete recovery at day 7 then systemic steroids were given.). 3. Specific drug within class: See intervention

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<tr><td></td><td></td></tr>
<tr><td>Funding</td><td>No funding (The authors have no funding, financial relationships or conflicts of interest to disclose.)</td></tr>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (TRANSTYMPANIC) versus PLACEBO

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Narrative reported mild adverse events at Not stated; Risk of bias: High; Indirectness of outcome: Serious indirectness

Protocol outcome 2: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (PTA ≤25 dB or identical to the contralateral non-affected ear) at Day 7; Group 1: 19/25, Group 2: 5/25; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Slight improvement (PTA improvement ≥10- 30 dB) at Day 7; Group 1: 3/25, Group 2: 0/25; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Marked improvement (PTA improvement >30 dB) at Day 7; Group 1: 2/25, Group 2: 0/25; Risk of bias: High; Indirectness of outcome: Serious indirectness</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination</td></tr>
</table>

Study	**Lee 2011**[314]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=46)
Countries and setting	Conducted in South Korea; Setting: Unclear
Line of therapy	2nd line
Duration of study	Intervention + follow-up: Post IV steroids, 2 week intervention followed by 4 weeks follow-up.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diagnostic criteria of SSNHL were an abrupt onset of hearing loss, more than 30 dB in three serial frequency, and lasting from 12hrs to several days.
Stratum	Patients refractory to treatment
Subgroup analysis within study	Post-hoc subgroup analysis: By partial/ no response to initial steroid treatments
Inclusion criteria	Failure to initial systemic steroid therapy was decided on recovering 10 dB or less of the affected ear pure tone average (PTA) immediately after initial systemic steroid therapy. No medical or central disease such as diabetes, hypertension, autoimmune disorders, syphilis, acoustic schwannoma and others that may affect hearing recovery.
Exclusion criteria	None described.
Recruitment/selection of patients	March 2004-December 2007.
Age, gender and ethnicity	Age - Mean (SD): IT steroid group 44 (16.2) years, Control group 45.3 (13.5). Gender (M:F): IT steroid group: 9:12, control group 9:16. Ethnicity: NR
Further population details	1. Bilateral SSNHL: Unilateral (Deduced from the figures given in the paper).

Indirectness of population	No indirectness
Interventions	(n=21) Intervention 1: Steroids - Dexamethasone (betamethasone) (transtympanic). Initial standard treatment prior to study: oral steroids (60mg/day for 5 days, followed by tapering for 5 days) and ginkgo biloba extracts for 10 days and followed by recommendation of resting, no smoking and low salt dieting for all 46 patients. Intratympanic dexamethasone injections were done for 2 weeks just after the initial steroid treatment. Confirmed an intact tympanic membrane in the supine position, lidocaine 10% pump spray (Xylocaine, 10mg/dose), 25 gauge spinal needle, one anterosuperior puncture was made for ventilation and another puncture was made at antero-middle portion for perfusion. Dexamethasone solution (Dexamethasone disodium phosphate, 5mg/ml) in the amount of 0.3-0.4ml was instilled. No myringotomy or insertion of ventilation tube was done. Patients to avoid swallowing or moving with the head tilted 45 degrees to the healthy side for 30 min. ITDI was done twice a week for 2 consecutive weeks. Duration 2 weeks. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=25) Intervention 2: No treatment. Initial standard treatment prior to study: oral steroids (60mg/day for 5 days, followed by tapering for 5 days) and ginkgo biloba extracts for 10 days and followed by recommendation of resting, no smoking and low salt dieting for all 46 patients. The patients were then given no further treatment for 2 weeks. Duration 2 weeks. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Not applicable / Not stated / Unclear 3. Specific drug within class: See intervention
Funding	Academic or government funding (Supported by the Korea Research Foundation Grant funded by the Korean Government.)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: DEXAMETHASONE (BETAMETHASONE) (TRANSTYMPANIC) versus NO TREATMENT	

Protocol outcome 1: Pure tone audiometry - Actual outcome for Patients refractory to treatment: PTA (calculated as an average of the threshold measured at 0.5,1,2 and 3 kHz) Final value at Week 8 (end of follow-up); Group 1: mean 63.2 dB (SD 25.6); n=21, Group 2: mean 71.2 dB (SD 24.6); n=25; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Patients refractory to treatment: Improvement (10 dB or more decrease in the PTA of the four frequencies: 0.5,1,2 and 3 kHz) at Week 8 (end of follow-up); Group 1: 10/21, Group 2: 4/25; Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health-related quality of life ; Speech discrimination ; Hearing-specific health-related quality of life ; Adverse events

Study	**Li 2011**[326]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=65)
Countries and setting	Conducted in China; Setting:
Line of therapy	2nd line
Duration of study	Intervention + follow-up: 15 days intervention, 2 month follow-up
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Sudden sensorineural hearing loss of at least 30 dB at 3 contiguous frequencies over a period of ≤ 3 days, no specific causes for the SSNHL after proper investigation
Stratum	Patients refractory to treatment
Subgroup analysis within study	Not applicable
Inclusion criteria	Sudden sensorineural hearing loss of at least 30 dB at 3 contiguous frequencies over a period of ≤ 3 days, time from the onset of hearing loss to the treatment was ≤14 days, no history of ear diseases, no specific causes for the SSNHL after proper investigation, admission to hospital and treatment with IV steroids comprising the administration of 1mg/kg prednisolone each day for 5 days followed by a division into 4 doses with a gradual tapering over the course of 9 days, the average of 4 pure tone frequencies (PTA; 0.5,1, 2, and 4 kHz) was <30 dB for the affected ear or <10 dB from the contralateral ear at the end of IV steroid treatment.
Exclusion criteria	Bilateral hearing loss, other contraindications the administration of intratympanic steroids (IT), the presence of a neoplasm or recent chemotherapy or radiation therapy, congenital cochlear malformations or the presence of otitis media with an abnormal tympanogram, recent use of ototoxic medications, liver or renal dysfunction and/or pregnancy.

Recruitment/selection of patients	Patients were admitted to the Third Affiliated Hospital, Sun Yat-Sen University between July 2006-September 2009.
Age, gender and ethnicity	Age - Mean (range): IT methylprednisolone 53.5 years (18-72), ear drop methylprednisolone 50 years (21-69), blank control group 55.1 years (22-73). Gender (M:F): IT methylprednisolone group 9/15, ear drop methylprednisolone 10/11, blank control group 7/13. Ethnicity: Not described.
Further population details	1. Bilateral SSNHL: Unilateral
Extra comments	The patients exhibited no response to the IV steroids and were consequently randomized to the three treatment groups.
Indirectness of population	No indirectness
Interventions	(n=24) Intervention 1: Steroids - Prednisolone (transtympanic). 1ml of 40mg/m methylprednisolone was buffered with 1ml of sodium bicarbonate. Local anaesthesia (topical phenol 85%) given, followed by the IT injection with a fine needle syringe (22 gauge) through the posterior inferior quadrant of the tympanic membrane of the affected ear, and 1ml of the solution was placed in the middle ear. Patients were then asked to refrain from swallowing and to remain with their heads turned to the opposite side for 45 minutes. The procedure was performed 4 times (once every 3 days) within the 15 day period. Duration 15 days. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=21) Intervention 2: Steroids - Prednisolone (ear drops). 1 ml of methylprednisolone was administered by directly dropping it on the tympanic membrane through the ear canal. The patients were treated 4 times (once every 3 days) within a 15 day period. Duration 15 days. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Postauricular 3. Specific drug within class: See intervention (n=20) Intervention 3: No treatment. The patients were not given any local methylprednisolone administration and were followed up for 2 months after the completion of systemic corticosteroid

	treatment. Duration NA. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Not applicable / Not stated / Unclear (Not applicable, no intervention.). 3. Specific drug within class: Not applicable
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (TRANSTYMPANIC) versus PREDNISOLONE (EAR DROPS) Protocol outcome 1: Pure tone audiometry - Actual outcome for Patients refractory to treatment: PTA (final score) at 2 months; Group 1: mean 52.9 dB (SD 67.116); n=24, Group 2: mean 60.9 dB (SD 50.4083); n=21; Risk of bias: Very high; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (TRANSTYMPANIC) versus NO TREATMENT Protocol outcome 1: Adverse events - Actual outcome for Patients refractory to treatment: Narrative adverse events mentioned in the paper at 2 months; Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 2: Pure tone audiometry - Actual outcome for Patients refractory to treatment: PTA (final score) at 2 months; Group 1: mean 52.9 dB (SD 67.116); n=24, Group 2: mean 59.9 dB (SD 51.4296); n=20; Risk of bias: Very high; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (EAR DROPS) versus NO TREATMENT Protocol outcome 1: Pure tone audiometry - Actual outcome for Patients refractory to treatment: PTA (final score) at 2 months; Group 1: mean 60.9 dB (SD 50.4083); n=21, Group 2: mean 59.9 dB (SD 51.4296); n=20; Risk of bias: Very high; Indirectness of outcome: No indirectness	

Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination

Study	Nosrati-Zarenoe 2012[417]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=103 randomised, data on 93 (mITT))
Countries and setting	Conducted in Sweden; Setting: 14 public otorhinolaryngological centers in Sweden
Line of therapy	1st line
Duration of study	Intervention + follow-up: Up to 30 days of treatment with follow-up at 3 months.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Sudden onset of hearing loss developing within 24 hours and without any known cause (no earlier or present ear diseases). The average change in hearing threshold should be 30 dB or higher for the 3 most affected contiguous frequencies in the affected ear.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Aged 18-80 years referred by GPs or seeking care directly, presenting with sudden onset of hearing loss developing within 24 hrs and without any known cause (no earlier or present ear diseases). The average change in hearing threshold should be 30 dB or higher for the 3 most affected contiguous frequencies in the affected ear.
Exclusion criteria	Common medical reasons for not using corticosteroids: pregnancy, diabetes, chronic infections, peptic ulcer, uncompensated heart disease, recent surgery or psychiatric disease.
Recruitment/selection of patients	GP referral or self-referral.
Age, gender and ethnicity	Age - Mean (SD): Prednisolone 56.8 (12.7) range 26-80 years, Placebo 53.8 (13.5), range 26-79 years. Gender (M:F): Prednisolone 24/23, Placebo 29/17. Ethnicity: Not reported.

Further population details	1. Bilateral SSNHL: Unilateral (47 people in prednisolone group, affected ear right 22, left 25. 46 in placebo group, affected ear right 24 and left 22.).
Indirectness of population	No indirectness
Interventions	(n=51) Intervention 1: Steroids - Prednisolone (oral). 10mg prednisolone capsules, given as a single dose of 60mg per day for 3 days. The dose was then reduced by 10mg per day, with a total treatment period of 8 days. If recovery was complete (mean difference in hearing thresholds for the 3 most affected contiguous frequencies comparing the audiogram before SSNHL and audiogram at the follow-up <10 dB) treatment stopped, otherwise medication was continued at 10mg daily to a total of 30 days from beginning. Patients asked to return capsule containers at the first and last follow-up visit- compliance checked. Duration 8–30 days of treatment, 3 month follow-up (from randomization) . Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic 3. Specific drug within class: See intervention (n=52) Intervention 2: Placebo. Placebo capsules, given as a single dose of 6 capsules for 3 days. The dose was then reduced by a capsule per day, with a total treatment period of 8 days. If recovery was complete (mean difference in hearing thresholds for the 3 most affected contiguous frequencies comparing the audiogram before SSNHL and audiogram at the follow-up <10 dB) treatment stopped, otherwise medication was continued at one capsule daily to a total of 30 days from beginning. Patients asked to return capsule containers at the first and last follow-up visit- compliance checked. Duration 8-30 days of treatment, 3 month follow-up (from randomization). Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic 3. Specific drug within class: Not applicable
Funding	Academic or government funding (Supported by grants from the Medical Research Council of Southeast Sweden (FORSS), the County Council of Ostergotland, Stiftelsen Tysta Skolan and Acta Oto-Laryngologica stipendium.)

<table>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) versus PLACEBO

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Adverse events (overall) at Day 90; Group 1: 15/51, Group 2: 11/52; Risk of bias: Very high; Indirectness of outcome: No indirectness

Protocol outcome 2: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Improvement in PTA at the end of treatment at Day 8; Group 1: mean 25.5 dB (SD 27.1); n=47, Group 2: mean 26.4 dB (SD 26.2); n=46; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Improvement in PTA at the end of follow-up at Day 90; Group 1: mean 39 dB (SD 20.1); n=47, Group 2: mean 35.1 dB (SD 38.3); n=46; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Recovery at the end of follow-up at Day 90; Group 1: 18/51, Group 2: 18/52; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Recovery at the end of treatment at Day 8; Group 1: 11/51, Group 2: 9/52; Risk of bias: ; Indirectness of outcome: No indirectness</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination</td></tr>
</table>

Study	**Plontke 2009**[448]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=23)
Countries and setting	Conducted in Germany; Setting: Carried out at the otolaryngology departments of two tertiary referral centers (a university hospital and a city hospital).
Line of therapy	2nd line
Duration of study	Intervention time: 2 weeks
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis: See in/exclusion criteria.
Stratum	Patients refractory to treatment
Subgroup analysis within study	Not applicable
Inclusion criteria	Age between 18 and 75, diagnosis of sudden (occurring within 72 hrs), unilateral, sensorineural hearing loss (ISSNHL) between 12 and 21 days before randomization, *hearing threshold of ≥50 dB HL for three or more frequencies in standard pure tone air conducted audiogram within the range of 0.5 to 4 kHz (0.5,1,2,3, and 4), ≥60 dB for 2 or ≥70 dB HL for any frequency within this range, or a speech reception threshold of ≥70 dB SPL or a speech discrimination score of ≤30%, insufficient recovery of hearing after systemic standard therapy that is, a hearing threshold in the contralateral ear of at least 20 dB HL better than the affected ear in at least three frequencies between 0.5 to 4 kHz in addition to*.
Exclusion criteria	Middle or external ear disease, conductive hearing loss ≥10 dB, bilateral ISSNHL, acute hearing loss other than ISSNHL, for example, acoustic trauma, Meniere's disease, fluctuating hearing loss, endolymphatic hydrops, suspected retrocochlear lesion, hearing loss after ear surgery perilymphatic fistula or barotraumas, ototoxic treatment such as chemotherapy or loop diuretics, history of an ischaemic disorder (stroke, heart

	attack, peripheral arterial occlusion disease) or autoimmune disease, any severe psychiatric or neurological disease (for example, epilepsy, Parkinson's disease, dementia/Alzheimer's disease, suspected neuroborreliosis, multiple sclerosis).
Recruitment/selection of patients	Two tertiary referral centers (a university hospital and a city hospital). An initiated third center was closed due to failure of recruiting patients. Recruited between June 2003-March 2006.
Age, gender and ethnicity	Age - Mean (SD): IT dexamethasone 53 (21) years, Placebo 56 (15 years). Gender (M:F): Placebo group 5/5, IT Dexamethasone 8/3. Ethnicity: NR
Further population details	1. Bilateral SSNHL: Unilateral (Deduced from the text in the paper).
Extra comments	Initial systemic treatment: High dose prednisolone (IV, 250mg/day) for 3 days followed by a dose reduction of 50% every 2 days together with systemic rheological medication (pentoxifylline, 3 x 400mg/day) and an antioxidant drug (alphasliponic acid, 1 x 600mg/day).
Indirectness of population	No indirectness
Interventions	(n=12) Intervention 1: Steroids - Dexamethasone (betamethasone) (transtympanic). High dose glucocorticoid therapy (systemic) with insufficient recovery of hearing at ~2 weeks (hearing threshold in the contralateral ear of at least 20 dB HL better than the affected ear in at least three frequencies (0.5-4 kHz and a hearing threshold of ≥50 dB HL for three or more frequencies in standard pure tone air conducted audiogram within the range of 0.5-4 kHz (0.5,1,2,3,4), ≥60 dB for 2 or ≥70 dB HL for any frequency within this range or a speech reception threshold of ≥70 dB SPL or a speech discrimination score of ≤30%. Patients underwent a tympansocopy under local anaesthesia for exclusion of a perilymphatic fistula. If excluded, a round window µCath was implanted using catheters with a tip diameter of 1.5mm in most cases. Cartridge of pump filled with a clear colourless study medication from a blinded vial, that was labelled with the random number only. Dexamethasone 21 dihydropgen phosphate (4mg/ml Fortecortin Inject, daily total dose 0.58mg) at a rate of 6µL/h. Implantation of the catheter: 'two tunnel technique'. Dexamethasone was started 15 days (SD 2.5, min 10 max 19) after onset of ISSNHL. Duration 2 weeks . Concurrent medication/care: Not described.

	Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=11) Intervention 2: Placebo. High dose glucocorticoid therapy (systemic) with insufficient recovery of hearing at ~2 weeks (hearing threshold in the contralateral ear of at least 20 dB HL better than the affected ear in at least three frequencies (0.5-4 kHz and a hearing threshold of ≥50 dB HL for three or more frequencies in standard pure tone air conducted audiogram within the range of 0.5-4 kHz (0.5,1,2,3,4), ≥60 dB for 2 or ≥70 dB HL for any frequency within this range or a speech reception threshold of ≥70 dB SPL or a speech discrimination score of ≤30%. Patients underwent a tympansocopy under local anaesthesia for exclusion of a perilymphatic fistula. If excluded, a round window µCath was implanted using catheters with a tip diameter of 1.5mm in most cases. Cartridge of pump filled with a clear colourless study medication from a blinded vial, that was labelled with the random number only. Sodium chloride 0.9% at a rate of 6µL/h. Implantation of the catheter: 'two tunnel technique'. Duration 2 weeks. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention
Funding	Other (Combination funding: Sponsored by the University of Tubingen, grant program for applied clinical research (AKF) and by a minor grant from Bess Medizintechnik GmbH.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: DEXAMETHASONE (BETAMETHASONE) (TRANSTYMPANIC) versus PLACEBO

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Patients refractory to treatment: PTA change (difference in 4 PTA: 0.5,1,2,3 kHz) in the affected ear before and after therapy) at 2 weeks; Group 1: mean -13.9 dB (SD 21.3); n=11, Group 2: mean -5.4 dB (SD 10.4); n=10; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome for Patients refractory to treatment: Recovery ('successful treatment according to Ho et al, complete and marked recovery: 6PTA≤25 dB and 6 PTA improvement >30 dB respectively) at 2 weeks; Group 1: 2/10, Group 2: 0/10; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome for Patients refractory to treatment: Recovery ('successful treatment' if ≥50% of maximum recovery (6 PTA) at 2 weeks; Group 1: 2/10, Group 2: 0/10; Risk of bias: High; Indirectness of outcome: No indirectness

<table>
<tr><td colspan="2">- Actual outcome for Patients refractory to treatment: PTA improvement (≥10 dB, 4PTA), post hoc analysis at 2 weeks; Group 1: 6/11, Group 2: 5/10; Risk of bias: Very high; Indirectness of outcome: No indirectness

Protocol outcome 2: Speech discrimination
- Actual outcome for Patients refractory to treatment: Change in maximum speech discrimination (monosyllables) in % at 2 weeks; Group 1: mean 24.4 % (SD 32); n=11, Group 2: mean 4.5 % (SD 7.6); n=10; Risk of bias: High; Indirectness of outcome: No indirectness</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Adverse events</td></tr>
</table>

Study	Stokroos 1998[525]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=44)
Countries and setting	Conducted in Netherlands; Setting: Multicentre; hospitals
Line of therapy	1st line
Duration of study	Intervention + follow-up: 7 days treatment (1 year follow-up)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Cochlear hearing loss of unknown aetiology of at least 30 dB at 3 contiguous frequencies. Hearing loss occurring within 24 hours and blank otological history. Exclusion: when a cause for sudden hearing loss was later identified patients were excluded from the study
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Cochlear hearing loss of unknown aetiology; hearing loss of at least 30 dB for 3 subsequent octave steps in frequency; hearing loss occurring within 24 h; blink otological history
Exclusion criteria	Hearing loss occurring >14 days ago; contraindications for experimental drugs. Laboratory investigations aimed to exclude infectious, inflammatory or autoimmune process or a coagulopathy.
Recruitment/selection of patients	Unclear
Age, gender and ethnicity	Age - Other: Average 45.5 years. Gender (M:F): States equal gender distribution. Ethnicity: Not stated
Further population details	1. Bilateral SSNHL: Not stated / Unclear

<table>
<tr><td>Indirectness of population</td><td>Serious indirectness: Children included</td></tr>
<tr><td>Interventions</td><td>(n=22) Intervention 1: Steroid + antiviral - Prednisolone + acyclovir. IV prednisolone (1mg/kg) on day 1 diminished in equal increments over 7 days to 0g. Acyclovir IV 10mg/kg 3-times daily for 7 days. Duration 7 days. Concurrent medication/care: Unclear
Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (IV). 3. Specific drug within class: See intervention

(n=22) Intervention 2: Steroid + placebo - Prednisolone + placebo (IV). IV prednisolone (1mg/kg) on day 1 diminished in equal increments over 7 days to 0g. Placebo IV 3-times daily for 7 days. Duration 7 days. Concurrent medication/care: Unclear
Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (IV). 3. Specific drug within class: See intervention</td></tr>
<tr><td>Funding</td><td>Equipment / drugs provided by industry (Glaxo-Wellcome Inc provided the study medication)</td></tr>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE + ACYCLOVIR versus PREDNISOLONE + PLACEBO (IV)

Protocol outcome 1: Adverse events
- Actual outcome: Adverse events at 7 days; Group 1: 2/21, Group 2: 6/22; Risk of bias: Very high; Indirectness of outcome: No indirectness</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Speech discrimination ; Hearing-specific health-related quality of life ; Pure tone audiometry</td></tr>
</table>

Study	**Tucci 2002**[553]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=105)
Countries and setting	Conducted in USA; Setting: Unclear, hospital setting?
Line of therapy	1st line
Duration of study	Intervention + follow-up: 12 days of systemic steroids, 10 days antiviral or placebo, total duration of study 6 weeks.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: See exclusion criteria. Initial patient assessment included: history and neurotologic evaluation, audiologic evaluation (PTA, speech audiometry (recorded speech), laboratory studies; required studies: complete blood count (haematocrit, leucocyte count, platelet count), blood chemistry (potassium, creatinine, random glucose), fluorescent treponemal antibody absorption test serology or equivalent to exclude syphilitic infection, studies to be obtained at the discretion of the physician; MRI with gadolinium or auditory brainstem evoked response test to exclude acoustic neuroma or other pathology central to the inner ear, laboratory evaluation including glycosylated haemoglobin, prothrombin, prothrombin time, total cholesterol, low density lipoprotein, high density lipoprotein, ESR, TSH and tetraiodothyronine.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not stratified but pre-specified: Those with normal hearing in the non-affected ear
Inclusion criteria	Loss of at least 30 dB in 3 contiguous frequencies over a period of <3 days in patients who have been monitored previously for hearing loss, subjective marked loss of hearing in patients with subjectively normal baseline hearing and no previous record of audiometry. In these patients, hearing in the contralateral ear was taken as "baseline". Patients seen within 10 days of onset of hearing loss. No underlying disease that could be associated with sudden sensorineural hearing loss as an etiologic factor (listed under "exclusion

	criteria". No contraindications to steroid or anti-viral medication use (exclusion: patients in whom steroid use is contraindicated or who refuse steroid use could be treated with valacyclovir "off protocol" and the results could be reported separately. Willingness to undergo audiometric, laboratory and imaging studies as stipulated in the protocol.
Exclusion criteria	Neoplasms: untreated or under active or recent treatment with chemotherapy or radiation therapy, pregnancy (lactating or breast feeding), patients with small vessel diseases, including giant cell arteritis, Buerger disease and others, Insulin dependent diabetes mellitus requiring treatment for >10 years, presence of autoimmune disorders by history with antinuclear antibody or rheumatoid factor to support diagnosis, history of recent barotrauma, history of congenital cochlear malformations, presence of otitis media with abnormal tympanograms, presence of neurologic disorders that may predispose to hearing loss, recent use of ototoxic medications (excluding otic drops), major psychiatric illness active or untreated with previous hospitalization, liver or renal dysfunction with supporting laboratory data (abnormal renal function with creatinine ≥3 or abnormal values in 2 liver function tests, age <18 years
Recruitment/selection of patients	Administered through a tertiary care medical center and clinical research institute. Enrolment by otolaryngologists in academic and private settings. Sites recruited from the membership of the Surgeons Outcomes Research Cooperative. 45 sites, 33 of which enrolled at least 1 pt. Max 10 per site. 32 month enrolment time.
Age, gender and ethnicity	Age - Mean (range): 55.8 years (range 18-82 years). Gender (M:F): 45/39. Ethnicity: White n=75, African American n=4, Asian n=2, Hispanic n=3
Further population details	1. Bilateral SSNHL: Unilateral
Indirectness of population	No indirectness
Interventions	(n=53) Intervention 1: Steroid + antiviral - Prednisolone + valacyclovir. Prednisolone: Day 1-4: 80mg a day in divided doses (40,20,20mg), day 5-6; 60mg a day in divided doses (20,20,20mg), Days 7-9 40mg a day in divided doses (20,20mg), day 10-12; 20mg per day. Valacyclovir: Days 1-10: 1g /day, Days 11-12: No drug administration. Treatments were packaged into blinded kits for distribution to the study sites at periodic intervals (carried

	out by the pharmacy at the clinical research institute). Initially 4 kits dispensed to each site. Each kit has its own unique identifying number and is tracked by the clinical institute. Duration 12 days of treatment, follow-up at 6 weeks. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Systemic 3. Specific drug within class: See intervention Comments: Note: Unclear the number randomised to each treatment group (total 105 patients). This has been estimated for attrition bias calculations and is not necessarily the figure of the study. (n=52) Intervention 2: Steroid + placebo - Prednisolone + placebo (oral). Prednisolone: Day 1-4: 80mg a day in divided doses (40,20,20mg), day 5-6; 60mg a day in divided doses (20,20,20mg), Days 7-9 40mg a day in divided doses (20,20mg), day 10-12; 20mg per day. Placebo: Days 1-10: 1g /day, Days 11-12: No drug administration. Treatments were packaged into blinded kits for distribution to the study sites at periodic intervals (carried out by the pharmacy at the clinical research institute). Initially 4 kits dispensed to each site. Each kit has its own unique identifying number and is tracked by the clinical institute. Duration 12 days of treatment, follow-up at 6 weeks. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Systemic 3. Specific drug within class: See intervention Comments: Note: Unclear the number randomised to each treatment group (total 105 patients). This has been estimated for attrition bias calculations and is not necessarily the figure of the study.
Funding	Equipment / drugs provided by industry (The study was supported in part by GlaxoWellcome, Inc., the manufacturer of Valtrex. The company provided the drug, placebo and a grant to partially fund the study. No salary or other support was provided to the co-authors.)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE + VALACYCLOVIR versus PREDNISOLONE + PLACEBO (ORAL) Protocol outcome 1: Health-related quality of life - Actual outcome for Treatment-naïve patients at first presentation: SF-12 at 2 weeks; Risk of bias: Very high; Indirectness of outcome: No indirectness	

Protocol outcome 2: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: PTA (Final score) at 6 weeks; Group 1: mean 44.4 dB (SD 32.5); n=39, Group 2: mean 38 dB (SD 31.7); n=29; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Treatment-naïve patients at first presentation: Recovery (within 10 dB of non-affected ear) at 6 weeks; Group 1: 15/39, Group 2: 14/29; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Treatment-naïve patients at first presentation: Recovery (within 20 dB of non-affected ear) at 6 weeks; Group 1: 17/39, Group 2: 15/29; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Treatment-naïve patients at first presentation: Recovery (within 50% of normal baseline) at 6 weeks; Group 1: 21/39, Group 2: 19/29; Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 3: Speech discrimination - Actual outcome for Treatment-naïve patients at first presentation: Change in Speech Discrimination score (Final score) at 6 weeks; Group 1: mean 64 % (SD 41.5); n=39, Group 2: mean 59.4 % (SD 42.1); n=29; Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Hearing-specific health-related quality of life ; Adverse events

Study	**Uri 2003[558]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=60)
Countries and setting	Conducted in Israel; Setting: Hospital
Line of therapy	1st line
Duration of study	Intervention + follow-up: 14 days of intervention, 1 year follow-up
Method of assessment of guideline condition	Method of assessment /diagnosis not stated: Hearing loss defined as a sensory hearing impairment of at least 20 dB in at least 3 frequencies. No information given on how they excluded those with known causes of their hearing loss apart from: CT or MRI of the cerebellopontine angle was performed to exclude an acoustic neuroma.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with idiopathic sudden sensorineural hearing loss.
Exclusion criteria	Patients younger than 18 years or older than 60 years, onset of hearing loss >7 days before admission. Patients with hypertension, diabetes, autoimmune, collagen and renal diseases, previous ear disease or known hearing loss.
Recruitment/selection of patients	Patients treated for idiopathic sudden sensorineural hearing loss (ISSNHL) in the Department of Otolaryngology- Head and Neck Surgery at Carmel Medical Center in Haifa, Israel between 1991-1999.
Age, gender and ethnicity	Age - Mean (SD): 45.8 years, range 18-60 years, median 48 years. Gender (M:F): 33/27. Ethnicity: NR

Further population details	1. Bilateral SSNHL: Unilateral (Deduced from the % left and % right ear affected by the hearing loss. Total 100% suggesting only one ear is affected.).
Extra comments	Tinnitus in 73%, dizziness 30%. Right ear affected 63.3%, left ear affected 36.7%. Symptomatic 1-4 days before admission n=40, 5-7 days n=20.
Indirectness of population	No indirectness
Interventions	(n=31) Intervention 1: Steroids - Hydrocortisone. Bed rest and treated with IV hydrocortisone 100mg tid for 7 days. After IV treatment, the patients were put on a taper regimen of prednisone for 7 days (dosing not described). Duration 7 days followed by 7 days prednisone tapering. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Systemic 3. Specific drug within class: See intervention (n=29) Intervention 2: Steroid + antiviral - Hydrocortisone + acyclovir. Bed rest, IV acyclovir 15mg/kg/day and hydrocortisone 100mg tid for 7 days. Followed by a taper regimen of prednisone for 7 days (dosing not described). Duration 7 days followed by 7 days prednisone tapering. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Systemic 3. Specific drug within class: See intervention
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: HYDROCORTISONE + ACYCLOVIR versus HYDROCORTISONE

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Side effects of acyclovir (CNS, renal or hepatic) at 1 year; Group 1: 0/29, Risk of bias: Very high; Indirectness of outcome: No indirectness

Protocol outcome 2: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: PTA improvement of 15 dB in the involved frequency average at 1 year; Group 1: 23/29, Group 2: 24/31; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Treatment-naïve patients at first presentation: Mean PTA improvement (dB) at 1 year; Other: p=0.700; Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 3: Speech discrimination - Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination at 1 year; Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life

Study	**Westerlaken 2007**[579]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=91)
Countries and setting	Conducted in Netherlands; Setting: Unclear, presume hospital setting.
Line of therapy	1st line
Duration of study	Intervention + follow-up: 12 month follow-up.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: To exclude known causes of HL there was a diagnostic protocol to exclude: infectious, inflammatory, autoimmune process or coagulopathy, extensive serological evaluation for herpes simplex virus, varicella zoster virus, cytomegalovirus, Epstein Barr virus, mumps, measles, influenza, parainfluenza, rubella, Borrelia, Chlamydia, and syphilis, to exclude Cogan's syndrome and systemic disease. In the cases where a cause of sudden HL was identified later, patients were excluded from the study.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Perceptive HL of unknown aetiology, HL of at least 30 dB HL for three subsequent 1 octave steps in the standard pure tone audiogram, HL occurred within 24 hours, blank otologic history of the affected ear, 18 years and older
Exclusion criteria	HL occurring more than 14 days before evaluation, had fluctuating HL or had contraindications to the use of high dose steroids (serious infections: herpes simplex oculi, active TB, hypertension (diastolic >110 mmHg, systolic >180mmHg, treated or untreated), manifest decompensatio cordis, cardiac arrhythmias, with the exception of AF, low serum potassium (below patient’s own hospital’s reference value), severe osteoporosis, Cushing syndrome, badly regulated insulin dependent diabetes mellitus, ulcer, pregnancy, oral

	anticoagulants (cumarin derivatives), use of corticosteroids.
Recruitment/selection of patients	Multicentre, recruited from April 2000- October 2004.
Age, gender and ethnicity	Age - Mean (SD): Prednisolone group: 49 (16), Dexamethasone group 46 (15). Gender (M:F): Prednisolone group 19/21, Dexamethasone group 25/16. Ethnicity: NR
Further population details	1. Bilateral SSNHL: Not stated / Unclear (All of the patients had reading for the PTA in the affected and unaffected ear at baseline, indicating that it is unilateral hearing loss, although specifically stated.).
Extra comments	Virus infection in preceding month: prednisolone; negative 38%, positive 10%, unknown 1%, Dexamethasone; negative 34%, positive 14%, unknown 2%. Previous herpes labialis: prednisolone; negative 33%, positive 15%, unknown 1%, Dexamethasone; negative 41%, positive 7%, unknown 2%. Delay in days mean (SD): Prednisolone 3 (3), Dexamethasone 4 (4).
Indirectness of population	No indirectness
Interventions	(n=47) Intervention 1: Steroids - Prednisolone. 70mg of prednisone per day tapered in steps of 10mg per day to 0 mg. The treatment lasted 7 days. 7 tablets for the first 3 days, 4 tablets on day 4, and 3 tablets on the last 3 days. Outpatient follow-up consisted of a consultation at week 1, 6, 6 months and 12 months after discharge. Trial medication was pre-packaged, supplied in identical sterile packaging with a label specifying the days of the regimen. Trial medication was dispensed at the University Medical Centre Groningen dispensary to ensure stable pharmacodynamics and pharmacokinetics. Pre-packaged trial medication delivered to the patient's physician. Duration 7 days. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (Oral). 3. Specific drug within class: See intervention (n=44) Intervention 2: Steroids - Dexamethasone (betamethasone). 300mg dexamethasone for 3 consecutive days followed by 4 days of placebo. The treatment lasted 7 days. 7 tablets for the first 3 days, 4 tablets on day 4, and 3 tablets on the last 3 days. Outpatient follow-up consisted of a consultation at week 1, 6, 6 months and 12 months after discharge. Trial medication was pre-packaged, supplied in identical sterile packaging with a label specifying the days of the regimen. Trial medication was dispensed at the University

<table>
<tr><td></td><td>Medical Centre Groningen dispensary to ensure stable pharmacodynamics and pharmacokinetics. Pre-packaged trial medication delivered to the patient's physician. Duration 3 days active treatment followed by 4 days placebo. Concurrent medication/care: Not described.
Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Systemic (Oral). 3. Specific drug within class: See intervention</td></tr>
<tr><td>Funding</td><td>Academic or government funding (The study was supported by the Heinsius Houbolt Foundation and is part of the research program of their department: Communication Through Hearing and Speech. The program is incorporated in the Sensory Systems Group of the Groningen Graduate School for Behavioral and Cognitive Neurosciences.)</td></tr>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISONE versus DEXAMETHASONE (BETAMETHASONE)

Protocol outcome 1: Pure tone audiometry
- Actual outcome: PTA (final score) at 12 months; Group 1: mean 42 dB (SD 29); n=35, Group 2: mean 36 dB (SD 28); n=36; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome: Recovery (post hoc definition: symmetrical hearing, interaural hearing difference of <20 dB HL) at 12 months; Group 1: 19/35, Group 2: 22/36; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome: Recovery (post hoc definition: more than a 50% decrease in hearing loss at 12 months) at 12 months; Group 1: 14/35, Group 2: 21/36; Risk of bias: Very high; Indirectness of outcome: No indirectness

Protocol outcome 2: Speech discrimination
- Actual outcome: Maximum speech discrimination of 100% at 12 months; Group 1: 20/35, Group 2: 23/36; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome: Speech discrimination improvement at Baseline compared to 12 months; Risk of bias: High; Indirectness of outcome: No indirectness</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Adverse events</td></tr>
</table>

Study	**Wu 2011**[592]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=60)
Countries and setting	Conducted in Taiwan; Setting: Conducted at 2 tertiary referral centers
Line of therapy	2nd line
Duration of study	Intervention + follow-up: 2 week intervention + 1 month follow-up (post treatment), total 6 week study
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Assume to exclude causes: 'a neuro-otological battery of tests was performed on each subject, including history taking, otological examination, pure tone audiometry, tympanometry, biochemical analysis and magnetic resonance imaging.' See also 'inclusion criteria'.
Stratum	Patients refractory to treatment: Stratified by age and sex
Subgroup analysis within study	Stratified then randomised:
Inclusion criteria	Sudden unilateral sensorineural hearing loss (occurring within 72hrs) or >30 dB in at least 3 contiguous frequencies, normal or nearly normal hearing in the better ear (4-frequency pure tone average <30 dB), currently receiving systemic steroid therapy that started within 7 days of SSNHL onset, previous treatment with 5 days of an IV steroid therapy (Solu-Medrol 40mg every 12 hrs) during the hospital stay, plus 5 days of tapering with oral prednisolone (starting from a daily divided dose of 1mg/kg) after discharge from the hospital, a post systemic therapy PTA difference between impaired and healthy ears of >20 dB, a Type A tympanogram, older than 18 years.
Exclusion criteria	The presence of a neoplasm or retrocochlear lesion, the presence of congenital cochlear malformations, the presence of otitis media, the presence of other neurologic disorders, recent use of ototoxic medications, liver or renal dysfunction and pregnancy.

Recruitment/selection of patients	October 2007- September 2008, subjects with recent onset SSNHL who had poor responses to systemic steroid therapy were enrolled.
Age, gender and ethnicity	Age - Mean (SD): IT steroid: 49.1 (14.2), IT saline 47.4 (15.7). Gender (M:F): ITSI (intratympanic steroid injection) group 9/18, ITNI (intratympanic normal saline injection) group 9/19. Ethnicity: NR
Further population details	1. Bilateral SSNHL: Unilateral (Stated in the inclusion criteria.).
Extra comments	Intratympanic injections: supine position, head turned 45 degrees to the healthy side. Anesthetized ear canal with 10% lidocaine pump spray. Remove lidocaine solution with suction, intratympanic injection of 0.5ml medication solution into the middle ear cavity at the posterior inferior part of the tympanic membrane, 27 gauge spinal needle, microscopic guidance. Rested with heads tilted and were asked to refrain from swallowing for 20 minutes.
Indirectness of population	No indirectness
Interventions	(n=30) Intervention 1: Steroids - Dexamethasone (betamethasone) (transtympanic). IV steroid therapy for 5 days during hospitalization and were tapered off steroids with oral prednisolone for 5 days after discharge. ~1 week after the completion of systemic steroid treatment the subjects who fulfilled the inclusion/exclusion criteria received intratympanic injection treatment. 4 injections of 0.5ml dexamethasone (8mg/2ml) within a 2 week period (4 days apart). Duration 2 weeks of treatment. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=30) Intervention 2: Placebo. IV steroid therapy for 5 days during hospitalization and were tapered off steroids with oral prednisolone for 5 days after discharge. ~1 week after the completion of systemic steroid treatment the subjects who fulfilled the inclusion/exclusion criteria received intratympanic injection treatment. 4 injections of 0.5mls of normal saline within a 2 week period (4 days apart). Duration 2 weeks of treatment. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention

Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: DEXAMETHASONE (BETAMETHASONE) (TRANSTYMPANIC) versus NORMAL SALINE (TRANSTYMPANIC) Protocol outcome 1: Adverse events - Actual outcome for Patients refractory to treatment: Perforation of tympanic membrane at 1 month after treatment finished; Group 1: 1/27, Group 2: 0/28; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome for Patients refractory to treatment: Gastrointestinal AEs (severe nausea and vomiting) at 1 month after treatment finished; Group 1: 0/27, Group 2: 0/28; Risk of bias: Low; Indirectness of outcome: No indirectness Protocol outcome 2: Pure tone audiometry - Actual outcome for Patients refractory to treatment: Change in PTA at 1 month after treatment finished; Group 1: mean 9.7 dB (SD 8.5); n=27, Group 2: mean 4.5 dB (SD 6.5); n=28; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome for Patients refractory to treatment: Response (hearing improvement of 10 dB or more) at 1 month after treatment finished; Group 1: 12/27, Group 2: 3/28; Risk of bias: Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination

Study	**Xenellis 2006**[594]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=37)
Countries and setting	Conducted in Greece; Setting: Outpatient
Line of therapy	2nd line
Duration of study	Intervention + follow-up: Intervention 15 days, follow-up 1.5 months (total time 2 months)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: See inclusion criteria.
Stratum	Patients refractory to treatment
Subgroup analysis within study	Not applicable
Inclusion criteria	Sensorineural hearing loss of at least 30 dB in 3 contiguous frequencies over a period of 3 days or less, time period from onset of hearing loss to treatment administration of 30 days or less, no history of ear disease, no specific cause for the SSNHL after proper investigation (standard ENT examination, basic audiometry, auditory brain stem response, electronystagmography when vestibular symptomatology exists, MRI with contrast, complete blood count, erythrocyte sedimentation rate, blood chemistries, T3, T4, TSH, syphilis serology (VDRL or PTA), toxoplasma antibody testing, antigen nonspecific serologic tests (ANA, AMA, ASMA), rheumatoid factor, acute and convalescent titers for EBV, CMV, HSV, total circulating immunoglobulins, total serum complement), the patient had received full course standard treatment for 10 days, and PTA 4 frequency (0.5, 1, 2, 4 kHz) average worse than 30 dB or worse than 10 dB from the contralateral ear at the end of IV steroid treatment.
Exclusion criteria	None described.

Recruitment/selection of patients	Hospital admissions for SSNHL - no description given.
Age, gender and ethnicity	Age - Mean (SD): Intratympanic treatment group 50.9 years, control group 50.3 years (no SD reported). Gender (M:F): Intratympanic treatment 9/10, Control 8/10. Ethnicity: NR
Further population details	1. Bilateral SSNHL: Unilateral (Deduced from figures for left and right ear hearing loss).
Extra comments	Intratympanic treatment group and control group respectively: mean interval from hearing loss onset to IV treatment administration was 11.8 days and 8.1 days (no SD reported).
Indirectness of population	No indirectness
Interventions	(n=19) Intervention 1: Steroids - Prednisolone (transtympanic). Non responders to 1st line treatment (prednisolone IV, 1mg/kg for 10 days divided in 3 doses, gradually tapered for 5 days. Acyclovir, 4g/day for 5 days, divided in 5 doses, buflomedil hydrochloride 300mg, divided in 3 doses for 10 days and ranitidine during steroid treatment). 2nd line treatment consisted of IT treatment, 1.5-2ml sterile aqueous suspension of methylprednisolone acetate in a concentration of 80mg/2ml (DepoMedrol, 80 MG/2ML) instilled slowly with a fine needle syringe (21 G) through the posterior-inferior quadrant of the tympanic membrane of the affected ear. Successful if whitish fluid could be seen through the tympanic membrane in the middle ear cavity. 30 minute perfusion with patient's head tilted 45 degrees away. Instructed to swallow as little as possible, stay still. Procedure done 4 times over a 15 day period. To overcome burning discomfort, 0.1ml of Lidocaine hydrochloride was used for the remainder of the session. Duration 15 days. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=18) Intervention 2: No treatment. Non responders to 1st line treatment (prednisolone IV, 1mg/kg for 10 days divided in 3 doses, gradually tapered for 5 days. Acyclovir, 4g/day for 5 days, divided in 5 doses, buflomedil hydrochloride 300mg, divided in 3 doses for 10 days and ranitidine during steroid treatment). 2nd line treatment - no treatment. Duration NA. Concurrent medication/care: Not described. Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Not applicable / Not stated / Unclear 3. Specific drug within class: Not applicable

Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (TRANSTYMPANIC) versus NO TREATMENT Protocol outcome 1: Adverse events - Actual outcome for Patients refractory to treatment: Adverse events: Perforation of tympanic membrane at 2 months from baseline (pre IV/1st line treatment); Group 1: 0/19, Group 2: 0/18; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Patients refractory to treatment: Adverse events: Infection at 2 months from baseline (pre IV/1st line treatment); Group 1: 0/19, Group 2: 0/18; Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 2: Pure tone audiometry - Actual outcome for Patients refractory to treatment: PTA (Final score) at 2 months from baseline (pre IV/1st line treatment); Group 1: mean 55.1 dB (SD 18.3074); n=19, Group 2: mean 69.7 dB (SD 16.5463); n=18; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for Patients refractory to treatment: Improvement of >10 dB at 2 months from baseline (pre IV/1st line treatment); Group 1: 9/19, Group 2: 0/18; Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination

41 H.7.2 Routes of administration

Study	**Ahn 2008**[9]
Study type	RCT (Patient randomised; Parallel)

Number of studies (number of participants)	(n=120)
Countries and setting	Conducted in South Korea; Setting: Initial 5 days the patients were hospitalised.
Line of therapy	First-line
Duration of study	Intervention + follow-up: 14 days of treatment, 3 months follow-up
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis: Does not state in the methods that underlying medical reasons for the sudden hearing loss were ruled out prior to inclusion. Only describes 'the diagnostic criteria for SSNHL were the acute onset of HL of 30 dB in three contiguous frequencies, which may have occurred instantaneously or progressively over several days".
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Diagnosed with SSNHL between February 2005 and March 2007. Diagnostic criteria: acute onset of HL of 30 dB in three contiguous frequencies, which may have occurred instantaneously or progressively over several days.
Exclusion criteria	Subjects with medical or central nervous system conditions, including diabetes, hypertension, connective-vascular disease, vestibular schwannoma and other conditions that could affect hearing recovery or selection of therapeutic methods. Subjects with true vertigo with whirling type were also excluded.
Recruitment/selection of patients	February 2005 to March 2007.
Age, gender and ethnicity	Age - Mean (SD): No age restriction given in inclusion criteria. ITD group 48.6 (15.4) years, Control 45.9 (14.7) years. Gender (M:F): ITD group 33/27, Control group 31/29. Ethnicity: Not reported.
Further population details	1. Bilateral SSNHL: Unilateral (Not directly stated, but in the baseline demographics it shows the number of people with left and right sided hearing loss, the total of which adds up to the number randomised.).

Indirectness of population	Serious indirectness: Risk that children were included as it wasn't stated that they were excluded.
Interventions	(n=60) Intervention 1: Steroids - Prednisolone. Methylprednisolone (oral) 48mg for 9 days, followed by tapering over 5 days as well as other medications, including vitamins and lipo-prostaglandin E1. Hospitalised for first 5 days, where they were fed a low salt diet. Duration 14 days of treatment, 3 month follow-up. Concurrent medication/care: Not described, only 'other medications, including vitamins and lip-prostaglandin E1'. Indirectness: Serious indirectness; Indirectness comment: Risk that some children may have been included. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (oral steroids). 3. Specific drug within class: See intervention (Methylprednisolone). (n=60) Intervention 2: Steroid + steroid - Prednisolone + dexamethasone. Methylprednisolone 48mg (oral) for 9 days, followed by tapering over 5 days as well as other medications, including vitamins and lipo-prostaglandin E1. Hospitalised for first 5 days, where they were fed a low salt diet. Confirmed intact tympanic membrane and middle ear status, local anaesthesia (cotton wool ball soaked in lidocaine 10% pump spray), applied to tympanic membrane for approximately 10 mins. Patient lay supine, head tilted 45 degrees to the healthy side, 25 gauge spinal needle introduced into the anterosuperior portion of the tympanic membrane and 0.3-0.4mL of 5mg/L dexamethasone given intratympanically on Day 1, Day 3 and Day 5. Patients were instructed to avoid swallowing or moving for 30 minutes. Duration 14 days of treatment, 3 months follow-up. Concurrent medication/care: Also took 'other medications, including vitamins and lipo-prostaglandin E1' and were on a low salt diet. Indirectness: Serious indirectness; Indirectness comment: Risk that some children may have been included. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (Systemic and transtympanic). 3. Specific drug within class: See intervention
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: METHYLPREDNISOLONE (ORAL) versus METHYLPREDNISOLONE (ORAL) + DEXAMETHASONE (IT)	

<table>
<tr><td colspan="2">Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (final hearing better than 25 dB) at 3 months; Group 1: 16/60, Group 2: 15/60; Comments: p=1.00
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: Serious indirectness, Comments: Risk that children have been included.; Baseline details: For the combination group and steroid groups respectively: initial PTA 74.3 (27.8), 70.3 (21.3), dizziness 20%, 30%, tinnitus 75%, 81.7%, duration, days, 6.5 (3.9), 7.1 (4.1); Blinding details: No description of blinding given.; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Treatment-naïve patients at first presentation: Slight hearing improvement or better (>15 dB gain and final hearing poorer than 45 dB) at 3 months; Group 1: 42/60, Group 2: 44/60; Comments: Also report slight improvement, partial recovery and complete recovery separately. All of these are combined to give 'Hearing improvement'. This has been extracted but it wasn't pre-specified in the methods.
p=0.84
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Comments - Combining slight improvement, partial recovery and complete recovery as the outcome 'hearing improvement' was not described in the methods.; Indirectness of outcome: Serious indirectness, Comments: Risk that children have been included.; Baseline details: For the combination group and steroid groups respectively: initial PTA 74.3 (27.8), 70.3 (21.3), dizziness 20%, 30%, tinnitus 75%, 81.7%, duration, days, 6.5 (3.9), 7.1 (4.1); Blinding details: No description of blinding given.; Group 1 Number missing: ; Group 2 Number missing:</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Speech discrimination ; Hearing-specific health-related quality of life ; Adverse events</td></tr>
</table>

Study	**Al-Shehri 2016**[13]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=39)
Countries and setting	Conducted in Saudi Arabia; Setting: Tertiary care referral hospital
Line of therapy	First-line
Duration of study	Intervention + follow-up: 2 weeks treatment; 2 month follow-up
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Pure tone average (PTA) 50 dB or higher, and the affected ear must at least 30 dB worse than the contralateral ear in at least 1 of the 4 PTA frequencies (0.5, 1, 2, and 4 kHz).
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Adult patients (aged above 18 years) with unilateral sensorineural hearing loss that developed within 72 hours and was present for two weeks or less. Patients' pure tone average (PTA) must have been 50 dB or higher, and the affected ear must have been at least 30 dB worse than the contralateral ear in at least 1 of the 4 PTA frequencies (0.5, 1, 2, and 4 kHz). Thorough evaluation, including medical and otologic history and extensive systems review, head and neck and otologic and neurologic physical examination, audiometry, and imaging to rule-out structural or retrocochlear pathology.

Exclusion criteria	Patients who indicated that their hearing has been asymmetric prior to the onset of ISSNHL. Patients who had pre-enrolment steroid usage, previous history of hearing loss, Meniere disease, or any chronic inflammatory or suppurative ear disease or cholesteatoma, otosclerosis, ear surgery (except ventilating tubes), hearing asymmetry prior to onset, congenital hearing loss, physical trauma or barotrauma to the ear immediately preceding hearing loss, history of genetic hearing loss with strong family history, or craniofacial or temporal bone malformations as revealed by computed tomographic scanning.
Recruitment/selection of patients	January 2011-December 2014
Age, gender and ethnicity	Age - Mean (SD): Experimental group: 49.8±5.9; control group: 49.7±7.3. Gender (M:F): 46/54%. Ethnicity: Not stated
Further population details	1. Bilateral SSNHL: Unilateral
Extra comments	Tinnitus: 44% Dizziness: 23% Vertigo: 21%.
Indirectness of population	No indirectness
Interventions	(n=20) Intervention 1: Steroids - Prednisolone (oral). Oral prednisolone 60 mg/day tapering over 14 days. Duration 14 days. Concurrent medication/care: Not stated Further details: 1. Rehabilitation as adjunct to medical treatment: No adjunctive rehabilitation 2. Route of administration : Systemic (Oral). 3. Specific drug within class: See intervention Comments: After initial visit only attended clinic for follow-up at 2 weeks, 1 month and 2 months. (n=19) Intervention 2: Steroids - Prednisolone (transtympanic). Intratympanic methylprednisolone sodium succinate (four 1-mL doses of 40 mg/mL of methylprednisolone over 2 weeks with a dose given every 3-4 days by injection through the tympanic membrane into the middle ear). . Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness

<table>
<tr><td></td><td>Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention
Comments: After initial visit, attended clinic for regular injections as well as for follow-up at 2 weeks, 1 month and 2 months.</td></tr>
<tr><td>Funding</td><td>Funding not stated</td></tr>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (INTRATYMPANIC) versus PREDNISOLONE (ORAL)

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Adverse events at 2 months; Group 1: 13/19, Group 2: 33/20; Comments: Mood change: 2 versus 8; blood glucose problem: 3 versus 6; sleep change: 1 versus 6; increased appetite: 1 versus 5; earache: 4 versus 0; pain due to injection: 2 versus 0; mouth dryness/thirst: 0 versus 5; weight gain: 0 versus 3.
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Only gender, associated symptoms and PTA baseline values given; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Change in pure tone average (mean of hearing thresholds at 4 frequencies, 0.5, 1, 2, and 4 kHz, in the affected ear) at 2 months; Group 1: mean 32.1 dB (SD 6.9); n=19, Group 2: mean 27.5 dB (SD 6.5); n=20
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Only gender, associated symptoms and PTA baseline values given; Group 1 Number missing: ; Group 2 Number missing:</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination</td></tr>
</table>

Study	Arastou 2013[27]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=77)
Countries and setting	Conducted in Iran; Setting: Amiralam Hospital (an ear, nose, and throat (ENT) referral center in Tehran)
Line of therapy	First-line
Duration of study	Intervention + follow-up: 10 days (2 weeks after last treatment)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Rapid-onset sensorineural hearing loss that developed within 24 h, without identifiable cause including retro-cochlear disease or trauma
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Rapid-onset sensorineural hearing loss that developed within 24 h, without identifiable cause including retro cochlear disease or trauma plus at least one poor prognostic factor: age greater than 40 years, hearing loss more than 70 dB, or greater than a 2-week delay between the onset of hearing loss and initiation of therapy.
Exclusion criteria	Hypertension, diabetes mellitus, tympanic perforation in the affected ear, history of surgery on the affected ear, bilateral SSNHL, ISSNHL in the hearing ear only, if they were pregnant, or if they received any therapy for SSNHL prior to enrolment in the study.
Recruitment/selection of patients	June 2008 and November 2009
Age, gender and ethnicity	Age - Mean (SD): Intervention group: 45.4(14.8); control group: 49.2(14.4). Gender (M:F): 73/27%. Ethnicity:
Further population details	1. Bilateral SSNHL: Unilateral

Extra comments	Delay to treatment: intervention group 18.97(23.6); control group 15.5(22.6) Hearing loss >70 dB: intervention group 20 (55.6%); control group 14 (34.4%). At baseline, a standard ENT examination and baseline audiometric evaluation (including PTA, SDS, and acoustic reflex) were performed in all patients. Laboratory studies included blood cell count, coagulation profile, measurement of blood glucose, lipid levels, blood urea nitrogen (BUN), creatinine, erythrocyte sedimentation rate, C-reactive protein (CRP), antinuclear antibody (ANA), rheumatoid factor, syphilis serology (fluorescent treponemal antibody-absorption; FTA Abs), human immunodeficiency virus (HIV) antibody, and urine analysis. Magnetic resonance imaging (MRI) examination of cerebellopontine (CP) angle and internal auditory canal was performed in all patients.
Indirectness of population	--: Poor prognosis subpopulation
Interventions	(n=41) Intervention 1: Steroid + antiviral - Prednisolone + acyclovir. Oral treatment with systemic prednisolone (1 mg/kg/day for 10 days), acyclovir (2 g/day for 10 days, divided in four doses), triamterene H (daily), and omeprazole (daily, during steroid treatment) . Duration 10 days. Concurrent medication/care: Advised to follow a low salt diet. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic 3. Specific drug within class: See intervention (n=36) Intervention 2: Steroid + steroid + antiviral - Dexamethasone + prednisolone + acyclovir. Intratympanic dexamethasone injections (0.4 ml of 4 mg/ml dexamethasone) two times a week for two consecutive weeks (four injections in total). The procedure was performed in the supine position, with the head tilted 45° to the healthy side, under a microscope. After administration of local anaesthesia using a lidocaine 10% pump spray, an anterosuperior puncture was made in the tympanic membrane by using a 25-gauge needle and insulin syringe, and the solution was introduced through the needle. Patients were instructed to avoid swallowing or moving for 20 min after the injections. This was combined with the same treatment as the control group: oral treatment with systemic prednisolone (1 mg/kg/day for 10 days), acyclovir (2 g/day for 10 days, divided in four doses), triamterene H (daily), and omeprazole (daily, during steroid treatment) . Duration 10 days. Concurrent medication/care: Advised to follow a low salt diet. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration :

	Systemic + transtympanic 3. Specific drug within class: See intervention
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: DEXAMETHASONE + PREDNISOLONE + ACYCLOVIR versus PREDNISOLONE + ACYCLOVIR Protocol outcome 1: Adverse events - Actual outcome for Treatment-naïve patients at first presentation: Adverse events at 2 weeks after treatment; Two patients (2.6%) developed tympanic perforation, and were treated with cauterization and paper patch and tympanoplasty surgery, respectively. Two patients (2.6%) had sarcoidosis.; Risk of bias: All domain - Very high, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - High, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: Improvement in PTA (average of thresholds at 0.25, 0.5, 1, 2, and 4 kHz) at 2 weeks after treatment; Group 1: mean 22.6 dB (SD 22.2); n=36, Group 2: mean 13.8 dB (SD 21.1); n=41 Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Treatment-naïve patients at first presentation: Improvement in PTA (decrease of at least 15 dB in PTA, measured as average of thresholds at 0.25, 0.5, 1, 2, and 4 kHz) at 2 weeks after treatment; Group 1: 27/36, Group 2: 17/41 Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: Serious indirectness, Comments: Not true recovery; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination

Study	**Battaglia 2008**[51]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=51)
Countries and setting	Conducted in USA; Setting: The patients were observed in Kaiser clinics in Fontana (8 pts), LA (1 patient), Panorama City (3 patients), Riverside (3 patients), San Diego (36 patients).
Line of therapy	Unclear
Duration of study	Not clear: Stated to be a 2 year study. Capsules taken for 2 weeks, transtympanic injections over 3 weeks, audiogram stated to have been taken 4 weeks after the final injection. Also describes a 3 month follow-up after the last patient enrolled.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: 'Audiometry, history, and physical examination were performed to confirm the diagnosis of ISSNHL as previously defined'. Unclear definition, assume they use the definition 'commonly defined as greater than 20 dB of hearing loss in at least 3 audiometric frequencies occurring within 3 days or less' as written in their introduction. Patients with no identifiable cause of sudden hearing loss were considered to have ISSNHL.
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients observed within 6 weeks of the onset of ISSNHL
Exclusion criteria	Pregnant patients and those who had received previous treatment. Those with recognised causes of sensorineural hearing loss such as Meniere's disease or autoimmune hearing loss.
Recruitment/selection of patients	Kaiser clinics in the USA.

Age, gender and ethnicity	Age - Mean (SD): No standard deviations were reported. Placebo taper + IT-Dex 60 years, HDPT + IT saline 54 years, HDPT + IT Dex 57 years. Gender (M:F): Not described. Ethnicity: Not described.
Further population details	1. Bilateral SSNHL: Not stated / Unclear
Extra comments	For Placebo taper + IT-Dex, HDPT + IT saline and HDPT + IT Dex respectively; Mean no. days between onset and treatment (SD); 11 (14), 7 (6), 4 (3), mean pre-treatment discrimination % (SD); 24 (38), 34 (40), 41 (40), mean pre-treatment PTA dB (SD); 82 (28), 80 (27), 75 (23). It was reported that there was no statistically significant differences between the treatment groups. Documentation made of: preceding upper respiratory infection or pre-existent hearing loss, whether the current hearing loss was sudden or progressive, age, history of hearing fluctuation, recent ear infection, surgery or hospitalization, exposure to ototoxins, trauma, drainage, tinnitus, pain, vertigo or family history of hearing loss. Medical conditions associated with hearing loss, for example, diabetes, syphilis, chronic renal disease and cardiovascular disease.
Indirectness of population	Serious indirectness: No age inclusion or ranges given. Risk of the inclusion of children.
Interventions	(n=19) Intervention 1: Steroid + steroid - Prednisolone + dexamethasone. All patients were given 66 capsules (10mg prednisolone), 6 capsules each morning with food for 7 days, then to take 5 capsules for 2 days, 4 for 2 days than 1 less capsule per day until finished. Counselled on potential side effects. Additionally once a week for 3 weeks, patients were administered a transtympanic injection (0.5-0.7ml) of 12mg/ml dexamethasone in a buffered solution. The patient was left supine for 20 minutes, with the head positioned to pool the injected fluid in the round window region. Duration 14 days of oral treatment, 3 weeks IT injections. Concurrent medication/care: Not described. Indirectness: Serious indirectness; Indirectness comment: No age range/ inclusion criteria stated. Risk of the inclusion of children. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic (Systemic oral prednisolone, transtympanic dexamethasone). 3. Specific drug within class: See intervention (n=20) Intervention 2: Steroid + placebo - Prednisolone + placebo (oral). All patients were given 66 capsules (10mg prednisolone), 6 capsules each morning with food for 7 days, then to take 5 capsules for 2 days, 4 for 2 days than 1 less capsule per day until finished. Counselled on potential side effects. Additionally once a week for 3 weeks, patients were administered a transtympanic injection (0.5-0.7ml) of Saline in a buffered

	solution. The patient was left supine for 20 minutes, with the head positioned to pool the injected fluid in the round window region. Duration 14 days of oral treatment, 3 weeks IT injections. Concurrent medication/care: None described. Indirectness: Serious indirectness; Indirectness comment: No age range/ inclusion criteria stated. Risk of the inclusion of children. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic (Prednisolone systemic + saline given transtympanically). 3. Specific drug within class: See intervention (n=21) Intervention 3: Steroid + placebo - Dexamethasone + placebo (transtympanic). All patients were given 66 capsules (placebo), 6 capsules each morning with food for 7 days, then to take 5 capsules for 2 days, 4 for 2 days than 1 less capsule per day until finished. Counselled on potential side effects. Additionally once a week for 3 weeks, patients were administered a transtympanic injection (0.5-0.7ml) of 12mg/ml dexamethasone in a buffered solution. The patient was left supine for 20 minutes, with the head positioned to pool the injected fluid in the round window region. Duration 14 days of oral treatment, 3 weeks IT injections. Concurrent medication/care: Not described. Indirectness: Serious indirectness; Indirectness comment: No age range/ inclusion criteria stated. Risk of the inclusion of children. Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic (Systemic placebo + transtympanic dexamethasone). 3. Specific drug within class: See intervention
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) + DEXAMETHASONE (TRANSTYMPANIC) versus PREDNISOLONE (ORAL) + PLACEBO (TRANSTYMPANIC)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: PTA (3 frequency average of the threshold value at 0.5, 1 and 2 kHz) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 35 dB (SD 21); n=16, Group 2: mean 59 dB (SD 33); n=18; Comments: Baseline PTA for combination group 75 (23), with an average improvement of 40 dB. Prednisolone (oral) + placebo (IT) baseline 80 (27) with an average improvement of 21 dB.
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note:

inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 2, Reason: No reasons given
- Actual outcome for Treatment-naïve patients at first presentation: Significant improvement in PTA (post hoc definition of an improvement of ≥15 dB) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 14/16, Group 2: 8/18
Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 2, Reason: No reasons given
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (recovery of hearing to within 5 percentage points of the contralateral speech discrimination score (SDS) or within 5 dB of the contralateral PTA) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 10/16, Group 2: 3/18
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 2, Reason: No reasons given

Protocol outcome 2: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score (SDS, tested phonetically balanced maximum levels and 25 word lists) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 85 % (SD 23); n=16, Group 2: mean 54 % (SD 44); n=18; Comments: Baseline SDS for combination group 41 (40), with an average improvement of 44%. Prednisolone (oral) + placebo (IT) baseline 34 (40) with an average improvement of 20%.
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL.; Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number

missing: 3, Reason: No reasons given; Group 2 Number missing: 2, Reason: No reasons given

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) + DEXAMETHASONE (TRANSTYMPANIC) versus PLACEBO (ORAL) + DEXAMETHASONE (TRANSTYMPANIC)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (recovery of hearing to within 5 percentage points of the contralateral speech discrimination score (SDS) or within 5 dB of the contralateral PTA) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 10/16, Group 2: 5/17
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given
- Actual outcome for Treatment-naïve patients at first presentation: PTA (3 frequency average of the threshold value at 0.5, 1 and 2 kHz) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 35 dB (SD 21); n=16, Group 2: mean 51 dB (SD 25); n=17; Comments: Baseline PTA for combination group 75 (23), with an average improvement of 40 dB. Placebo (oral) + dexamethasone (IT) baseline 82 (28) with an average improvement of 31 dB.
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given
- Actual outcome for Treatment-naïve patients at first presentation: Significant improvement in PTA (post hoc definition of an improvement of ≥15 dB) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 14/16, Group 2: 12/17
Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL.; Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given

Protocol outcome 2: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score (SDS, tested phonetically balanced maximum levels and 25 word lists) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 85 % (SD 23); n=16, Group 2: mean 60 % (SD 37); n=17; Comments: Baseline SDS for combination group 41 (40), with an average improvement of 44% . Placebo (oral) + dexamethasone (IT) baseline 24 (38) with an average improvement of 36%.
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 3, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (ORAL) + PLACEBO (TRANSTYMPANIC) versus PLACEBO (ORAL) + DEXAMETHASONE (TRANSTYMPANIC)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (recovery of hearing to within 5 percentage points of the contralateral speech discrimination score (SDS) or within 5 dB of the contralateral PTA) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 3/18, Group 2: 5/17
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 2, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given
- Actual outcome for Treatment-naïve patients at first presentation: PTA (3 frequency average of the threshold value at 0.5, 1 and 2 kHz) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 59 dB (SD 33); n=18, Group 2: mean 51 dB (SD 25); n=17; Comments: Baseline PTA for Prednisolone (oral) + placebo (IT) 80 (27) with an average improvement of 21 dB and for the Placebo (oral) + dexamethasone (IT) 82 (28), with an average improvement of 31 dB.
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note:

<table>
<tr><td colspan="2">inclusion criteria- within 6 weeks of the onset of ISSNHL.; Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 2, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given
- Actual outcome for Treatment-naïve patients at first presentation: Significant improvement in PTA (post hoc definition of an improvement of ≥15 dB) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: 8/18, Group 2: 12/17
Risk of bias: All domain - Very high, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 2, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given

Protocol outcome 2: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score (SDS, tested phonetically balanced maximum levels and 25 word lists) at 7 weeks (3 weeks treatment, 4 weeks follow-up); Group 1: mean 54 % (SD 44); n=18, Group 2: mean 60 % (SD 37); n=17; Comments: Baseline SDS for Prednisolone (oral) + placebo (IT) 34 (40) with an average improvement of 20% and for the Placebo (oral) + dexamethasone (IT) 24 (38), with an average improvement of 36%.
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - High, Comments - Incomplete recruitment so study was suspended and results analysed for enrolled patients. Note: inclusion criteria- within 6 weeks of the onset of ISSNHL. Indirectness of outcome: Serious indirectness, Comments: Risk of the inclusion of children; Baseline details: Very limited baseline characteristics given. No info on sex. Stated to not be statistically significant, baseline mean time (days) between onset and treatment; combination group 4 (3), oral prednisolone + placebo 7 (6), oral placebo + dexamethasone (IT) 11 (14) days.; Group 1 Number missing: 2, Reason: No reasons given; Group 2 Number missing: 4, Reason: No reasons given</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Adverse events</td></tr>
</table>

Study	**Dispenza 2011[141]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=51)
Countries and setting	Conducted in Italy; Setting: Unclear
Line of therapy	First-line
Duration of study	Intervention + follow-up: 2 weeks (6 months follow-up)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: SSNHL of at least 30 dB across three contiguous frequencies over a period of 24 h
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	SSNHL of at least 30 dB across 3 contiguous frequencies over 24 hours
Exclusion criteria	Previous episode of hearing loss; history of ear pathology; previous treatments administered elsewhere; contraindication to systemic steroid administration. Patients with subsequent evidence of retrocochlear disease on MRI were excluded from the analysis
Recruitment/selection of patients	January 2008 - December 2009
Age, gender and ethnicity	Age - Mean (SD): 50. Gender (M:F): 61/39%. Ethnicity: Not stated
Further population details	1. Bilateral SSNHL: Unilateral
Extra comments	Mean time from onset of symptoms to presentation: 9.4 days in IT group versus 3.8 days in oral group

	Tinnitus: 76% Dizziness: 28.2% Baseline PTA: 65 dB IT group versus 51 dB oral group. Patient evaluation included: thorough history, otoscopy, bedside peripheral vestibular system exam, PTA (repeated weekly), MRI of internal auditory canal and cerebello-pontine angle
Indirectness of population	--
Interventions	(n=25) Intervention 1: Steroids - Dexamethasone (betamethasone) (transtympanic). Patient in supine position with the head rotated 45° to the unaffected side; myringotomy in anterior-inferior quadrant of the tympanic membrane to allow exit of the air in the middle ear during drug administration. Dexamethasone 4mg/ml injected through posterior-inferior quadrant completely filling the middle ear. Patient maintained head position for 20 minutes and instructed to avoid swallowing, speaking and movements of the head. Injected repeated weekly for 4 weeks. Duration 4 weeks. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=21) Intervention 2: Steroids - Dexamethasone (betamethasone) (oral). 60mg prednisolone tapered over 14 days. Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not stated / Unclear 2. Route of administration : Systemic 3. Specific drug within class: See intervention
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: DEXAMETHASONE (INTRATYMPANIC) versus DEXAMETHASONE (BETAMETHASONE) (ORAL)

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Treatment-related complications at 6 months; Mean; ;

<table>
<tr><td colspan="2">Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low, Comments - 3 patients lost during follow-up (reasons not stated) and 2 excluded after evidence of vestibular schwannoma was identified; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Mean PTA improvement (tinnitus subgroup); based on 4-tone PTA (0.5, 1, 2 and 4 kHz) at 6 months; Group 1: mean 24.6 dB (SD 22.4); n=19, Group 2: mean 20.6 dB (SD 14.9); n=17
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - 3 patients lost during follow-up (reasons not stated) and 2 excluded after evidence of vestibular schwannoma was identified; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Treatment-naïve patients at first presentation: Mean PTA improvement (no tinnitus subgroup); based on 4-tone PTA (0.5, 1, 2 and 4 kHz) at 6 months; Group 1: mean 35.2 dB (SD 6.5); n=6, Group 2: mean 22.5 dB (SD 9.6); n=4
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - 3 patients lost during follow-up (reasons not stated) and 2 excluded after evidence of vestibular schwannoma was identified; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination</td></tr>
</table>

Study	**Eftekharian 2016**[152]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=67)
Countries and setting	Conducted in Iran; Setting: University-based tertiary care hospital
Line of therapy	First-line
Duration of study	Intervention + follow-up: 2 weeks (3 months)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Hearing loss ≥30 dB over at least 3 contiguous frequencies within 3 days
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Sensorineural hearing loss of 30 dB or more covering at least 3 contiguous frequencies, which occur within 3 days or fewer; no identifiable cause despite adequate investigation; normal or near-normal hearing in the contralateral ear; age 18–60 years; ≤10 days from disease onset; no history of previous treatment; no contraindication for proposed therapy
Exclusion criteria	Any identified aetiology during therapy; previous disease or therapy in the affected ear; pregnant or lactating women
Recruitment/selection of patients	Prospective; 3 declined to participate
Age, gender and ethnicity	Age - Mean (SD): IV group: 42.2(12.6); oral group: 40.1(11.9). Gender (M:F): 48/52%. Ethnicity:
Further population details	1. Bilateral SSNHL: Unilateral

Extra comments	Baseline differences in PTA (dB): IV 76.07(25.6) versus oral 66.85(36.54) Baseline differences in WRS (%): IV 32.24(38.13) versus oral 49.64(36.79) More severe hearing loss at baseline in the IV group. Days from onset to treatment: IV 6.7(2.2) versus oral 7.3(2.3)
Indirectness of population	No indirectness
Interventions	(n=34) Intervention 1: Steroids - Prednisolone (IV). 500 mg daily intravenous methylprednisolone for 3 consecutive days followed by 1mg/kg (maximum 60mg) oral prednisolone . Duration 14 days. Concurrent medication/care: Not stated Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (IV). 3. Specific drug within class: See intervention (n=33) Intervention 2: Steroids - Prednisolone (oral). 1mg/kg (maximum 60 mg) oral prednisolone. Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic (Oral). 3. Specific drug within class: See intervention
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (IV) versus PREDNISOLONE (ORAL)

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Adverse events or complications at 3 months after treatment; Group 1: 0/29, Group 2: 0/31
Risk of bias: All domain - Very high, Selection - Low, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: PTA improvement (averaged across 0.5, 1, 2 and 4 kHz) at 3 months after treatment; Group 1: mean 60 dB (SD 37.84); n=29, Group 2: mean 54.59 dB (SD 31.8); n=31

Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Treatment-naïve patients at first presentation: Complete recovery: return to within 10 dB HL of the unaffected ear and recovery of word recognition scores to within 5%-10% of the unaffected ear at 3 months after treatment; Group 1: 7/29, Group 2: 6/31 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 2 Protocol outcome 3: Speech discrimination - Actual outcome for Treatment-naïve patients at first presentation: Word recognition score improvement (%) at 3 months after treatment; Group 1: mean 58.58 % (SD 42.44); n=29, Group 2: mean 63.06 % (SD 41.14); n=31 Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life

Study	**Gundogan 2013[204]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=79)
Countries and setting	Conducted in Turkey; Setting: Unclear
Line of therapy	First-line
Duration of study	Intervention + follow-up: 14 days (1 month follow-up)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Unexplained sudden sensorineural hearing loss, which was defined as a sensorineural hearing loss of at least 30 dB at 3 contiguous frequencies over a period of ≤3 days
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	(1) unexplained sudden sensorineural hearing loss, which was defined as a sensorineural hearing loss of at least 30 dB at 3 contiguous frequencies over a period of ≤3 days; (2) time from the onset of hearing loss to the treatment of ≤14 days; (3) no initial treatment before; (4) no history of ear disease in the affected ear; (5) and unilateral sudden hearing loss.
Exclusion criteria	Chronic otitis media, trauma, previous radiotherapy or chemotherapy, recent use of ototoxic drugs, liver or renal dysfunction, retrocochlear lesion, and interval to first treatment greater than 14 days from onset
Recruitment/selection of patients	December 2009 - January 2013
Age, gender and ethnicity	Age - Mean (SD): Combination: 52.32(12.94); oral: 51.6 (16.77). Gender (M:F): 37/36. Ethnicity: Not stated
Further population details	1. Bilateral SSNHL: Unilateral

Extra comments	All patients were hospitalised. Baseline PTA (4 tone average over 0.5, 1, 2 and 3 kHz): combination - 80.7(22.8); oral - 76.3(27.2) Baseline SDS: combination - 29.7(20.96); oral - 43.3(30.7)% Duration from onset: combination - 4.7(4.0); oral - 5.14(3.52)
Indirectness of population	No indirectness
Interventions	(n=39) Intervention 1: Oral steroid (1 mg/kg of oral methylprednisolone and 10 mg taper every 3 days) Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=40) Intervention 2: Steroid + steroid - Prednisolone + dexamethasone. IT methylprednisolone was administered as in the control arm. Additionally, all patients were hospitalised for 1 week, and all were treated with a 14-day course of oral steroid (1 mg/kg of oral methylprednisolone and 10 mg taper every 3 days). Duration 14 days. Concurrent medication/care: Patients received proton pump inhibitors for gastrointestinal protection, and patients were instructed to avoid a diet with salt. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic 3. Specific drug within class: See intervention
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE + METHYLPREDNISOLONE versus PREDNISOLONE (ORAL)

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Complications at 4 weeks; Three patients complained of vertigo immediately after injection, and all of these patients recovered after 2 hours of rest. Otalgia occurred in 5 patients after injection, which was relieved after 1 hour. No case of residual tympanic membrane perforation and otitis media was noted. No long-term complications resulted from either oral steroid or intratympanic steroid in any of the patients.;

Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3, Reason: Lost to follow-up; Group 2 Number missing: 3, Reason: Lost to follow-up

Protocol outcome 2: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (averages over 0.5, 1, 2 and 3 kHz) at 2 weeks; Group 1: mean 41.2 dB (SD 18.35); n=37, Group 2: mean 24.5 dB (SD 16.27); n=36
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3, Reason: Lost to follow-up; Group 2 Number missing: 3, Reason: Lost to follow-up
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (averages over 0.5, 1, 2 and 3 kHz) at 4 weeks; Group 1: mean 44.05 dB (SD 21.53); n=37, Group 2: mean 25.72 dB (SD 19.77); n=36
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3, Reason: Lost to follow-up; Group 2 Number missing: 3, Reason: Lost to follow-up
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery (final threshold more than 25 dB) at 4 weeks; Group 1: 14/37, Group 2: 10/36
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3, Reason: Lost to follow-up; Group 2 Number missing: 3, Reason: Lost to follow-up

Protocol outcome 3: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score improvement at 2 weeks; Group 1: mean 36.21 % (SD 20.06); n=37, Group 2: mean 19.85 % (SD 16.4); n=36
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3, Reason: Lost to follow-up; Group 2 Number missing: 3, Reason: Lost to follow-up
- Actual outcome for Treatment-naïve patients at first presentation: Speech discrimination score improvement at 4 weeks; Group 1: mean 41.08 % (SD 21.98); n=37, Group 2: mean 20.06 % (SD 22.69); n=36
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3, Reason: Lost to follow-up; Group 2 Number missing: 3, Reason: Lost to follow-up

Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life

Study	Khorsandi Ashtiani 2012[267]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=63)
Countries and setting	Conducted in Iran; Setting: Tehran University of Medical Sciences Hospital
Line of therapy	First-line
Duration of study	Intervention time: 10 days
Method of assessment of guideline condition	Method of assessment /diagnosis not stated: "SSNHL is most commonly defined as sensorineural hearing loss of 30 dB or greater over at least three contiguous audiometric frequencies occurring within a 72-hr period."
Stratum	Overall
Subgroup analysis within study	Not applicable:
Inclusion criteria	Patients with idiopathic unilateral SSNHL who were referred to hospital during the first 10 days following the onset of symptoms
Exclusion criteria	Not stated
Recruitment/selection of patients	Unclear
Age, gender and ethnicity	Age - Mean (range): 50 (20-70). Gender (M:F): 17/28. Ethnicity: Not stated
Further population details	1. Bilateral SSNHL: Unilateral
Extra comments	Baseline PTA

	oral [q.d] + IT: 55(8.38); oral [q.a.d.] + IT: 60.33(9.43); oral: 60.47(7.26) Baseline SDS oral [q.d] + IT: 79.33(18.77); oral [q.a.d.] + IT: 80.64(10.42); oral: 72.76(8.50) Baseline speech reception threshold oral [q.d] + IT: 17.09(65.71); oral [q.a.d.] + IT: 12.55(70.66); oral: 10.29(66.76).
Indirectness of population	No indirectness
Interventions	(n=21) Intervention 1: Steroid + steroid - Prednisolone + dexamethasone. Oral prednisolone 1 mg/kg every day for 10 days plus intratympanic dexamethasone 2 mg for the first 3 days. Duration 10 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration: Systemic + transtympanic 3. Specific drug within class: See intervention (n=21) Intervention 2: Steroid + steroid - Prednisolone + dexamethasone. Oral prednisolone 1mg/kg every other day for 10 days with the addition of intratympanic dexamethasone 2 mg for the first 3 treatments. Duration 10 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration: Systemic + transtympanic 3. Specific drug within class: See intervention (n=21) Intervention 3: Steroids - Prednisolone. Oral prednisolone 1 mg/kg alone for 10 days. Duration 10 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration: Systemic 3. Specific drug within class: See intervention
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE + DEXAMETHASONE versus PREDNISOLONE Protocol outcome 1: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (frequencies not defined) at 10 days; Group 1: mean 41.42 dB (SD	

4.01); n=14, Group 2: mean 25.88 dB (SD 5.09); n=16
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 7, Reason: Non-medical reasons; Group 2 Number missing: 5, Reason: Non-medical reasons

Protocol outcome 2: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Change in SDS at 10 days; Group 1: mean 19.33 % (SD 9.91); n=14, Group 2: mean 18.3 % (SD 3.5); n=16
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 7, Reason: Non-medical reasons; Group 2 Number missing: 5, Reason: Non-medical reasons

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE QAD + DEXAMETHASONE versus PREDNISOLONE

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (frequencies not defined) at 10 days; Group 1: mean 28.33 dB (SD 1.02); n=15, Group 2: mean 25.88 dB (SD 5.09); n=16
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 6, Reason: Non-medical reasons; Group 2 Number missing: 5, Reason: Non-medical reasons

Protocol outcome 2: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Change in SDS at 10 days; Group 1: mean 11.01 % (SD 0.98); n=15, Group 2: mean 18.3 % (SD 3.5); n=16
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - High, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 6, Reason: Non-medical reasons; Group 2 Number missing: 5, Reason: Non-medical reasons

Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Adverse events

Study (subsidiary papers)	**Lim 2013[329] (Lim 2013[328])**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=60)
Countries and setting	Conducted in South Korea; Setting: Out-patient department
Line of therapy	First-line
Duration of study	Intervention + follow-up: 10 days (follow-up at day 17 or 21)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Acute onset of hearing loss >30 dB in 3 consecutive frequencies within 3 days
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Acute onset of hearing loss greater than 30 dB in 3 consecutive frequencies occurring within 3 days.
Exclusion criteria	History of acoustic trauma, barotrauma, Ménière's disease, tumour, or other serious disease
Recruitment/selection of patients	Prospective
Age, gender and ethnicity	Age - Mean (SD): Oral - 51.3 (14.4); IT - 53.3(15.3), oral + IT - 47.8(14.2). Gender (M:F): 31/29. Ethnicity:
Further population details	1. Bilateral SSNHL: Unilateral
Extra comments	Routine tests included history taking, physical examination, pure-tone audiometry, serologic tests, autoimmune tests, and inner ear magnetic resonance imaging. Time from onset to treatment: oral - 5.4 (3.1), IT - 10.1(8.1), oral + IT - 9.6(7.5) days

	Baseline PTA: oral - 57.8 (28.5), IT - 58.9(31.2), oral + IT - 56.8(28.3) dB. Participants were advised to adopt a low-salt diet, cease smoking, and refrain from drinking.
Indirectness of population	No indirectness
Interventions	(n=20) Intervention 1: Steroids - Prednisolone (oral). Prednisolone (Solondo; Yuhan, Seoul, Korea) for 10 days. 60 mg/d for 5 days, 40 mg/d for 2 days, 20 mg/d for 2 days, and 10 mg/d for 1 day. Duration 10 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic 3. Specific drug within class: See intervention (n=20) Intervention 2: Steroids - Dexamethasone (betamethasone) (transtympanic). IT dexamethasone procedure twice a week for 2 weeks, for a total of 4 times on days 0, 3, 7 and 10. Initially conducted immediately at the time of enrolment and only in patients with intact eardrums. Local anaesthesia was applied into the external auditory canal with a 10% lidocaine pump spray (Xylocaine, 10 mg/dose; AstraZeneca Korea, Seoul, Korea) with the patient in the supine position. Two perforations (1 puncture for ventilation and the other for injection) in the anterosuperior quadrant of eardrums with a 25-gauge needle under microscopic guidance. Dexamethasone (dexamethasone disodium phosphate, 5 mg/mL, 0.3-0.4 mL; Il Sung Pharm, Seoul, Korea) was instilled through the injection site. Each patient was instructed to avoid swallowing, to refrain from head motion during the procedure, and to keep his or her healthy ear pointed down during the 30-minute procedure. The procedure was done twice weekly for 2 consecutive weeks. Duration 10 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention (n=20) Intervention 3: Steroid + steroid - Prednisolone + dexamethasone. IT dexamethasone procedure while simultaneously taking oral prednisolone for 10 days. Duration 10 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic + transtympanic 3. Specific drug within class: See intervention
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: DEXAMETHASONE (BETAMETHASONE) (TRANSTYMPANIC) versus PREDNISOLONE (ORAL)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery: return to within 10 dB of the unaffected ear and WRS to within 5-10% of unaffected ear. (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz. at 17-21 days; Group 1: 3/20, Group 2: 6/20
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz) at 21 days;
Risk of bias: All domain - ; Indirectness of outcome: No indirectness
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz) at 17-21 days;
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz) at 21 days; Group 1: mean 12.1 dB (SD 14.6); n=20, Group 2: mean 18.7 dB (SD 19.1); n=20
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - ; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE + DEXAMETHASONE versus PREDNISOLONE (ORAL)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery: return to within 10 dB of the unaffected ear and WRS to within 5-10% of unaffected ear. (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz. at 17-21 days; Group 1: 8/20, Group 2: 6/20
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz) at 17-21 days; Group 1: mean 21.9 dB (SD 26.2); n=20, Group 2: mean 18.7 dB (SD 19.1); n=20
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:

<table>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE + DEXAMETHASONE versus DEXAMETHASONE (BETAMETHASONE) (TRANSTYMPANIC)

Protocol outcome 1: Pure tone audiometry
- Actual outcome for Treatment-naïve patients at first presentation: Complete recovery: return to within 10 dB of the unaffected ear and WRS to within 5-10% of unaffected ear. (PTA calculated across 4 frequencies: 0.5, 1, 2 and 3 kHz. at 21 days; Group 1: mean 21.9 dB (SD 26.2); n=20, Group 2: mean 12.1 dB (SD 14.6); n=20
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Speech discrimination ; Hearing-specific health-related quality of life ; Adverse events</td></tr>
</table>

Study (subsidiary papers)	**Sudden hearing loss clinical trial (NCT00097448) trial: Rauch 2011[472] (Halpin 2012[212])**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=250)
Countries and setting	Conducted in Canada, USA; Setting: 16 academic and community based otology referral practices.
Line of therapy	First-line
Duration of study	Intervention + follow-up: 2 weeks (6 months)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: SSNHL that developed within 72 hours and was present for 14 days or less. Pure tone average (PTA), calculated as the arithmetic mean of the hearing thresholds at 0.5, 1, 2, and 4 kHz in the affected ear, must have been 50 dB or higher, and the affected ear must have been at least 30 dB worse than the contralateral ear in at least 1 of the 4 PTA frequencies.
Stratum	Treatment-naïve patients at first presentation: 45.6% were treatment naive, 54.4% had received oral steroids for <10days
Subgroup analysis within study	Not stratified but pre-specified: Steroid naive versus exposed
Inclusion criteria	Age of at least 18 years and a unilateral sensorineural hearing loss that developed within 72 hours and was present for 14 days or less. Pure tone average (PTA), mean of the hearing thresholds at 0.5, 1, 2, and 4 kHz in the affected ear, 50 dB or higher, and affected ear at least 30 dB worse than the contralateral ear in at least 1 of the 4 PTA frequencies. To the best of the participant's knowledge, hearing must have been symmetric prior to onset of sensorineural hearing loss. Hearing loss deemed idiopathic following a suitable otolaryngologic evaluation, including medical and otologic history and extensive systems review, head and neck and otologic and neurotologic physical examination, audiometry, and imaging to rule-out structural or retrocochlear pathology, such as vestibular schwannoma, stroke, or demyelinating disease
Exclusion criteria	Otologic exclusion criteria included a previous history of hearing loss in either ear, history of fluctuating

	hearing or Meniere disease, history of chronic inflammatory or suppurative ear disease or cholesteatoma, history of otosclerosis, prior ear surgery of any kind (except ventilating tubes), hearing asymmetry prior to onset, congenital hearing loss, physical trauma or barotrauma to the ear immediately preceding hearing loss, history of luetic deafness, history of genetic hearing loss with strong family history, or craniofacial or temporal bone malformations revealed by computed tomographic scanning. Systemic exclusion criteria included history of tuberculosis or prophylactic therapy for positive purified protein derivative skin test, insulin-dependent diabetes mellitus, rheumatic disease, active atherosclerotic vascular disease, serious psychiatric disease, prior treatment with chemotherapy agents or other immunosuppressive drugs, pancreatitis, known human immunodeficiency virus, hepatitis C or B infection, chronic renal insufficiency, alcohol abuse, active herpes zoster infection, severe osteoporosis, general anaesthesia within 4 weeks of hearing loss onset, history of head and neck cancer, or history of radiation therapy.
Recruitment/selection of patients	December 2004-October 2009.
Age, gender and ethnicity	Age - Mean (SD): 50 years. Gender (M:F): 3:2. Ethnicity:
Further population details	1. Bilateral SSNHL: Unilateral
Extra comments	Mean days from onset of HL to study entry: oral - 6.7 (6.1-7.4); IT - 7.0 (6.4-7.6). Mean baseline PTA in affected ear: 86.6 (84.0-89.1) dB. Mean baseline word recognition in affected ear: 15.0 (12.3-17.6)%. Pre-enrolment steroid usage of less than 10 days was acceptable as long as audiometric criteria were met on the day of enrolment.
Indirectness of population	No indirectness
Interventions	(n=130) Intervention 1: Steroids - Prednisolone (transtympanic). Four 1-mL doses of 40 mg/mL of methylprednisolone over 2 weeks, with a dose given every 3 to 4 days by injection through the tympanic membrane into the middle ear by an otolaryngologist using an operating microscope. Anaesthesia was obtained with topical phenol. Patients were positioned supine with the affected ear slightly up and remained in this position for 30 minutes after the injection. They were instructed to keep water out of the treated ear for the duration of treatment. Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness

<table>
<tr><td></td><td>Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention

(n=125) Intervention 2: Steroids - Prednisolone (oral). Oral prednisolone 60 mg/d for 14 days, followed by a 5-day taper (50 mg, 40 mg, 30 mg, 20 mg, and to 10 mg). Duration 19 days . Concurrent medication/care: Not stated. Indirectness: No indirectness
Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic 3. Specific drug within class: See intervention</td></tr>
<tr><td>Funding</td><td>Academic or government funding (National Institute on Deafness and Communication Disorders)</td></tr>
<tr><td colspan="2">RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (TRANSTYMPANIC) versus PREDNISOLONE (ORAL)

Protocol outcome 1: Adverse events
- Actual outcome for Treatment-naïve patients at first presentation: Treatment-related serious adverse events at 2 months; Group 1: 0/129, Group 2: 1/121; Comments: Of 11 serious adverse events reported (5 in oral and 6 in IT group), 1 was thought to be study related. This was a case of hyponatraemia from worsening of pre-existent mild renal insufficiency in a patient with type 2 diabetes.
Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13, Reason: Contact lost, withdrawal of consent, missed visit; Group 2 Number missing: 7, Reason: Contact lost, withdrawal of consent, missed visit
- Actual outcome for Treatment-naïve patients at first presentation: Patients reporting any adverse event at 6 months; Group 1: 116/129, Group 2: 106/121
Risk of bias: All domain - Low, Selection - Low, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 22, Reason: Contact lost, withdrawal of consent; Group 2 Number missing: 20, Reason: Contact lost, withdrawal of consent
- Actual outcome for Treatment-naïve patients at first presentation: Tympanic membrane perforation at 2 months; Group 1: 5/129, Group 2: 0/121
Risk of bias: All domain - High, Selection - Low, Blinding - Low, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13, Reason: Contact lost, withdrawal of consent, missed visit; Group 2 Number missing: 7, Reason: Contact lost, withdrawal of consent, missed visit

Protocol outcome 2: Pure tone audiometry</td></tr>
</table>

<table>
<tr><td colspan="2">- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (mean threshold across 0.5, 1, 2 and 4 kHz) at 2 months; Group 1: mean 28.7 dB (SD 18.545); n=129, Group 2: mean 30.7 dB (SD 18.545); n=121; Comments: Not differences in findings among those with and without prior steroid use
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13, Reason: Contact lost, withdrawal of consent, missed visit; Group 2 Number missing: 7, Reason: Contact lost, withdrawal of consent, missed visit
- Actual outcome for Treatment-naïve patients at first presentation: Change in PTA (mean threshold across 0.5, 1, 2 and 4 kHz) at 6 months; Group 1: mean 29.5 dB (SD 21.8125); n=129, Group 2: mean 31.7 dB (SD 21.6674); n=121
Risk of bias: All domain - Very high, Selection - Low, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 22, Reason: Contact lost, withdrawal of consent; Group 2 Number missing: 20, Reason: Contact lost, withdrawal of consent

Protocol outcome 3: Speech discrimination
- Actual outcome for Treatment-naïve patients at first presentation: Word recognition score - change from baseline at 2 months;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13, Reason: Contact lost, withdrawal of consent, missed visit; Group 2 Number missing: 7, Reason: Contact lost, withdrawal of consent, missed visit
- Actual outcome for Treatment-naïve patients at first presentation: Word recognition score - change from baseline at 6 months; Group 1: mean 35.3 % (SD 34.4407); n=129, Group 2: mean 35.9 % (SD 35.5568); n=121
Risk of bias: All domain - Very high, Selection - Low, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 22, Reason: Contact lost, withdrawal of consent; Group 2 Number missing: 20, Reason: Contact lost, withdrawal of consent</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Health-related quality of life ; Hearing-specific health-related quality of life</td></tr>
</table>

Study	Swachia 2016[534]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=42)
Countries and setting	Conducted in India; Setting: Out-patient department
Line of therapy	First-line
Duration of study	Intervention + follow-up: 2 weeks (2 months)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: NIDCD criteria: Subjective sensation of hearing impairment in one or both ears developing within 72 hours and a decrease in hearing of more than or equal to 30 decibels (dB), on 3 consecutive frequency in comparison to normal ear on audiometry
Stratum	Treatment-naïve patients at first presentation
Subgroup analysis within study	Not applicable
Inclusion criteria	Age 18-65 reporting SSNHL who met NIDCD criteria.
Exclusion criteria	Presenting 14 days after onset of hearing loss; prior history of ear disease, history of noise-induced trauma; congenital hearing loss; pregnant woman; contraindication to steroids; history of head and neck cancer; undergone radiotherapy
Recruitment/selection of patients	Unclear
Age, gender and ethnicity	Age - Mean (SD): 44.3 years. Gender (M:F): 61.9/38.1%. Ethnicity: Not stated
Further population details	1. Bilateral SSNHL: Unilateral (Majority (83%) unilateral).

Extra comments	. Complete history taking was undertaken with focus on mode of onset and duration and progression of hearing loss, along with history of associated symptoms such as aural fullness and tinnitus. Patients had a general physical exam and complete ENT exam. Impedance audiometry was performed to rule out any inner ear pathology
Indirectness of population	No indirectness
Interventions	(n=22) Intervention 1: Steroids - Prednisolone (oral). 1mg/kg body weight for first 10 days; 0.5mg/kg days 11-12; 0.25mg/kg days 13-14. Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Systemic 3. Specific drug within class: See intervention (n=20) Intervention 2: Steroids - Prednisolone (transtympanic). Intratympanic methylprednisolone 1ml of 40mg/ml solution injected into the middle ear cavity twice a week for 2 consecutive weeks. The patient was required to lie in a supine position with the head tilted 45 away from the affected ear. The external ear canal was rinsed with povidine iodine solution and a sterile cotton pledget soaked in 4% xylocaine solution was placed in the external auditory canal. After injection the patient was turned to one side with the injected ear on the top and required to lie as such for 30 minutes, during which time they were advised not to swallow or try to pop the ear. Duration 14 days. Concurrent medication/care: Not stated. Indirectness: No indirectness Further details: 1. Rehabilitation as adjunct to medical treatment: Not applicable 2. Route of administration : Transtympanic 3. Specific drug within class: See intervention
Funding	No funding
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PREDNISOLONE (TRANSTYMPANIC) versus PREDNISOLONE (ORAL) Protocol outcome 1: Adverse events - Actual outcome for Treatment-naïve patients at first presentation: Adverse events at 60 days; Group 1: 7/20, Group 2: 5/22; Comments: Oral group: puffiness of face, mouth ulcers, increased appetite, diarrhoea and dizziness. IT group: severe ear pain, mild pain, ringing in ear, dizziness Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low,	

Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Pure tone audiometry - Actual outcome for Treatment-naïve patients at first presentation: Change in PTA threshold average over 4 frequencies (0.5, 1, 2 and 4 kHz) at 60 days; Group 1: mean 14.68 dB (SD 12.88); n=20, Group 2: mean 18.24 dB (SD 8.72); n=22 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Treatment-naïve patients at first presentation: Complete recovery: final 4-frequency PTA of ≤25 dB at 60 days; Group 1: 5/20, Group 2: 4/22 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: - Actual outcome for Treatment-naïve patients at first presentation: Complete recovery or marked improvement: final 4-frequency PTA of ≤25 dB or PTA improvement >30 dB at 60 days; Group 1: 8/20, Group 2: 5/22 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Health-related quality of life ; Hearing-specific health-related quality of life ; Speech discrimination

42 H.8 Information and advice

Study	Aguayo 2001[7]
Aim	To explore the psychological and social effects of becoming deaf as an adolescent or adult and the adequacy of rehabilitation services "general sense the inadequacy of the rehabilitative system for this condition… literature lacks in-depth accounts from deafened adults about the psychological and social effect of acquired deafness. This study addresses both of these issues."

Study	Aguayo 2001[7]
Population	n=8 (out of 10 respondents were included) 50% female. All white. Residence: major city n=4, medium sized city n=2, rural n=2, mean age 49 years (range 31-68 years). Mean age at the onset of hearing loss 32 years (13-40 years), mean number of years with a hearing loss 17 years (range 2-39). Causes of deafness: medical n=2, surgical n=3, progressive idiopathic n=3. Gradual decline of hearing n=4, rapid n=1, sudden deafness n=3 (removal of auditory nerve)
Setting	Unclear
Study design	Qualitative interviews
Methods and analysis	Recruitment: a request for volunteers mailed to 25 Ontario residents who subscribed to a newsletter written for deafened people in Canada Purposive sampling: cause of deafness, age at onset, present age, gender, and geographical location (rural/urban) In-depth interviews, semi-structured open ended questions. Interview schedule was based on literature review and first author's experience of being deafened, pretested with a late deafened adult. First author conducted all the interviews. n=5 interviewed in person with the help of computer assisted real time translation (CART) stenography. n=2 via email exchanges over a period of weeks (remote geographical location). n=1 conducted by telephone (telecommunication device for the deaf, which generated a visual display of questions and answers on a computer. Converted verbal dialogue into typed text; allowed respondents to read the interviewer's questions and produced transcript. Interviewer also fluent in ASL (but participants had low level of sign language skills). Interview approx. 2hrs. Analysis: "general process of qualitative analysis used in this study was adapted from Lincoln and Guba (1985)". Transcribed. 1st author analysed. Reviewed transcripts number of times. Data broken down into units, coded as themes and sorted into categories of themes.
Findings	Psychological and Social effects of Becoming Deaf: Three themes
	Emotional trauma: Anxiety, grief, mourning, inadequacy, self-doubt, uncertainty about the future, embarrassment and shame
	Oppression, Exclusion and Isolation within the family: mixed experiences; significant communication difficulties, isolation within the family, felt excluded from family interaction, magnitude of hearing loss minimised or ignored outright, discrimination, oppressed or abused by some family members, concealment, one participant had an understanding/supportive family.
	General oppression, exclusion and social isolation: social isolation, discrimination, issues at work (discrimination), school (taunt/ridicule), many learned to conceal their deafness
	Experiences with Rehabilitative Services: Two themes
	Exclusive Medical Orientation and Revolving Door in Rehabilitative Services: 36 healthcare providers (medical/paraprofessional/ GPs, ENT specialists, audiologists, neurologists, hearing aid dispenser, occupational therapist, military hearing examiner). No mental health professionals involved to help address psychosocial needs. Multiplicity of stages of treatment/ professionals involved- image of ineffective revolving door of services
	Dissatisfaction with Rehabilitation Services: many expressed dissatisfaction (competence of the medical professionals, shortcomings in professional

Study	**Aguayo 2001**[7]
	knowledge and skill including the inability to provide correct diagnoses and the lack of knowledge about appropriate services and resources… poor professional manner, interpersonal sensitivity, lack of attention to the emotional, psychological and social effects of deafness. Some had more positive experiences, but overall sense of inadequacy of rehabilitation services.
	Authors conclusions: Rehabilitation often consists exclusively of medically orientated services and that counselling for psychosocial needs of the individual are overlooked Complaints about inadequate training and knowledge, insensitivity of professionals to the psychosocial aspects Advocating for formal and informal interventions (for individual/family and groups) Suggestion of the input from a social worker (grief counselling, link to peer groups, engage family/ act as mediator, broker of resources/information Need for medical professionals to be better informed about the traumatic effects of adventitious deafness
Limitations and applicability of evidence	Includes patients with child onset deafness, surgical causes of deafness (n=3) No description of ethics approval Context not clearly described Author carries out all parts of the study (bias not discussed) Data analysis does not appear to be rigorous Overall limitations: Severe

Study	**Barlow 2007**[45]
Aim	To examine the views of people with experience of late deafness living in the UK. Particular interest in participants' in depth experiences of attending the LINK Intensive Rehabilitation programme and the experience of late deafness on emotions, family relationships, and employment given the prominence of these themes in the established literature.
Population	Convenience sample of 9 participants, recruited via the LINK centre. They had attended the LINK rehabilitation course and were recruited as part of a larger study which investigated their experiences of delivering a deafened version of the Expert Patient Programme (Challenging Deafness), a self-management programme (part of NHS's commitment to people with long term conditions). The 9 participants were the tutors of the Challenging Deafness course. 1 tutor did not respond to the interview requests so the study population was 8 participants. Male n=6. Age range 33-60 years.
Setting	UK, 5 interviews were conducted in the University and there were conducted in participants' homes.
Study design	Not specifically stated.

Study	**Barlow 2007**[45]
Methods and analysis	Face to face semi-structured interviews (interview schedule specifically designed for the study). Flexible interview schedule One author conducted all the interviews (training given on basic communication, body language and deaf awareness skills, provided by LINK) Interview set up: optimum condition for lip reading, attention to clothing and perfume (so not to distract from the face), interviewer sat appropriately to maximise communication, spoke clearly, took regular breaks (lip reading can be tiring), personal lip pattern familiarization If a question was not understood: repeated, rephrased, then if necessary, written down. Framework analysis (as specific issues being addressed, some themes generated a priori, but allows other themes to emerge) Repeated readings, thematic framework. 2 researchers independently analysed the transcripts, random sample analysed by a third researcher. Consistent themes identified. Coding, data chart according to the 5 themes that were referenced in existing literature. Phenomenological approach Copy of results mailed to participants, confirmed interpretation, adding to validity.
Findings	Emotional impact of hearing loss: 7 participants- overwhelming and pervasive impact of late deafness on their lives. One participant described the loss as ‘something similar to a bereavement’. Range of negative emotions at the initial and early stages of deafness including anger, frustration, aggression, clinical depression and suicidal thoughts. 1 participant had attempted suicide. Common reactions: loss of confidence, low sense of self-worth, bewilderment, denial and lack of acceptance. One participant began to have panic attacks; she attributed to fear of being ridiculed or humiliated. Perceived lack of intelligence by others. The authors found that those who had sudden loss of hearing over a short time period, struggled most accepting being deaf. One exception, former marine who had previously learnt to lip read whilst working in a noisy environment. Was referred to LINK programme 2 weeks after becoming deafened and he found it relatively easy to adjust. Anger tended to be internalised, leading to feelings of depression and influencing interactions with other people. Lack of patience with themselves and others leading to frustration, laboured conversation, as each person struggled to understand what the other person was saying. Some did not like what they had become, lost sense of self. Physical and emotional isolation- nearly all participants. Participants felt between worlds: they did not belong in the hearing world or the prelingually deaf world, deafness robbed them of their identity. “You don’t realize how isolated you’re going to be before you lose all your hearing. Being hard of hearing is one thing, but being completely deafened is a different ball game all together. So that said, you’re not in the hearing world, you’re not in the deaf world with a capital D, where they’re signing because you don’t know their culture.”
	Impact on family and social networks/relationships: Exacerbation of negative effects/ loss of confidence when family/friends/employers were unable/unwilling to provide emotional and practical support. Upsetting to feel ignored, albeit sometimes inadvertently by family/friends/ shop assistants/ general public, to avoid ‘awkward’ or ‘embarrassing’ encounters. Issues cooking/hearing microwave ‘pings’, running taps unheard.

Study	**Barlow 2007**[45]
	Impact on employment: Many had to give up work because of the deafness but were reluctant to do so. Some felt that they could have continued if communication support was implemented e.g. flashing light system to indicate when customers enter a shop. One participant- left out of meetings, work colleagues reluctant to acknowledge the deafness and communicate accordingly (one person speak at a time/ speaking directly). Perceived threat to social identity losing employment, anger and anxiousness about financial provision for family.
	Contact with health and social care professionals: Experiences varied considerably, focus on the nature of their contact with health and social care professionals rather than treatment per se. 3 participants: dissatisfied with care, felt healthcare professionals lacked knowledge and sensitivity. 1 participant found they tended to raise their voices and/or shout to make themselves heard in consultations. Lack of confidentiality regarding personal data (n=1), receptionist shouting out personal information.
	Provision of peer support and training through LINK's Intensive Rehabilitation Programme: 6 day course- found by all to be instrumental in assisting them coming to terms with being deaf and managing the problems associated with the hearing loss. Course designed for and delivered by deafened adults. Sharing of experiences.
	Implications of the research: "Even in the absence of severe, clinical , mental health problems, newly deafened people should be immediately referred to supportive organizations for appropriate psychosocial practical support".
Limitations and applicability of evidence	Applicability issues: convenience sample of the LINK course tutors. Talk more openly than other people with hearing loss. Focussed on 5 specific areas, framework analysis (no information given if any other experiences outside these topics were found) Overall limitations: Minor

Study	**Bennion 2011**[54]
Aim	The study aims to explore, and develop a greater understanding of the experience of living with age-related hearing impairment from the perspectives of older people themselves to highlight possible recommendations for the improvement of hearing aid (HA) services and rehabilitation.
Population	Older people, fluent in English with self-reported hearing impairment. All participants used hearing aids in their everyday lives. n=9; Male 33.3%, Female 66.6%, aged between 61-93 years. Average length of time living with HI was approx. 12 years. 8 participants had NHS digital hearing aids, 1 private digital.
Setting	UK, Recruitment was achieved via the use of notice boards and announcements at local HI groups and a local support service.
Study design	Qualitative
Methods and analysis	Descriptive qualitative method in the form of descriptive thematic analysis. Findings are reported from semi structured interviews. Interview transcripts were analysed using descriptive thematic analysis (Braun & Clarke, 2006).

Study	Bennion 2011[54]
	Initial analysis was done by hand, transcripts read several times, important themes and ideas underlined and annotated in margins as codes. Codes tabulated to structure analysis by theme. Process repeated for each transcript, overall summary table and theme diagram produced. At all times, the analysis was compared with the entire data set, and quotations were used to illustrate themes to ensure that the analysis was grounded in the data.
Findings	The loss itself: All progressive. Others being aware of the hearing loss first. Not realising how hearing had deteriorated until given HAs to assist them. Viewed as a common and natural part of aging. Few saw themselves as 'deaf' and believed severe or total deafness would be much worse.
	Communication: Difficulties with crowds and groups (even with use of a HA), one to one conversations, and the impact it had on the individual. Embarrassment as a frequent reaction to miscommunication. Clear speaking was highlighted as a barrier, accents were also a problem. Diagnosis and communication with doctors and medical staff: misunderstanding around medical information 'they tested my ears, and she says 'yes I think they are closing up slowly', and that I would benefit by a hearing aid, because I knew I wasn't that deaf, but it was going slowly you see?'. Frustration with those around them and not being able to hear: 'If just one person talks, not just one person talking, the whole room are going at it, well you can't hear what that one person said, because I can't , I said 'what did you say my duck?' they said 'have you got the hearing aid in?' I said 'yes', they said 'have you got it on?' I said 'yes' they said 'well why can't you hear me?' I said 'look' I said' can you hear anybody with a hearing aid when they are all shouting?' no there are a lot of them in that place [day care centre] you know? And they all talk at once'. Acknowledge frustration of others when ask to repeat what they said a few times.
	Using Hearing Aids: Almost all found digital HAs preferable. Majority used their HA day to day. One young participant found the volume of the HA 'torture' and frequently chose not to wear it during the day. Highlighted maintenance issues: changing battery, dampness in the bit in your ear. Cosmetic factors: 'When I go have my hair cut I'll tell him leave it so long so that it just covers the hearing aids, because with having two in I don't like the idea of showing them all the time'.
	Isolating factors: Difficulties hearing speech on some TV programmes. Use of subtitles. Inability to hear household sounds such as the door bell, missing visitors at the door, hearing the telephone ringing. Hobbies: theatre – difficulty in hearing, one participant stopped attending as the solution to the problem. Use of the 'loop system' as a potential way to limit the problems with this. Some had not experienced the loop system. Physical dangers- car parks and crossing the roads.
	Coping strategies: Passive (compared their experiences to others worse off, withdrawal, not taking part in activities, or choosing not to do anything at all) and active (speaking out that they could not hear, lip reading (some were unaware they were doing it), positioning of the person so that they can hear them more clearly) methods.
	Implications of the research: Lack of societal understanding: education of the general public and medical/nursing staff, implementation of the loop system in more places, Strategies to reduce the stigma of the HA (early detection, regular screening for HI built into routine healthcare appointments, increase the uptake of HAs and support services and reduce the negative impact of HI), nurse-led pre- and post-issue interventions aiming to provide counselling and support to HA patients Education and provision of information about the causes of HI/ address misunderstandings between healthcare providers and patients

Study	**Bennion 2011**[54]
Limitations and applicability of evidence	Unclear setting of the interviews, who the interviewers were/ their background, who carried out the analysis. Although the findings lead to the suggestions for improvements in the hearing impairment service provision, the participants were not asked directly what they think would improve hearing aid services and rehabilitation. Recommendations may not be universal as the study was restricted to the older population with hearing impairment rather than complete hearing loss. Applicable as based in the UK, however the information, support and advice needs of patients with hearing loss given are 2nd order evidence (authors/researchers views and interpretations of the participant's views) Overall: Moderate limitations

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Study	**Claesen 2012**[104]
Aim	Pilot study using qualitative methods to learn about the psycho-social needs of people who seek help with hearing loss
Population	Adults, referred to the audiology department of Salisbury District Hospital by their GPs because of hearing difficulties. First 100 new cases, >50 years old, were send a consent form and participation information sheet. Purposefully selected to provide a rich contrast amongst the sample. Classed as a diverse population due to variations in age, background, working history, gender and the social activities they undertook. n=6, 50% male, 50% female, age range 65-77 (66,77, 77, 76, 66,65) years, all were married, n=4 had children, n=1 had grandchildren. n=4 retired (doctor, consultant surgeon, manual worker, waitress), n=2 working (part time non-manual occupation, administration part time worker)
Setting	UK, Home based
Study design	Qualitative
Methods and analysis	Interviews: 'conversation with purpose', 1hr long at home at a time to suit Audiotaped, transcribed verbatim, anonymised tapes Analysed using thematic analysis Patients given the transcript and audiotape afterwards for records and reflection. They were telephone to check that they were happy with it (approx. 15 mins)
Findings	Symptom construction: Recognition of hearing problems as hearing loss (n=4), behaviour of others/ difficulty hearing particular voices but does not think he has a problem (n=1), health problem worsened over time (n=1). Others influence their perception (family members). Shared problem between affected individual and their communication partners.
	Help seeking: hoping for a medical solution to the hearing difficulties. Clear preference for a solution over a hearing aid.

Study	**Claesen 2012**[104]
	Hearing aids and stigma: Biggest themes, stigma of a hearing aid. Negative associations with ageing and refer to distancing themselves from a hearing aid to preserve self-esteem and social identify. Potential gender differences in uptake of hearing aids. Secrecy of wearing a hearing aid/ denial of deafness/ being the only one in their social group with one.
	Responsibility for communication: Every patient: impact of hearing loss on those around them is what prompts them to seek help. Dimensions described: Feeling a lack of empathy from the people they were interacting with, a withdrawal from social situations and a feeling of being bothersome to others.
	Expectations: Hearing aid an option but undesirable. Social impact of a hearing aid- recurring theme: isolation embarrassment, blame and public incidents. Views range from pragmatic to resistant.
	Authors recommendations: Better information for patients, GPs and significant others regarding audiological and social services, lip reading classes, communication training and hearing aids. Those not prepared for a hearing aid: hearing therapy advice and counselling may be useful resources
Limitations and applicability of evidence	No description of researcher/experience relationship to the design of the study. Unclear interview content and structure ‘conversational’. No description of data saturation or how the themes emerged. Overall limitations: Severe

Study	**Detaille 2003**[138]
Aim	This study attempted to determine factors that help currently employed people with rheumatoid arthritis, diabetes mellitus or hearing loss to continue working
Population	n=69 participants of which n=25 with hearing loss Recruitment: patient records of the rheumatology, diabetes and audiology outpatients of the Academic Medical Center (AMC), Amsterdam and referrals from occupational physicians and patient associations. Arthritis consultant, diabetes consultant or audiologist screened the patients for illness inclusion, researcher for the age and work inclusion criteria. Inclusion criteria for those with hearing loss: having a moderate or severe HL; 40 to 80 dB mean loss at l, 2, and 4 kHz in the best ear, lack of any other chronic illness that may affect work, having a paid job and age between 21 and 60 years. 60 HL patients met the inclusion criteria. Patients were selected from the patient records of the AMC Audiological Center and had been referred by the Dutch Association of Hearing Loss Patients. 25 were selected at random from the 60. Purposeful sampling. Female 64%, Hearing loss first diagnosed; 0-2years ago 20%, 2-5 years 5%, >10 years ago 75%, mostly verbal communication 56%, mostly nonverbal communication 44%. Work situation after diagnosis; not changed 56%, fewer hours a week 20%, another job at same company 8%, type of job changed 16%. Mean age 49 (range 36-58) years.

Study	**Detaille 2003**[138]
Setting	Not described.
Study design	Qualitative study that used three concept mapping sessions
Methods and analysis	Concept mapping: to gather statements on the problems the participants experienced at work. This method can be used in groups to develop conceptual frameworks to guide planning and evaluation. 4 hour session with one facilitator. First asked to generate statements in a collective group session, focus question; 'What a person with hearing loss needs to be able to keep on working is…". Statements must not contain multiple messages or be bonded to time and place. Facilitator encouraged the participants to clarify unfamiliar terms or jargon and helped them to edit their statements if needed. Each statement was typed up and printed on card. Each participant received a stack of cards with the statements on asked to rate them on a Likert scale from 1 to 5 (1 lowest, 5 highest priority). Participants sorted the statements in a logical manner according to themes by forming clusters. Each participant recorded the results of the priority rating and the theme sorting of the statements on a special form, which were then entered onto a computer. Analysis: Mulitdimensional scaling analyses using Ariadne software. Two dimensional scale map formed with the individual scores as points. Statements frequently placed in the same theme or cluster were located closer to each other than those grouped together less often. They were then asked to name each cluster. Clusters were also compared between groups. Clusters with similar meanings across groups, were grouped together under thematic headings. Overall: 69 participants produced 172 statements, in 24 clusters. In the hearing loss group, 59 statements were generated in 9 clusters.
Findings	The top 5 statements for each cluster and their mean priority (1 is low, 5 is high)
	1. Knowledge of hearing aids and ways: Mean priority score 3.46. Awareness of the latest hearing aids and of ways to finance them
	2. Communication strategies: Mean priority score 3.19. Ability to tell colleagues of hearing loss and also what the limitations of hearing loss are. Communication strategies shared with others with hearing loss.
	3. Ability to cope and be assertive: Mean priority score 3.18. Acceptance of having hearing loss. Assertive enough to communicate with others, Determined and persistent enough to ask for the needed adaptations at work. Enough determination and courage to go on the job market. Sense of humour to cope with difficult situations.
	4. Support of occupational physicians. Mean priority score 3.12. Occupational physicians make the needed adaptations at work quickly. Occupational physicians have enough knowhow about hearing loss to coach well. One central place where people with hearing loss can go for incapacity benefits and financial aid. Only people with enough knowhow about hearing loss in charge of the facilities. Occupational physicians more specialised with hearing loss.
	5. Accessibility of hearing equipment. Mean priority score 3.10. Hearing device that can help communicate better with the surroundings. Additional communication devices besides the hearing device. Knowledge of the latest hearing equipment and also of ways to finance them. Good patient organization. Education courses accessible to him or her in terms of more visual material.
	6. Consideration from colleagues and management. Mean priority score 2.95. Quiet work environment. Colleagues who accept that he or she has hearing loss. Colleagues who know what it means to have hearing loss. Colleagues who take into consideration the limitations of an employee with

Study	Detaille 2003[138]
	hearing loss. Recognition that having hearing loss is very tiring.
	7. Acceptance by society. Mean priority score 2.76. Recognition that the use of a hearing device does not totally overcome the hearing loss. Job that is not tiring. Opportunity to exchange views with other people with hearing loss. Opportunity to follow courses more often than other employees in order to do his or her job well.
	8. Responsibility of the manager. Mean priority score 2.56. Possibility to claim the needed adaptations from the management directly. Management recognition and awareness that many people who have a handicap like hearing loss want to work. Use of a translator when talking to people in another language.
	9. Professionalization of suppliers. Suppliers of hearing aids that are less commercial.
	Authors conclusions: Generalised across the three chronic diseases, saying different patient groups gave the themes a different priority ranking. Due to small sample size, not generalizable. Each chronic disease has specific problems and difficulties at work. Healthcare setting in which patients receive treatment may have affected the prioritization.
Limitations and applicability of evidence	Unclear context (setting) Unclear role of the facilitator No reasoning given for using concept mapping. Unclear data richness Overall limitations: Severe

Study	Grenness 2014[201]
Aim	To define patient-centred care specific to audiological rehabilitation from the perspective of older adults who have owned hearing aids for at least one year
Population	Recruited: audiology clinics, general practice medical clinics, and hearing advocacy groups Inclusion: Adults (aged 60+) who had owned hearing aids for at least one years; participants did not need to be current hearing aid users Purposive sampling: age, gender, eligibility for Australian Federal Government subsidy of hearing services and self-reported ethnicity n=10, age 60-75 years n=6, >75 years n=4, 50% female, eligible for government subsidy 40%, ethnicity; Oceania and Antarctica 60%, Southern and Eastern Europe 30%, North West Europe 10%, highest level of completed education; lower than secondary school 10%, secondary school 30%, higher than secondary school 60%, hearing impairment in the better ear mild (≥25 and ≤40 dB HL) 20%, moderate (>40≤65 dB HL) 40%, severe (>65≤90 dB HL) 30%, profound (>90 dB HL) 10%, years owning a hearing aid mean 7.9, range 1-25 years, number of audiologists seen, mean 2.5,

Study	**Grenness 2014**[201]
	range 1-5.
Setting	Place of preference; home n=5, University of Melbourne n=5
Study design	Semi structured qualitative interviews
Methods and analysis	Interviews carried out by the first author, 40-60 minutes, audio recorded. Followed a topic guide; focus on participant's experience with audiological rehabilitation and their thoughts, feelings, and preferences about the nature of patient-centred audiological rehabilitation Individual in depth interviews were chosen to provide rich and personal data on the 'insider perspective' Transcribed verbatim. NVivo9 software used. Content analysis; content analysed within the interviews is defined by the research aim Identify and label meaning units, code assignment, grouping according to shared meaning into subcategories, further sorting into categories. 10 interviews: 975 meaning units, 237 codes. Led to 3 categories. Thematic interpretation. First author checked analysis against the original interview transcripts at multiple stages of analysis. 3 other authors reviewed the analytic process of condensation and abstraction and reviewed the thematic exploration of the data.
Findings	Overarching theme: individualised care- essential ingredient in ensuring that audiological rehabilitation was patient-centred for any given patient
	3 categories:
	Therapeutic relationship: heart of patient care; trust, loyalty. Contrast: some participants found audiologist untrustworthy due to the commercial arrangement they were often engaged in.
	Players (audiologist and patient): Interpersonal skills: communication and professionalism. Good communication: friendly, making the patient feel cared for and understood. Poor communication skills: audiologist did not appear to listen or value the patient's perspective. Knowledge that the audiologist's recommendations are not influenced by his or her own potential to benefit. Mixed experiences. Motivation to ask questions.
	Clinical processes: Amount of information wanted by the patients varied, but all reported having to ask for more information about why a particular hearing aid was right for them. Preference for a greater involvement in their audiological rehabilitation decisions than they had previously had. Time to involve their family in the decision-making process. Ability to trial different devices and having input into problem solving with hearing aids e.g. fin-tuning and repairs.
	Authors conclusions: • Individualised care: individual preferences for being informed and involved in clinical processes. Flexibility of rehabilitation • Therapeutic relationship: information exchange and decision-making/problem solving. Addressing patients individual experience and their emotional needs • Generally, patients in the present study wanted more information than they were given and preferred it to be easier to understand
Limitations and applicability of	Applicability to the UK Role of researcher: no reflection on risk of bias

Study	Grenness 2014[201]
evidence	No discussion of data saturation Overall limitations: Moderate

Study	Kelly 2013[263]
Aim	To explore older adults' perceptions of and experiences with new hearing aid use and to identify what they believed would enable them to successfully adjust to wearing a hearing aid
Population	At least 60 years old, any type of hearing loss, having no cognitive impairment, not having a terminal or life threatening illness and speaking English. Post questionnaire/ focus group population: Mean age 74.8 (SD7.9), n=14 men, n=17 women (total n=31). Age range 60-87 years. Self-selecting patients. Mean length of time they had been hard of hearing 16.7 years (SD 20.9), range 1-74 years. Approximately 50% had already been fitted with a hearing aid, some short others long term users.
Setting	Scotland, unclear setting of interviews and focus group discussions
Study design	Mixed methods: Four phases including quantitative and qualitative aspects
Methods and analysis	Four phases: Phase 1: Semi-structured key informant interviews with professionals providing services to older people with hearing difficulties. Purposive sample based on location of organization and sector. All people approached agreed to participate. Interviews assessed strengths and weaknesses of services currently offered, rehabilitation services. Audio recorded, field notes taken. Thematic analysis. Findings informed the survey in Phase 2. Phase 2: Survey of older people either on a waiting list for a hearing aid or already fitted with a hearing aid (long term users, first time users). Random sample from patient databases of audiology depts. (urban, remote and rural areas of Scotland). 1000 postal questionnaires, reminder letter and duplicate questionnaires sent at 1 month to non-respondents. Questionnaire varied slightly depending on if on waiting list or already had a hearing aid. Phase 3: Focus groups with older audiology out-patients. 8 groups. Survey respondents who were interested in participating in the focus groups were invited to attend. Semi structured: own hearing loss journey, helpful supports, adjustments to life with a HA, additional supports needed. Survey results presented/discussed. Phase 4: Confirmatory round of focus groups. Used to confirm findings and further explore a proposed group based approach to audiological rehabilitation. Flipchart used for qu/responses. Sessions audiotaped/transcribed and compared to recordings and flipcharts. Analysed independently by 2 researchers. Krippendorf's approach to content analysis used, pre-existing framework used (pre-/post-fitting needs: informational, support and practical help, issues around families and family involvement, hearing problems in general, thoughts concerning a group service and issues relating to ageing. Text also coded outside these themes. Coding compared and agreed.

Study	Kelly 2013[263]
Findings	Results from the focus groups:
	Needs prior to hearing aid fitting: lack of information about hearing aids and process of receiving audiological services. For example; differences between NHS and private dispensers (confusion on NHS provisions, pressure into buying by private dispensers, not enough information on hearing aid options), digital and analogue hearing aids, importance of understanding the causes of deafness and of having realistic expectations (thought their hearing would be normal again with a hearing aid and was disappointed)
	Needs after fitting: Experienced difficulties/ lacked basic information about wearing, maintaining and getting the most out the hearing aid e.g. coping with new sounds, managing controls, when to wear it (some were afraid that wearing it too much would reduce current level of hearing). Lack of information on environmental aids: assistive devices, loop systems (some knew about them but had not used them), telephones, doorbells, televisions, alarm clocks, safety devices (smoke detectors). Informational need on cleaning aid, dealing with condensation, getting it wet in rain, changing batteries. Overwhelming, not remembering information once they got home from the audiologist. Shock, discomfort, issues with high noise situation (e.g. stadiums)- avoidable situations had they received more information.
	Support post-fitting: Psychological, practical and problem solving needs e.g. follow-up, adjustment period help, hearing aid issues (whistling, noises, assembly, ear infections), interference from other electronic devices, coping with cosmetic worries, inserting aid/ battery changes, help coming to terms with hearing loss and wearing an aid, assertiveness and confidence. Expressed need for audiology clinic follow-up. Family involvement: some were the source of referral, hearing as cause of family tensions, barriers to family involvement including paternalistic treatment, not seen as a serious illness, family too busy. Consensus family should be given the chance to attend audiology appointment with the patient, and given written information.
	Authors conclusions: Need for further information on hearing loss and the use of hearing aids for older people and their families Increase in support (follow-up for those needing extra support), further research into rehabilitation support groups Suggestions of support: online support and information, peer mentoring, better designed information packages, well time individual support and service-user-led community based programmes
Limitations and applicability of evidence	Mixed methods- extracted the qualitative information, Framework analysis No description of researcher/experience/ relationship to the design of the study but they were stated to have carried out independent analysis. Unclear who carried out the focus groups. Overall limitations: Minor

Study	Laplante 2012[302]
Aim	Explore and describe hearing help-seeking and rehabilitation perspective of adults with hearing impairment
Population	n=34

Study	Laplante 2012[302]
	Different help seeking behaviour (see categories below/ in the same order): 15%, 18%, 18%, 18%, 31% Site: Australia 24%, Denmark 26%, UK 24%, USA 26% Age: <50 years 21%, 50-65 years 32%, >65 and ≤80 years 26%, >80 years 21% Gender: 56% female. Hearing impairment in the better ear: Normal (≤25 dB HL) 21%, mild (<35≤40 dB HL) 38%, moderate (>40≤60 dB HL) 35%, severe (>60 and≤80 dB HL) 6%. Education level: lower than secondary school 6%, secondary school 62%, high than secondary school 32%. Eligibility for public payment of hearing aids: eligible 68%, not eligible 32%, self-reported hearing disability (without hearing aids): none 3%, mild 21%, moderate 35%, severe 29%, profound 12%.
Setting	Most convenient to the participant (home n=25, workplace n=1, interviewer workplace n=8)
Study design	Descriptive qualitative interview study
Methods and analysis	Four sites: University of Queensland in Australia, Eriksholm Research Centre at Oticon in Denmark, Hull York Medical School in the UK ad University of Louisville in the USA Authors: expertise in audiology, engineering, ethnology, health sociology, psychology and speech pathology, stated to have used interdisciplinary approach in all phases of the research Maximum variation sampling: experience with hearing help seeking and rehabilitation (5 levels; never sought hearing help, sought help but did not get hearing aids, obtained hearing aids but has not used them for at least 3 months, obtained and used in the last 3 months but dissatisfied/neutral with them, obtained and used in the last 3 months and is satisfied/v satisfied with them), site, age, gender, degree of hearing impairment, self-reported hearing disability, occupational status, living arrangement, education level and eligibility for subsidised hearing services Recruitment: print/electronic media, notice boards, word of mouth (snow-balling). Participants either provided a copy of their recent hearing test results performed in the past 6 months or completed a hearing assessment (otoscopy and air conduction pure tone audiometry) Inclusion: at least 18 years old with hearing impairment (defined as at least one air-conduction threshold at 0.5, 1,2, or 4 kHz greater than 25 dB HL in at least one ear. Exclusion: cochlear implant or had undergone ear surgery. Obtained their current hearing aids >5 years ago (deemed important to focus on recent hearing aid technologies) Participants interviewed by one of the authors (trained in interviewing) at their site of choice (see settings above). Individual in-depth interviews favoured- to provide rich data on the perspective of adults with hearing impairment. Audio recorded. 1 hour approx. duration and followed a topic guide focussing on participant's actions, thought, and feelings in relation to help seeking and rehabilitation. Topic guide provided. Analysis: NVivo 8. Translation verbatim and into English if conducted in Danish. Each interviewer reviewed transcripts for accuracy and expanded them with relevant contextual information. Inductive and qualitative form of content analysis. Research aim informed 3 content areas; actions thoughts and feelings that participants reported in relation to their hearing impairment, actions, thoughts and feelings that participants reported

Study	Laplante 2012[302]
	in relation to their hearing help seeking and rehabilitation and decisive or turning points. Content areas divided into meaning units (each coded by one of 4 authors). Excerpts of the coded interviews were reviewed by two of the authors who had not been involved in the initial coding step. First 31 interviews: 2435 different codes. Last 3 interviews used to assess data saturation. 2 of the 3 last interviews were coded by an author (not familiar with the latest categorization). Saturation test did not unveil new categories. 34 interviews, 3191 meaning units, 151 subcategories, 25 categories and 4 main categories. Category density: identified by means of a consensus during face to face meeting in which all 10 authors took part.
Findings	Four main categories (only dense subcategories illustrated):
	Perceiving my hearing impairment: experiencing my hearing difficulties (frustration, fatigue, social isolation e.g. difficulties joining in humour, tired by the effort of hearing) and having a hearing impairment and interacting with other people (communication partners/work colleagues mixed responses; impatient and unsupportive to accepting and supportive).
	Seeking hearing help: decided to seek help (reasons for not seeking help; lack of resources (time/money), concerns about the appearance of the hearing aids, beliefs that hearing aids would not address their hearing difficulties, low perceived degree of hearing disability), GP clinic (minimising of hearing complaints with important consequences, some recommended specific hearing providers, whilst other were disappointed by a lack of guidance or referral), ENT clinic (ruling out of other hearing pathologies), hearing test (unclear name/title of clinician who carried out the test, sometimes perceived as quick screenings performed in suboptimal conditions, others extensive diagnostic assessment. Issues with private clinics motivations for free hearing tests/ selling their products), hearing aid provider clinic (influenced by recommendations, marketing, location and costs when choosing a hearing aid provider, public services perceived as having a longer wait for an initial appointment but being more affordable, cost of private being prohibitive. Hearing aid styles, appearance, types available for subsidy, cost- affected hearing aid selection. Difficultly understanding the differences between hearing aid prices. Emphasised the guidance (lack of) from the hearing aid provider (example of no knowing how to adjust/ fit hearing aid). Following values and noticed if not available: good interpersonal skills, genuine interest with participant, availability of follow-up.
	Using my hearing aids: deciding to use hearing aids, describing my hearing aids, using hearing aids and interacting with other people. Variable use. Some experienced problems with the hearing aids and help was unsuccessful/ too complex to access. Feeling of pressure to wear one.
	Perspectives and knowledge: No results given in this paper as no dense subcategories.
	Authors conclusions: Not clearly stated Selective hearing aid use and satisfaction Emphasis on aspects of relevance to their daily lives such as the guidance they received on hearing aid use and care (few recollected this done by hearing aid provider) Viewed as ‘quick fix’ rather than hearing rehabilitation as a pathway/process/ timeline for both clients and clinicians Client centred perspective needed for hearing rehabilitation to acknowledge the clients point of view
Limitations and	Applicability: 4 countries (includes UK 24%), mixed funding (68% eligible for funding)

Study	**Laplante 2012**[302]
applicability of evidence	Authors conclusions not explicit/ clear Overall limitations: Minor

Study	**Laplante 2013**[300]
Aim	• To explore the meaning and determinants of optimal hearing aid use from the perspectives of hearing aid clients and audiologists • To contrast the perspectives of the clients and audiologists
Population	Inclusion: at least 18 years of age, able to communicate verbally in the language of the focus group (Danish or English), and to travel to the location of the focus group. Owned hearing aids which were <5 years old, had worn them at least once in the past three months, never had ear surgery and did not have a cochlear implant. Provide a copy of their recent hearing test results (<12months old), or if they could not provide a copy to complete a hearing screening immediately after the focus group. Audiologists: recruited via professional contacts with the Eriksholm Research Centre (Denmark) and the Audiology and Deafness Research Group at the University of Manchester (UK). Recruited in the Copenhagen area and Manchester area via advertisements on public and online notice boards, via registries of research participants and word of mouth. Four focus groups: clients in Denmark (n=7), clients in the UK (n=10), audiologists in Denmark (n=6), audiologists in the UK (n=7) Participant characteristics: Age: median 67 (range 23-90 years), female 35.3%, median years of hearing aid experience 5 (range 2-23) years, public funding 64.7%, private funding 11.8%, research funding 23.5%. Self-reported hearing aid use pattern; daily 70.6%, not daily 29.4%, hearing impairment in better ear median 42.5 (range 10-87.5), occupational status; employment or study (full or part time) 35.3%, retirement or unemployment 64.7%.
Setting	Focus groups took place at the University of Manchester, and a conference centre in the Copenhagen area, or hearing aid manufacturers headquarters in Copenhagen (Danish audiologists). Small and quiet meeting rooms. Participants and facilitator's chairs were arranged in a circle around a table whilst the note taker sat apart. Participants/facilitators could see each other at all times.
Study design	Descriptive qualitative research, focus group discussions
Methods and analysis	Participants: sampling by maximum variation (age, gender, years of hearing aid experience, setting in which current hearing aids were obtained (publicly or privately funded provider), self -reported hearing aid use pattern, self-reported hearing disability, occupational status and living arrangement. Audiologists: age, gender, years of experience as audiologist, primary current setting, and level of education. Each participant took part in one focus group session, approx. 3 hours long. Audio recorded. Set procedure for the focus group (described in the paper). Two researchers: one facilitator (trained in focus group facilitation, experienced in interacting with people with hearing impairment and audiologists. Introduced questions from a topic guide and exercises), one note taker (documented non-verbal behaviours, contextual cues, and

Study	Laplante 2013[300]
	interactions, not active participants, but had the opportunity to request further discussion or clarification of topics the focus group had raised but not exhausted). Analysis: Transcribed verbatim. Note takers and a second researcher reviewed transcripts and expanded them with turn taking and other relevant contextual information. Professional translator translated the two Danish transcripts into English. Two bilingual Danish/English researchers compared the translations to transcripts. NVivo8 – platform for data analysis. Inductive qualitative content analysis. Two content areas: the meaning of optimal hearing aid use and the determinants of optimal hearing aid use. Content areas divided into meaning units which were coded. Each code was as concrete and close to the meaning unit as possible (when necessary non-verbal information was coded. Open coding used. Two researchers identified and coded all meaning units. Third researcher who had not been involved in the open coding independently coded transcripts. 3 excerpts randomly chosen from the 4 transcripts (>10% of each transcript). Two data sets, client and audiologist. For each data set a researcher clustered the codes into categories. Inductive and iterative approach. Multi-levelled hierarchical structure. Discussed conceptual commonalities and differences. Independent group of 3 researchers also reviewed and commented on the two results sets. Random 10% codes of the UK client focus group and 10% of codes for UK audiologist focus group were used to assess saturation. Codes used for the saturation test did not generate new categories, they only required minimal categorization changes. So saturation was deemed to be reached. Dense categories are presented in the paper (qualitative richness of the category content). Finding below in **BOLD** are the dense categories.
Findings	Client determinants:
	• Meaning of Optimal Hearing Aid Use: Optimal use did not necessarily correspond to wearing the hearing aid all/most of the time. It was defined as related to clients' needs. Misinformed clients could not use their hearing aids optimally.
	• **Dependence on Hearing Aids:** Related to hearing impairment and degree, but also general health status
	• **Knowledge and Personal Factors/ Lifestyle and Personal Factors:** Stigma. Emphasised the importance of knowledge e.g. informed about their hearing and their hearing aids' capabilities. Recollected situations where their lack of experience and knowledge was detrimental for optimal hearing aid use e.g. as a new user, do not know the questions to ask.
	Audiologist determinants:
	• Reception of Information and Advice/ Giving of Information and Advice: Information and advice from audiologist central. Most clients found they had not received information and advice or wanted to have received more. Poor information retention and misunderstandings were potentially detrimental to optimal hearing aid use. Audiologists who repeated information, provided written information, gave access to an ongoing stream of information e.g. newsletters and follow-up information were particularly appreciated.
	• Relationship with me as a Client: Valued audiologist who involved them in decisions e.g. by trialling different hearing aids, and who took into account individual needs/preferences.
	Hearing Aid Determinants:
	• **Benefits and Limitations:** Limited benefit in background noise

Study	**Laplante 2013**[300]
	• **Features, Accessories and Hearing Assistive Technology:** Hearing aid controls e.g. program change, volume control, were compared, appreciated or desired. Hearing Assistive Technology was viewed v positively/ improved hearing ability.
	Authors conclusions: • Importance of client access to information • Reception of information and advice from their audiologist to be central • Written information, information repetition and ongoing streams of information (newsletters, other forms of follow-up) must be better integrated into practice • Information technology: opportunity to improve access to information for people with hearing impairment • Shared decision-making (client’s needs with clinician’s expertise) • Hearing aids which performed well and had relevant features- most central to the clients. Many did not understand modifications; physical e.g. to address management issues, signal processing e.g. improve sound quality • If Hearing aids were not optimal, clients looked towards accessories and hearing assistive technology • Many clients unaware of what an audiologist can do beyond hearing aid dispensing
Limitations and applicability of evidence	Applicability to the UK Overall limitations: Minor

Study	**Pryce 2012**[458]
Aim	To explore the factors affecting communicating with a hearing loss in residential care
Population	18 residents in 2 residential care homes 57 residents of which 30 had capacity to give fully informed consent and were approached, 18 agreed to take part. 7 of the 16 staff also consented to take part. n=18 had dementia (including Alzheimer’s disease, vascular dementia and dementia with Lewy bodies. n=14 female, n=4 male Age range 76-99 years old. 8 regular hearing aid users, 8 identified as hearing difficulties but not sought help, 2 people considered their hearing to be good (11%)
Setting	Two residential care homes run by the same public Health and Social Care organisation. Homes cater up to 15 residents with dementia on one floor, 15 residents who require personal and nursing care on a separate floor. Two settings very similar with identically designed buildings and amenities. Staff may work across both homes or in one with shared training and employment structures. There were 57 residents at the time of

Study	Pryce 2012[458]
	the study. Observations taken in communal areas, day rooms, lounge areas, dining areas Interviews: private rooms
Study design	Qualitative: ethnographic observational study with in-depth interviews
Methods and analysis	19 sessions of observation (nature of communication, social relationships and environment) In-depth interviews: to explore observed factors in more detail Analysis: constant comparison methods. No other details given. Role of researcher: First author carried out all the observations (is a Hearing Therapist with experience working with older people with a variety of communication difficulties and this facilitated access to the settings, also has hearing loss). To 'reduce the influence of this professional role on resident's insights, the researcher sat with them in communal areas to observe the working of the home as a resident might. Field notes taken, audio taped interviewed which were transcribed.
Findings	Hearing history and perspectives on hearing: Access to hearing services relied on staff/family/friends. No specific services in the residential homes to help with hearing aid maintenance, no additional access to environmental equipment (television or telephone aids), no staff training specific to hearing services. Most had not accessed hearing services.
	Two themes:
	Social context: Hearing loss frequently affected participation in activities e.g. quizzes, communication was task focussed. Issues with background noise at mealtimes. Limited interactions between residents at meal times, needs focussed communication with staff. Residents deliberately chose their communication opportunities e.g. social group attendance, meals in communal area, seeking out contact in a social area. Some sought isolation. Choices about communication relied on residents being able to remove themselves from social situations. Choice not always possible e.g. delays in staff taking them back to their rooms. Resident to resident communication often experienced communication breakdown (noise levels from music or television, residents/staff raising voices, singing along to music), and often stopped attempting to speak against the background noise.
	Environmental factors: Every observation of a meal, additional music or television was present. Only once staff asked whether the residents wished to have the music playing. Background noise in dining room from kitchen. Residents had not discussed background noise with the staff (who could alter the noise levels). Resident choice making dependent on the need to maintain an equilibrium within their social setting.
	Authors conclusions: Suggests individual hearing difficulties are compounded by a social and environmental context which shapes choices in communication Conceptualise hearing loss as a shared communication difficulty within care settings Didactic training and patient based assessment and amplification strategies (limited success) Role of communication and effects of background noise discussions with staff and residents

Study	Pryce 2012[458]
Limitations and applicability of evidence	Data collection and analysis not rigorous 11% of the residents consider their hearing to be 'good'. Overall limitations: Moderate

Study	Pryce 2013[459]
Aim	This study identifies staff perspectives on hearing loss and their views about potential hearing service improvements
Population	Staff employed centrally by the Trust. 65 staff were eligible for inclusion. Staff approached 30 residents with capacity to consent, 19 agreed to take part/consented. Staff characteristics: Age range 22-58 years, 5 care workers, 5 senior care workers
Setting	Residential care homes (3 care homes in Bath and north-east Somerset, UK)
Study design	Four staged mixed methods study: qualitative interviews, observation, a survey and a stakeholder involvement meeting Stage 1: Provide insight into how communication operates in the care setting (ethnographic observation), alongside interviews with residents Stage 2: explored staff perspectives (qualitative interviews), experiences and views of working with people with hearing loss Stage 3: Prevalence data (survey- quantitative) and addresses findings from Stage 1 and 2 Stage 4: Describe the process of developing interventions. Staff took part in Stakeholder meetings, to address the needs of residents and staff that were highlighted in the other stages.
Methods and analysis	Stage 1: 6.30am-8pm: observations of all activities. Researcher sat with residents, shadowed care staff. Recorded as field notes. Stage 2: Interviewed staff (n=10)in their offices, approximately 30 mins: schedule of topics (incl. experience of working with residents who have hearing loss, adaptations they make in communication, views about the use of hearing aids, noise levels and preferred communication styles. Open questions. Methods of constant comparison, data was analysed. Analysis: Observational field notes recorded, grouped under broad themes/headings. Audio recorded, transcribed, anonymised and analysed using a constant comparative approach derived from grounded theory. Open coding and grouping codes into headings. Axial coding used to place codes into a descriptive process or paradigm with codes relating to pre-conditions, phenomena, intervening conditions, strategies and consequences grouped and compared. Stage 3: Questionnaire survey, questions based on findings from Stage 1 & 2. 54/65 staff completed the survey. Stage 4: Stakeholder meeting: All care home staff invited to a day meeting with the Hearing Therapy Service Lead and 2 Hearing therapists. Findings from Stages1- 3 were discussed. n=30 attended. Recorded in meeting notes. Mind mapping approaches used in groups. Identified key themes.
Findings	Stage 1: Gaps in deaf awareness, communication choices by staff made by access to information, skills and services. Valued communication,

Study	Pryce 2013[459]
	important part of work. Felt responsible for social contact between residents. Good communication: depended on prior knowledge of the resident, contact with outside agencies e.g. audiology services in the provision of hearing aids, home based agencies e.g. music therapist, reading group volunteer. Communication and interaction with residents as key to job satisfaction. Interactions often brief 'You OK?' when passing by. • Access to knowledge: who has hearing loss? Focus on those with hearing aids/known hearing loss. Shared communication problem • Access to knowledge: how do we manage communication with a hearing loss? Talking loudly, in front of the person, clearly to enable lip reading, writing things down. No formal training. Staff usually favour one method. • Access to knowledge: what are the effects of background noise? Staff did not realise having the TV on in the background (classed as a morning activity) contributed to communication difficulties. Suggestions that interventions would include strategies to reduce background noise. • Access to hearing services: access to hearing aids. HA seen as a solution to hearing difficulties. Need for wider access to hearing services. Need for staff to understand the implications of adjusting to amplified sound. Staff unaware how to refer patients for a hearing aid. Referral would involve multiple visits for resident and carer to GP and audiology dept. Requirement for special transport and considerable time for the staff. Resulting in first time access to hearing services rare. Majority with HAs, arrived with hearing aids already fitted to the care home. Suggestion of an onsite service to reduce logistical problems. • Access to skills: how do we manage a hearing loss? Some experience changing batteries in HAs, not confident in fitting hearing aids in ears, cleaning ear moulds, managing switches. No formal or current training/ learnt on the job.
	Questionnaire survey: "Findings from Stage 3 suggest that many staff were aware that most residents had hearing difficulties but that a proportion do not think that this is the case. Nearly a third of respondents thought that music was "relaxing" at mealtimes and did not identify background noise as an issue… environmental noise was not considered an obstacle and implications for the resident of listening to amplified sound in a communal setting were not considered".
	Stakeholder meeting intervention aims that were agreed: • Improve access to hearing services. To facilitate assessment and reassessment of hearing needs and enable staff and residents to make informed choices about management. • Improve support to assist hearing aid use or use of environmental equipment • Improve communication by teaching staff about implications of hearing loss on auditory discrimination and listening behaviours. To shift expectations about how interactions should occur and accommodate hearing needs. For example, reduce extraneous noise; ensure that speakers face listeners • Provide further opportunities for social interactions. Increased social interaction promoting a sense of being 'at home' rather than living in a home • Develop social identity as an individual with a hearing loss. Through this social identity develop resilience to negative stigma associated with hearing loss • Develop self-efficacy as an individual who can make informed and empowered choices about their hearing in communication. To promote 'ownership' of responsibility for meeting hearing needs to the community with in the care home, staff and resident alike

Study	Pryce 2013[459]
Limitations and applicability of evidence	Mixed methods approach No description of researcher/experience No mention of data saturation Overall limitations: Moderate

H.9 Decision tools

None

H.10 Assistive listening devices

Study	McInerney 2013[367]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=27)
Countries and setting	Conducted in USA; Setting: Not stated
Line of therapy	Not applicable
Duration of study	Intervention time:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Pure-tone screening at 20 dB HL, and pure-tone thresholds at 0.5, 2 and 4 kHz for both ears using the modified Hughson-Westlake approach were conducted. A pure tone average (pure tone thresholds at 0.5, 1, 2 and 4 kHz) of the right and left ear was calculated. These 2 averages were averaged to obtain the binaural pure-tone average (BPTA) of hearing thresholds. Participants were then assigned to a hearing loss group (BPTA >40) or no hearing loss (BPTA <40).

Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	No cognitive impairment and no impacted cerumen
Exclusion criteria	Cognitive status was assessed using the MMSE and patients who scored less than or equal to 24 were excluded. All subjects received otoscopy and all subjects with impacted cerumen were excluded from the study.
Age, gender and ethnicity	Age - Mean (range): 82.45 years (70-93). Gender (M:F): 86.4% Female. Ethnicity:
Further population details	1. Auditory lifestyle as evaluated with the Auditory Lifestyle and Demand Questionnaire : Not stated / Unclear
Extra comments	Elderly patients recruited from retirement homes . Patients with hearing impairment were randomised allocated into one of two groups (with and without ALD) and those without hearing impairment were randomised into one of two groups (with and without ALD). Groups consisted of: HL with ALD = 7 HL without ALD = 5 No HL with ALD = 5 No HL without ALD = 5
Indirectness of population	No indirectness
Interventions	(n=7) Intervention 1: Assistive listening devices FM / RF radio frequency modulators - Any. Sonic Super Ear: wired assistive listening system composed of headphones, an amplifier and a microphone wired to each other. Duration of intervention. No follow-up. Concurrent medication/care: None (n=5) Intervention 2: No ALD - No assistive device used. No assistive device used . Duration of the intervention. No follow-up. Concurrent medication/care: None
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ANY versus NO ASSISTIVE DEVICE USED

Protocol outcome 1: Outcomes reporting restricted participation or activity limitations - Actual outcome: Communication efficiency measured as the number of observed communication breakdowns at Duration of intervention ; Group 1: mean 1.57 Number of communication breakdowns (SD 1.27); n=7, Group 2: mean 12.6 Number of communication breakdowns (SD 6.46); n=5; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Hearing-specific health related quality of life ; Outcomes reporting social interactions, employment or education ; Listening ability ; Health-related quality of life

H.11 Hearing aids

H.11.1 Hearing aids versus no hearing aids

Study	**Humes 2017**[238]
Study type	RCT (People randomised; 3 arm, parallel, single-centre)
Number of studies (number of participants)	1 (n=164)
Countries and setting	Conducted in the USA; Setting: university research clinic
Line of therapy	Not applicable
Duration of study	Intervention and follow-up time: 6 weeks
Method of assessment of guideline condition	Adequate method of assessment or diagnosis: hearing loss (PTA averaged across 0.5, 1.0, 2.0 kHz = 28.1 dB HL (SD 8.0); high frequency PTA averaged across 1.0, 2.0, 4.0 kHz = 38.8 dB HL (SD 7.9)
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	People aged 55 to 79 years, English as native language, MMSE score > 25, no prior hearing aid experience, pure-tone audiometry (air) consistent with age-related hearing loss within the fitting guidelines of this study, bilaterally symmetrical hearing loss
Exclusion criteria	Presence of a medically treatable ear condition bilateral, flat tympanograms known fluctuating or progressive HL presence of cognitive, medical or language-based conditions that limit ability to complete all test procedures, currently

	or recently taking platinum-based cancer drugs or mycin-family antibiotics, previously diagnosed with either multiple sclerosis or Meniere’s disease, failure to seek or waive medical evaluation and clearance following hearing evaluation, unwillingness to be randomly assigned to a treatment group
Recruitment or selection of people	Not reported
Age, gender and family origin	Age - Mean (SD): 69.1 (6.1). Gender (M:F): male: 92; female: 72 (number randomised not analysed). Family origin: not reported
Indirectness of population	No indirectness
Interventions	(n=108) Intervention 1+2: Active hearing aids (Resound Alera mini), behind-the-ear, fully digital. Bilateral fits. Fixed directional microphones, dynamic feedback suppression and noise reduction unclear if enabled. 1: fitted using real-ear measurements according to the NAL-R target, with adjustments as necessary. Verified via real ear measurements using Audioscan Verifit system; 2: three possible prescriptions based onNAL-NL2 fit to three most common patterns of hearing loss among older adults in the US. Different programmes applying different constant gains across all frequencies (gain values based on chosen typical prescription). Duration 6 weeks. Concurrent medication or care: none up to 6 weeks post-baseline, then the CD group was offered AB-delivered hearing aids for a further 4 to 5 weeks trial (n=51) Control: placebo hearing aids (Resound Alera mini), behind-the ear, fully digital. Bilateral fits. Fixed directional microphones (n=20), omni-directional microphones (n = 23), dynamic feedback suppression and noise reduction enabled. Programmed to achieve 0 dB insertion gain. Verified via real ear measurements using Audioscan Verifit system. Duration 6 weeks. Concurrent medication or care: none up to 6 weeks post-baseline, then the CD group was offered AB-delivered hearing aids for a further 4 to 5 weeks trial
Funding	National Institute on Deafness and Other Communication Disorders R01 DC011771

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: HEARING AID versus PLACEBO
Protocol outcome 1: Hearing-specific HRQoL
- Actual outcome: Hearing-specific HRQoL (assessed using Hearing Handicap Inventory for the Elderly) at 6 weeks; Intervention (mean (SD)): 13.46 (14.28), n=108; Placebo (mean (SD)): 24 (13.86), n=51. All domain - High, Selection - Low, Blinding - Unclear, Incomplete outcome data - Low, Outcome reporting - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 4

Protocol outcome 2: Listening ability
- Actual outcome: Listening ability (assessed using the Profile of Hearing Aid Performance at 6 weeks; Intervention (mean (SD)): 0.22 (0.12); Placebo (mean (SD)): 0.37 (0.14) All domain - High, Selection - Low, Blinding - Unclear, Incomplete outcome data - Low, Outcome reporting - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 5; Group 2 Number missing: 4

Protocol outcomes not reported by the study	Adverse effects: pain, health-related quality of life, adverse effects: noise-induced hearing loss.

Study	**McArdle 2005**[365]
Study type	RCT (People randomised; semi cross-over, parallel, non-blinded)
Number of studies (number of participants)	1 (n=380)
Countries and setting	Conducted in the USA; Setting: 4 sites, US veterans awaiting hearing aids for the first time at Veteran Affairs Medical Centres.
Line of therapy	Not applicable
Duration of study	Intervention time and follow-up: 2 months
Method of assessment of guideline condition	Adequate method of assessment or diagnosis: hearing loss (PTA averaged across 0.5, 1.0, 2.0, 4.0 kHz = 43.17 dB HL)
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	PTA at 2.0, 3.0, 4.0 kHz >= 30 dB HL in better hearing ear, Mini mental State Exam pass, eligible for hearing aids, no prior hearing aid experience
Exclusion criteria	Conduction or retrocochlear pathology, asymmetry (not defined), speech recognition in quiet (not defined)
Recruitment or selection of people	Not reported
Age, gender and family origin	Age - Mean (SD): 69.4 (9.0). Gender (M:F): male: 374; female: 16 (number randomised not analysed). Family origin: not reported
Indirectness of population	No indirectness
Interventions	(n= 189) Intervention : hearing aids (manufacturer not specified), in-the ear, analogue or fully digital fitted 2 weeks post-baseline. Bilateral fits routine. Fitted using real-ear measurements according to the NAL-R target, with adjustments as necessary. Fitted 2 weeks post-baseline. Duration 2 months. Concurrent medication or care: none up to 10 weeks post-baseline, then both groups had hearing aid

	(n=230) Control: waiting list controls, no hearing aids up to 10 weeks post-baseline. Duration 2 months. Concurrent medication or care: none up to 10 weeks post-baseline, then both groups had hearing aid
Funding	Veteran's Association
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: HEARING AID versus CONTROL Protocol outcome 1: Hearing-specific health-related quality of life - Actual outcome: Hearing-specific health-related quality of life (assessed using the Hearing Handicap Inventory for the Elderly) at 2 months; Intervention (mean (SD)): 10.5 (11.49), n=189; Control (mean (SD)): 43.07 (22.12), n=191. All domain - High, Selection - Low, Blinding -High , Incomplete outcome data - Low, Outcome reporting – Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13; Group 2 Number missing: 5 Protocol outcome 2: Health-related quality of life - Actual outcome: Health-related quality of life (measured using the World Health Organization Disability Assessment Schedule II) at 2 months; Intervention (mean (SD)): 12.7 (12.9), n=189, Control (mean (SD)): 19.16 (15.99), n=191. All domain - High, Selection - Low, Blinding -High , Incomplete outcome data - Low, Outcome reporting – Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13; Group 2 Number missing: 5 Protocol outcome 3: Listening ability - Actual outcome: Listening ability (measured using the Abbreviated Profile of Hearing Aid Benefit) at 2 months; Intervention (mean (SD)): 18.11 (9.81), n=189, Control (mean (SD)): 51.21 (15.3), n=191. All domain - High, Selection - Low, Blinding -High , Incomplete outcome data - Low, Outcome reporting – Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 13; Group 2 Number missing: 5	
Protocol outcomes not reported by the study	Adverse effects: pain, adverse effects: noise-induced hearing loss.

Study	**Mulrow 1990**[389]
Study type	RCT (People randomised; Parallel)
Number of studies (number of participants)	1 (n=194)
Countries and setting	Conducted in the USA; Setting: 1 site, US veterans undergoing hearing assessments at the Audie L.Murphy Memorial Veterans Hospital and associated primary care clinics.
Line of therapy	Not applicable
Duration of study	Intervention time: 16 weeks

Method of assessment of guideline condition	Adequate method of assessment or diagnosis: hearing loss (hearing aid group PTA 1.0, 2.0, 4.0 kHz better ear: 53 (± 10) dB HL; control group PTA 1.0, 2.0, 4.0 kHz better ear: 51 (± 8) dB HL
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	PTA at 2 kHz better ear >= 40 dB HL in better hearing ear, over 64 years.
Exclusion criteria	Severely disabling comorbid disease, current hearing aid users, live more than 100 miles from the clinic, existing hearing aid users
Recruitment or selection of people	Not reported
Age, gender and family origin	Age - Mean (SD): Intervention: 73 (7); Control: 71 (5). Gender (% M): Intervention: 100%; Control: 99. Family origin: not reported
Indirectness of population	No indirectness
Interventions	(n=92) Intervention: hearing aids (manufacturer not specified), in-the-ear (98%), unilateral fits (97%), typically to the worst hearing. Duration 16 weeks. Concurrent medication or care: Not applicable (n=96) Control: waiting list controls, no hearing aids. Duration 16 weeks. Concurrent medication or care: Not applicable
Funding	Robert Wood Johnson Foundation, a Milbank Scholar Program Award, and an American College of Physicians' Teaching and Research Scholar Award
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: HEARING AID versus CONTROL Protocol outcome 1: Hearing-specific health-related quality of life - Actual outcome: Hearing-specific health-related quality of life (assessed using the Hearing Handicap Inventory for the Elderly) at 16 weeks; Intervention (mean (SD)): 14.7 (17.7), n=92; Control (mean (SD)): 51.2 (28), n=96. All domain - High, Selection - Low, Blinding -High , Incomplete outcome data - Low, Outcome reporting - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3; Group 2 Number missing: 3 Protocol outcome 2: Health-related quality of life - Actual outcome: Health-related quality of life (measured using the Self-Evaluation of Life Function) at 16 weeks; Intervention (mean (SD)): 92 (18.2), n=92, Control (mean (SD)): 96.8 (18.8), n=96. All domain - High, Selection - Low, Blinding -High , Incomplete outcome data - Low, Outcome reporting - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3; Group 2 Number missing: 3	
Protocol outcomes not reported by the study	Adverse effects: pain, listening ability, adverse effects: noise-induced hearing loss.

H.11.2 1 hearing aid versus 2 hearing aids

Study	**Cox 2011**[119]
Study type	Randomised cross-over trial
Number of studies (number of participants)	1 (n=100)
Countries and setting	2 centres from USA around 2005-2007, University of Memphis Hearing Aid Research Laboratory (HARL) and Mountain Home Veterans Affairs Medical Centre
Line of therapy	First line; Provision of hearing aids
Duration of study	12 weeks in total, 3-week period where patients were randomised to different orders of bilateral, left or right side hearing aids, followed by 9 weeks where they used the hearing aids as desired ("encouraged to experiment with using the hearing aids in different configurations").
Method of assessment of guideline condition	Better pure-tone average (over 0.5, 1 and 2 kHz) of 30 – 80 dB HL, details of assessment not provided
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Aged between 50 and 85 years of age. Bilateral symmetric stable sensorineural impairments with a better pure-tone average (over 0.5, 1 and 2 kHz) of 30 – 80 dB hearing loss. Open mindedness of preference for using one or two aids. Normal immittance test results. Active lifestyle, good health.

	Adequate literacy and cognitive competence to respond to questionnaires. Willingness to wear the aid/s at least 4 hours per day.
Exclusion criteria	Existing preference for either one or two hearing aids. Observed or reported neurologic or psychiatric disorders. Fluctuating hearing. Chronic middle or external ear disease.
Recruitment/selection of patients	Two sources of patient recruitment: The Veteran Centre recruited male participants seeking amplification. Of 98 male veterans considered, 49 met the inclusion criteria. The HARL advertised for males and females interested in new hearing. Of 71 interested participants, 51 met the inclusion criteria. All subjects were paid for their participation. Of these 100 patients 6 [6%] withdrew and the remaining 94 patients all concluded the study.
Age, gender and ethnicity	Age – Mean (SD): 70.1 (7.1) Gender (M:F) 57: 37 Ethnicity: NS
Further population details	76[82%] were new hearing aid users.18 [19%] owned and used 1 or 2 aids but did not know their preference for 1 or 2 aids.
Extra comments	32[68%] of veteran patient were provided with purchased aids that they could keep. All other patients [n=48] were loaned their aids for the duration of the study
Indirectness of population	Atypical population
Interventions	Hearing aids

	The hearing aids used this in this study were required to meet the following criteria to be consistent with the subject audiograms and with current practice in hearing aid fitting: (1) appropriate for a 30 – 80 dB HL three-frequency average sensorineural hearing loss with a flat or sloping configuration, (2) good quality digital programmable device, (3) some form of compression, (4) a directional microphone (either fixed or adaptive technology) and (5) at least two programs (program 1 set for omni-directional and program 2 set for directional). *Comment; considerably more details available on aid fitting* Field trial and randomisation schedule Following the fitting and orientation to the hearing aids, each subject was given a three-week wearing schedule to ensure that both unilateral and bilateral amplification were experienced in a variety of daily life settings. The wearing schedule encompassed three one-week periods during which each aid was worn unilaterally for one week and both were worn bilaterally for one week. There were six possible orders of the three conditions (left, right, and both). Each block of six consecutive subjects was randomised to the six orders so that all orders were used equally often. During each one-week trial, the subject completed a daily checklist to record the hours of device use and the type of listening situations encountered. The checklists were returned to the researcher at each post-fitting visit. Outcome assessment At the end of the trial, subjects returned to the laboratory to declare their preference for wearing one or two hearing aids in daily life and to complete outcome questionnaires. For the average subject, the total length of the study from fitting to end was 94 days [74-161 days]
Funding	NIH-NIDCD

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON:

Protocol outcome 5: Patient preference
- Actual Outcome: Participants were asked their preference after a 9-week period of usage where they could “use as desired” and “experiment with different configurations”. 54% (51/94 participants) preferred one hearing aid. Of the subjects who preferred one hearing aid, 29% preferred the right ear, 40% preferred the left ear, and 31% did not have an ear preference.

Risk or bias: High; Indirectness of outcome: No serious indirectness

<u>Additional information related to outcome:</u>

Main reasons for preferences: Monoaural – Comfort (“feeling more normal and free, not closed in, plugged or cut off”), quality, meets need (good enough); Binaural – Balance, quality, comfort (“more capable, secure, relaxed and safe”

Study	**Stephens 1991**[523]
Study type	Randomised cross-over trial
Number of studies (number of participants)	1 (n=38)
Countries and setting	United Kingdom, Welsh Institute of Hearing Research
Line of therapy	1st line, provision of hearing aids
Duration of study	6 months
Method of assessment of guideline condition	Adequate: Hearing loss equal or worse than 30 dB in the better ear
Stratum	Overall
Subgroup analysis within study	None
Inclusion criteria	Aged 50 -65 years a bilateral hearing impairment equal or worse than 30 dB [average over 0.5, 1,2 and 4 kHz] in the better ear Had not previously used hearing aids
Exclusion criteria	Previous hearing aid

Recruitment/selection of patients	289 patients [out of 588] aged 50-65 from two general practices responded to a hearing disability questionnaire indicating a disability were invited for audiological assessment. 49 eligible but 11 refused participation
Age, gender and ethnicity	Aged 50- 65. 23 male, 6 female Ethnicity not specified
Further population details	None stated
Extra comments	Sound localisation and speech discrimination in noise were measured but seems to have been compared between groups who expressed preference for binaural or monoaural rather than the group allocated.
Indirectness of population	Patients not a clinical sample referred for consideration of the fitting of a hearing aid. Patients only used each type of fitting for 4-6 weeks.
Interventions	UK National Health Service BE 18 post-aural hearing aids with appropriate ear moulds, vented of open as individually indicated Intervention 1: Binaural hearing aids (4-6 weeks) Intervention 2: Monoaural hearing aids to preferred ear (4-6 weeks) At return visit the patients crossed over to the other arm.
Funding	Welsh Institute of Hearing Research, MRC Institute of Hearing Research

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON:

Protocol outcome 5: Patient preference

Actual outcome: 16/29 [55%] opted for binaural aids, 13/29[45%] opted for a monaural aid.

Risk of bias: High; Indirectness of outcome: Serious indirectness

Additional information related to outcome:

Reasons for preference:

Binaural- acoustical reasons; clarity, localisation, loudness.

The Social Hearing Handicap Index Score was significantly worse in the group opting for binaural aids [t=3.44; p<0.0002]

Study	**Vaughan-Jones 1993**[563]
Study type	Randomised cross-over study
Number of studies (number of participants)	1 (n=61)
Countries and setting	United Kingdom. Dundee. Regional University Hospital Department of Otolaryngology
Line of therapy	First line; provision of hearing aids
Duration of study	24 weeks
Method of assessment of guideline condition	Pure-tone audiometry to identify those with a bilateral hearing impairment of > 25 dB HL [average over 0.25, 0.5, 1, 2, 4 and 8 kHz]
Stratum	
Subgroup analysis within study	Patients with tinnitus
Inclusion criteria	Those with a bilateral hearing impairment of > 25 dB HL [average over 0.25, 0.5, 1, 2, 4 and 8 kHz].

	No previous hearing aid provision.
Exclusion criteria	External or middle ear disease. Mental or physical disorder that would interfere with HA use. Primary complaint of tinnitus.
Recruitment/selection of patients	64 consecutive patients referred by their General Practitioners for the provision for an NHS hearing aid.
Age, gender and ethnicity of those completing the study	Age – mean (range): 67.9 (40-83) Gender (M/F): 31/25 Ethnicity: NR
Further population details	None
Extra comments	• Method of randomisation not stated but equal numbers of patients in the three arms [n=18,19 and 19] • No data is given on the range of type or severity of the hearing impairments nor of the number of patients with asymmetric hearing • Potential bias towards monaural preference as more patients had this as their last fitting [37 versus 19] • However, twice as many patients were fitted with monaural fitting in the phase I and the last phase of the trial before preference questions were asked. There was statistical significance (analyzed by Cochrane authors) for preference of binaural aid versus initial arrangements (chi-square <0.005).
Indirectness of population	None

Interventions	Visit 1. Bilateral impressions. 4 weeks later 2. Randomised to one of two groups; monaural aid left [n=18] or right [n=19] and binaural aids [n=19] 3. 10 weeks later monaural aid changed to the other ear Or binaural aids with one aid randomly returned 4. 10 weeks later previous monaural aid user given binaural aids Or those with initially binaural aids change the side of use of a monaural aid 5. 10 weeks later patient preference for aid use; Binaural or monaural use and if the later which ear. Standard range of NHS aids to match the ear's hearing were used in 59 of the 61 patients and commercial aids in 2 patients to match their hearing impairment. During the trial 13 aids were made more powerful and one aid made less powerful. Uncomfortable listening level and Uncomfortable Loudness Levels [ULL]were used to guide choice of hearing aid No comments are made regarding the choice of ear moulds.
Funding	None stated but likely to be within the NHS service delivery costs.
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: Protocol outcome 5: Patient preference 40% [22 of 55] preferred binaural fitting and 60% [35 of 55] preferred monaural fitting. Risk of bias: High; Indirectness of outcome: serious indirectness	

Protocol outcome 6: Usage of hearing aids (including data logging and self- report)-Actual outcome: self-reported usage of “often or all the time”: 28% of responses of participants issued with binaural HA, 84% of responses in monoaural HA

Risk of bias: High; Indirectness of outcome: serious indirectness

Protocol outcome 7: Adverse effects: Pain, infection

Adverse effects not measured

Protocol outcome 9: Sound localisation as measured by laboratory test

- Actual outcome: “better when monoaurally aided”; Risk of bias: High; Indirectness of outcome: serious indirectness

Protocol outcome 10: Speech in noise detection as measured by laboratory tests

-Actual outcome: 65% reported “improvement” in monoaural HA, 43% reported “worse than when unaided” in binaural HA Risk of bias: High; Indirectness of outcome: serious indirectness

Study	**Erdman 1981**[158]
Study type	Quasi-randomised (alternation) cross-over study
Number of studies (number of participants)	30 military personnel attending an aural rehabilitation program.
Countries and setting	United States of America. The Army Audiology and Speech Centre, Washington DC.
Line of therapy	First line; provision of hearing aids.
Duration of study	3 months
Method of assessment of guideline	Pure-tone audiometry to identify hearing level (Only 0.5, 1, 1.5, 2 kHz mentioned)

condition	
Stratum	NA
Subgroup analysis within study	NA
Inclusion criteria	Military personnel attending a comprehensive aural rehabilitation programme at the centre (inclusion criteria not explicitly stated).
Exclusion criteria	Not stated
Recruitment/selection of patients	30 military personnel attending a military aural rehabilitation program.
Age, gender and ethnicity	Age range 23–58 years old with a mean of 39.8. Gender & ethnicity not recorded.
Further population details	The population were army soldiers who had suffered from military (noise) induced hearing loss 23 (23/30 77%) subjects with high frequency (>2 kHz) sensorineural hearing loss secondary to long term noise exposure. High frequency loss not quantified. 7 (7/30 23%) subjects had a flat sensorineural hearing loss secondary to long term noise exposure. PTA in range < 30 dB HL to >51 dB HL. 10 subjects with pure tone thresholds <25 dB HL below and including 2 kHz fitted with hearing aids. 8 (8/30 27%) had asymmetrical hearing (not defined) loss but both ears were aidable.
Extra comments	Army personnel are issued hearing aids free of charge
Indirectness of population	Very serious: The population studied were US Army soldiers with noise induced hearing loss. The study states "Attitudes to

	hearing aids in the military are mixed. For example, promotions are often thought to depend on the physical fitness of a soldier". It is suggested that this might influence aiding ("four out of five patients wearing monoaural aids were senior enlisted men of the same grade and the fifth is a middle management office…. "there were cosmetic reasons involved"). The review authors were concerned that: • There is large financial implications for the soldiers in terms of career and compensation (review authors' opinion) • Not sure if hearing aids of that era would be specific enough to selectively amplify only the thresholds above 2 kHz.
Interventions	Vist1 **Phase1**: subjects (n=30) fitted alternatively with either monaural or binaural hearing aids in a counter balanced fashion for a period of one hour each Assumption (n=15 monaurally aided 1st & n=15 binaurally aided 1st) **Phase2**: Next subjects were instructed to wear both binaural and monaural fittings for 2 consecutive days each. **Phase3**: subjects were then permitted to utilise primarily the preferred fitting for an additional 3 days but were instructed to continue to compare the other fitting in a variety of listening condition. Limited information on type/s of hearing aids used "typically high pass instruments most frequently recommended". No data on HA fitting procedure.
Funding	None stated but likely to be within The Army Audiology and Speech Centre delivery costs.
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON:	

After 3 months:

(23/30 77%) preferred binaural fitting.

Risk of bias: high Indirectness: very serious

H.12 Hearing aid microphones and noise reduction algorithms

H.12.1 Microphones

Study	**Ruscetta 2007**[484]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=57)
Countries and setting	Conducted in USA; Setting: Home
Line of therapy	Not applicable
Duration of study	Intervention time: Data collected at the end of the intervention period (3 months)
Method of assessment of guideline condition	Method of assessment /diagnosis not stated
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Adults aged 60 to 75 with symmetrical bilateral sensorineural hearing loss
Exclusion criteria	Presence of brain injuries and any factors which may prevent participation in activities that would allow completion of

	the questionnaire
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (range): 66.6 (60-75). Gender (M:F): 38:19. Ethnicity: Not reported
Further population details	1. Hearing loss severity: Moderate (The acceptable range of hearing loss was dictated by the amount of hearing loss expected to make at least high-frequency sound inaudible yet not so much that sound could not be made audible through amplification.).
Extra comments	
Indirectness of population	Serious indirectness: The duration of hearing loss ranged from 4 months to 50 years which implies that some of the participants may have had hearing loss since childhood. Also, none of the participants had ever used a hearing aid before entering the study.
Interventions	(n=19) Intervention 1: Hearing aids with omnidirectional microphones - Bilateral hearing aids with disabled directional microphones. Siemens custom, in-the-ear style, MUSIC hearing aids equipped with a first-order, hypercardioid, directional microphone with an average reported free-field directivity index of 5.3 dB with the directional microphone being disabled (that is, functioned only in the omni-directional mode). Duration 3 months. Concurrent medication/care: All 57 participants constituted the unaided group (the control group) prior to being randomly assigned to one of the three intervention groups. Further details: 1. Unilateral or bilateral hearing aids: (n=19) Intervention 2: Hearing aids with directional microphones - Bilateral hearing aids with directional microphone (front). Siemens custom, in-the-ear style, MUSIC hearing aids equipped with a first-order, hypercardioid, directional microphone with an average reported free-field directivity index of 5.3 dB (that is, functioned only in the directional mode). Duration 3 months. Concurrent medication/care: All 57 participants constituted the unaided group (the control group) prior to being randomly assigned to one of the three intervention groups. Further details: 1. Unilateral or bilateral hearing aids:
Funding	Academic or government funding (Pennsylvania Lion's Hearing Research Foundation)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: BILATERAL HEARING AIDS WITH DISABLED DIRECTIONAL MICROPHONES versus BILATERAL

HEARING AIDS WITH DIRECTIONAL MICROPHONE (FRONT) Protocol outcome 1: Listening ability - Actual outcome: Self-perceived level of ability to tell the direction of sounds (localisation disability) at 3 months: Mean score: Omnidirectional microphone 3.06 versus Directional microphone 3.14 Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 2: Outcomes reporting restricted participation or activity limitations - Actual outcome: Self-perceived amount of withdrawal from activities of daily living at 3 months: Mean score: Omnidirectional microphone 3.92 versus Directional microphone 3.87 Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Hearing-specific health related quality of life ; Speech recognition in noise ; Ease of listening/ listening effort ; Health-related quality of life ; Outcomes reporting social interactions, employment or education ; Safety ; Adherence ; Adverse events

H.12.2 Noise reduction algorithms

None

H.13 Monitoring and follow-up

None

H.14 Interventions to support the use of hearing aids

Study	Aazh 2016[2]
Study type	Randomised trial (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=37)

Study	Aazh 2016[2]
Countries and setting	Conducted in United Kingdom; Setting: Hospital Audiology Department
Line of therapy	Not applicable
Duration of study	Intervention plus follow-up: 1 month
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Aged 18 or over who were fitted with hearing aids between January 2011 and January 2012 and reported using their hearing aids for 4 hours or less per day.
Exclusion criteria	(1) inability to respond reliably to pure tone audiometry, (2) inability to complete the questionnaires in English language, (3) poor manual dexterity, and (4) presence of medical contraindications for hearing aid as described by the British Academy of Audiology
Recruitment/selection of patients	Randomly selected from survey respondents (recruitment rate 17%)
Age, gender and ethnicity	Age - Mean (SD): Intervention group 75 (8.8), control group 69(13.6). Gender (M:F): 22:15. Ethnicity: Not reported
Further population details	Mean (SD) hearing aid use (h/day by data logging): intervention group – 1 (1.4); control group – 1.3 (2); PTA of better ear (dB): intervention group – 31 (10); control group – 30 (10); GHABP initial disability score: intervention group – 41.6 (15.2); control group – 39 (20)
Indirectness of population	No indirectness
Interventions	(n=19) Intervention 1: Motivational interviewing plus standard care. MI combined with hearing aid review by a qualified audiologist with MI training. Usually the first half of the session was allocated to MI. Instructions and education were provided within the MI component when indicated. The second half was allocated to review and adjustment of the hearing aid(s). The blend of MI with hearing aid adjustment tasks was flexible and based on the needs of each patient. Duration Sessions allocated 60 minutes (follow-up session at 1 week optional). Concurrent medication/care: Not reported (n=17) Intervention 2: Standard care. This involved a hearing aid review appointment with a qualified audiologist with no MI training. Audiologists were instructed to manage the patients in the same way as they would do in their routine clinics and no attempt was taken to standardise their activities. Consistent with the routine clinical practice, audiologists typically conducted the activities listed below based on the needs of the patient: 1. Discussed patients’ problems with regard to their hearing aid use.

Study	Aazh 2016[2]
	2. Checked comfort and suitability of hearing aid(s) and ear moulds/open tubes. 3. Problem solving, practiced using hearing aid functions, changing batteries, hearing aid maintenance, as well as insertion and removal of the hearing aid(s). 4. Real Ear Measurements (REM) (if needed, REM had already been undertaken for all patients at the time of the initial fitting as a part of the routine practice). 5. Adjusted the gain-frequency response of the hearing aid(s), feedback manager, acclimatisation setting, compression, directional microphones, loop system, and additional programmes as well as automatic applications (when needed). 6. Provided brief education and explanations with regard to (a) patient’s hearing status, (b) why they need a hearing aid, (c) how a hearing aid operates and its limitations, and (d) communication strategies/assistive listening devices. 7. Advised the patient that they need to use their hearing aid(s) consistently. 8. Offered them an optional follow-up appointment in one week’s time. Duration Sessions allocated 60 minutes (follow-up session at 1 week optional). Concurrent medication/care: Not reported
Funding	Academic/government

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MOTIVATIONAL INTERVIEWING versus STANDARD CARE

Protocol outcome 1: Hearing aid use

- Actual outcome: Change in hearing aid use (hours per day by data logging) at 1 month; Group 1: mean 6 h (95% CI 4.26 to 7.6); n=19, Group 2: mean 2.8 h (95% CI 1.24 to 4.27); n=17; Top=High is good outcome;

Baseline scores – mean (SD): intervention group 1 (1.4)h, control group 1.3 (2)h

Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Baseline details: difference in GHABP handicap subscale at as baseline; Group 1 Number missing: 1; Group 2 Number missing: 0

Protocol outcome 2: Hearing-specific health-related quality of life

- Actual outcome: International Outcome Inventory for Hearing Aids at 1 month; Group 1: mean 8.3 (95% CI 5.2 to 11.3); n=19, Group 2: mean 7.5 (95% CI 3.9 to 11.2); n=17; IOI-HA 7-35 Top=High is good outcome; Comments: -

Baseline scores – mean (SD): intervention group 17.6 (6.6), control group 18.4 (7.5)

Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Baseline details: difference in GHABP handicap subscale at as baseline; Group 1 Number missing: 1; Group 2 Number missing: 0

<table>
<tr><th>Study</th><th>Aazh 2016[2]</th></tr>
<tr><td colspan="2">- Actual outcome: International Outcome Inventory for Hearing Aids – Significant Other at 1 month; Group 1: mean 10.9 (95% CI 4.7 to 17); n=9, Group 2: mean 8 (95% CI 2.5 to 13.5); n=10; IOI-HA-SO 7-35 Top=High is good outcome; Comments: -
Baseline scores – mean (SD): intervention group 15.7 (5.3), control group 17.8 (7)
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Baseline details: difference in GHABP handicap subscale at as baseline; Group 1 Number missing: 1; Group 2 Number missing: 0

Protocol outcome 3: Health-related quality of life
- Actual outcome: WHO-DAS II at 1 month; Group 1: mean -1.3 (95% CI -3.1 to 0.6); n=19, Group 2: mean -0.4% (95% CI -1.9 to 1.1); n=17; WHO-DAS II 12-60 Top=High is poor outcome; Comments:
Baseline scores – mean (SD): intervention group 19.6 (8.6), control group 15.5 (4.8)
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Baseline details: difference in GHABP handicap subscale at as baseline; Group 1 Number missing: 1; Group 2 Number missing: 0

- Actual outcome: HADS (anxiety score) at 1 month; Group 1: mean -0.63 (95% CI -1.8 to 0.5); n=19, Group 2: mean -0.9 (95% CI -1.9 to 0.1); n=17; HADS (anxiety score) 0-21 Top=High is poor outcome; Comments:
Baseline scores – mean (SD): intervention group 3.7 (4.8), control group 3.6 (3.1)
Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Baseline details: difference in GHABP handicap subscale at as baseline; Group 1 Number missing: 1; Group 2 Number missing: 0
- Actual outcome: HADS (depression score) at 1 month; Group 1: mean -0.4 (95% CI -1.7 to 0.9); n=19, Group 2: mean -0.5 (95% CI -1.4 to 0.5); n=17; HADS (depression score) 0-21 Top=High is poor outcome; Comments:
Baseline scores – mean (SD): intervention group 3.9 (4.5), control group 1.8 (2.3) Risk of bias: All domain - High, Selection - High, Blinding - Low, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness; Baseline details: difference in GHABP handicap subscale at as baseline; Group 1 Number missing: 1; Group 2 Number missing: 0</td></tr>
<tr><td>Protocol outcomes not reported by the study</td><td>Adverse effects</td></tr>
</table>

Study	Barker 2016[44]

Study type	Systematic review of RCTs and quasi-randomised studies
Number of studies (number of participants)	37 (n=4129)
Countries and setting	Majority of studies conducted the USA or Sweden, with small numbers from the UK and Brazil; Setting: outpatient clinics
Line of therapy	Adjunctive to current care
Duration of study	Intervention plus follow-up: Results in short-term (≤12 weeks), medium-term (>12 to <52 weeks) and long-term (≥52 weeks) reported
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: hearing loss >25 dB HL in better ear averaged across 4 frequencies (or fitted with hearing aid as surrogate measure)
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Adults with sensorineural, conductive or mixed hearing loss greater than 25 dB HL in the better ear averaged across four frequencies (0.5 kHz, 1 kHz, 2 kHz and 4 kHz) who were fitted with a hearing aid for at least one ear.
Exclusion criteria	Trials that included participants using implantable devices such as bone-anchored hearing aids or cochlear implants.
Recruitment/selection of patients	-
Age, gender and ethnicity	Age – majority >50 years. Gender (M:F): unclear. Ethnicity: Not stated
Further population details	1. Hearing aid: Hearing aid user.
Extra comments	
Indirectness of population	Unclear: may have included some patients with onset of hearing loss in childhood (but likely to be a very small proportion)
Interventions	See **Table 23**.
Funding	Academic or government funding (National Institute for Health Research, via Cochrane Infrastructure, Cochrane Programme Grant or Cochrane Incentive funding to Cochrane ENT)
RESULTS (NUMBERS ANALYSED) See **Table 24**, **Table 25** and **Table 26**.	
Protocol outcomes not reported by the study	Outcomes reported by carers or relatives

Study	**Ferguson 2016**[163]
Study type	Quasi randomised trial (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=68)
Countries and setting	Conducted in United Kingdom; Setting: Nottingham Audiology Services
Line of therapy	Not applicable
Duration of study	Intervention plus follow-up: 10 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	First time hearing aid users, age greater than 18 years, better ear pure tone average thresholds greater than 20 dB HL across octave frequencies between 0.25 to 4 kHz, and native English speaking or good understanding of English
Exclusion criteria	Inability to complete the questionnaires due to age related problems, such as cognitive decline and dementia, based on the audiologists opinion
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Intervention group 71.85 (9.7), control group 70.31 (9.8). Gender (M:F): 34:34. Ethnicity: Not reported
Further population details	1. Auditory lifestyle as evaluated with the Auditory Lifestyle and Demand Questionnaire: Not stated / Unclear
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Motivational engagement. The motivation tools include the Line, Box and Circle. The line tool asks two questions and aims to help patients assess their own motivations/readiness to improve hearing, and assess self-efficacy for hearing aids and any fears. The box tool involves benefits and costs of taking or not taking action. The circle tool is a visual representation of the patients' readiness to receive hearing care recommendations. The tools were used by two audiologists. Duration Unclear. Concurrent medication/care: Not reported (n=36) Intervention 2: Standard care. Duration Unclear. Concurrent medication/care: Not reported
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MOTIVATIONAL ENGAGEMENT versus STANDARD CARE Protocol outcome 1: Hearing-specific health-related quality of life	

<table>
<tr><th>Study</th><th>Ferguson 2016[163]</th></tr>
<tr><td colspan="2">- Actual outcome: Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - overall at 10 weeks; Group 1: mean 85.25 % (SD 12.16); n=28, Group 2: mean 81.32 % (SD 13.2); n=25; MARS-HA 0-100 Top=High is good outcome; Comments: No baseline data
p=0.279
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - basic handling at 10 weeks; Group 1: mean 97.14 SD 11.43); n=28, Group 2: mean 97.14 (SD 15.71); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - adjustment at 10 weeks; Group 1: mean 93.33 (SD 13.33); n=28, Group 2: mean 96.67 (SD 23.33); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - aided listening at 10 weeks; Group 1: mean 86.35 (SD 16.29); n=28, Group 2: mean 85.54 (SD 12.86); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - advanced handling at 10 weeks; Group 1: mean 66.59 (SD 25.21); n=28, Group 2: mean 56.15 (SD 31.15); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Satisfaction with amplification in daily life - overall at 10 weeks; Group 1: mean 5.71 (SD 0.86); n=28, Group 2: mean 5.31 (SD 0.57); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Satisfaction with amplification in daily life - positive effect at 10 weeks; Group 1: mean 5.33 (SD 1.17); n=28, Group 2: mean 5.03 (SD 0.19); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low,</td></tr>
</table>

Study	**Ferguson 2016**[163]
Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 - Actual outcome: Satisfaction with amplification in daily life - negative features at 10 weeks; Group 1: mean 5.56 (SD 1.31); n=28, Group 2: mean 4.84 (SD 1.3); n=25 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 - Actual outcome: Satisfaction with amplification in daily life - personal image at 10 weeks; Group 1: mean 6.3 (SD 1.19); n=28, Group 2: mean 5.87 (SD 1.09); n=25 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 - Actual outcome: Satisfaction with amplification in daily life - service and cost at 10 weeks; Group 1: mean 6.26 (SD 0.91); n=28, Group 2: mean 6.17 (SD 0.66); n=25 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 Protocol outcome 2: Adherence - Actual outcome: Hearing aid use at 10 weeks; Group 1: mean 10.01 Hours/day (SD 5.1); n=28, Group 2: mean 8.73 Hours/day (SD 5.35); n=25; Comments: No baseline data p=0.415 Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 Protocol outcome 3: Health-related quality of life - Actual outcome: Glasgow Hearing Aid Benefit Profile - overall at 10 weeks; Group 1: mean 78.55 % (SD 16.57); n=28, Group 2: mean 80.49 % (SD 18.22); n=25; GHABO 0-100 Top=High is poor outcome; Comments: No baseline data This is overall results, subscales include use, benefit, satisfaction, residual disability Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 - Actual outcome: Short form Patient Activation Measure at 10 weeks; Group 1: mean 67.39 (SD 15.49); n=28, Group 2: mean 65.55 (SD 14.95); n=25; Activation score 0-100 Top=High is good outcome; Comments: p=0.683	

<table>
<tr><th>Study</th><th>Ferguson 2016[163]</th></tr>
<tr><td colspan="2">Baseline scores: intervention group 61.03 (13.79), control group 57.76 (10.26), p=0.289
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Hospital Anxiety and Depression scale - overall at 10 weeks; Group 1: mean 4.8 (SD 3.48); n=28, Group 2: mean 5.81 (SD 2.85); n=25; HADS 0-56 Top=High is poor outcome; Comments: This is overall score (also available anxiety score and depression score). Intervention versus control p=0.285
Baseline scores: intervention group: 4.98 (2.41), control group: 7.33 (4.21), p=0.028
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Glasgow Hearing Aid Benefit Profile - use at 10 weeks; Group 1: mean 100 (SD 43.75); n=28, Group 2: mean 100 (SD 25); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Glasgow Hearing Aid Benefit Profile - benefit at 10 weeks; Group 1: mean 65.83 (SD 19.03); n=28, Group 2: mean 68.26 (SD 23.76); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Glasgow Hearing Aid Benefit Profile - satisfaction at 10 weeks; Group 1: mean 78.33 (SD 17.48); n=28, Group 2: mean 73.41 (SD 22.43); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Glasgow Hearing Aid Benefit Profile - residual disability at 10 weeks; Group 1: mean 16.59 (SD 14.55); n=28, Group 2: mean 15.48 (SD 13.12); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Hospital Anxiety and Depression scale - anxiety at 10 weeks; Group 1: mean 4.33 (SD 3.86); n=28, Group 2: mean 5.41 (SD 3.06); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8
- Actual outcome: Hospital Anxiety and Depression scale - depression at 10 weeks; Group 1: mean 5.88 (SD 3.89); n=28, Group 2: mean 6.38 (SD 3.15); n=25
Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low,</td></tr>
</table>

Study	**Ferguson 2016**[163]
Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8 - Actual outcome: Short form Patient Activation Measure - level of activation at 10 weeks; Group 1: mean 3.19 (SD 0.94); n=28, Group 2: mean 3.14 (SD 1.11); n=25; PAM 1-4 Top=High is good outcome; Comments: Baseline: intervention group 2.79 (1.07), control group 2.74 (0.92) Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: difference in HADS overall and anxiety subscale at assessment; Group 1 Number missing: 4; Group 2 Number missing: 8	
Protocol outcomes not reported by the study	Adverse effects

Study	**Zarenoe 2016**[605]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=50)
Countries and setting	Conducted in Sweden; Setting: ENT clinic
Line of therapy	Not applicable
Duration of study	Intervention plus follow-up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Mild to moderate sensorineural hearing loss, first time users of hearing aids
Exclusion criteria	Middle ear disorders or hearing loss since birth/childhood. Multi-handicapped patients and those who did not speak fluent Swedish and needed an interpreter were also excluded
Recruitment/selection of patients	Not reported
Age, gender and ethnicity	Age - Mean (SD): Intervention group: 56.5 (8.3); control group: 62.8 (10.8). Gender (M:F): 31:15. Ethnicity: Not reported
Further population details	1. Auditory lifestyle as evaluated with the Auditory Lifestyle and Demand Questionnaire: Not stated / Unclear
Indirectness of population	No indirectness
Interventions	(n=25) Intervention 1: Motivational interviewing. Standard hearing aid selection and fitting followed by motivational interviewing; including open questions, reflective listening, summaries, and affirmations. Carried out by an audiologist

Study	**Zarenoe 2016**[605]
	who received 16 hours of training in MI and 1 year of academic education in communication in health care. There were 4 overlapping processes which are assumed to work together in guiding patients to use hearing aids: engaging (developing working alliance between audiologist and patient), focusing (on a single behaviour, for example, using hearing aids), evoking (patients' own motivation to use the hearing aids) and planning (developing a plan for daily hearing aid use). 60 minute sessions. Duration 3 months. Concurrent medication/care: Not reported (n=25) Intervention 2: Standard practice: conventional hearing aid fitting. Choice of hearing aid was based on the patient’s audiogram, their ability to handle the hearing aids and their preferences for hearing type. Real environment testing of hearing aid. All patients received information about the probable outcomes with regard to the function in hearing aids, and informed about limitations of hearing aids in certain situations. They were provided with written information on skills that could enhance listening, and instructed to use their hearing aids as often as possible. Follow-up visits for further tuning were planned according to the patients' individual needs. Four visits in total. Duration 3 months. Concurrent medication/care: Not reported
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MOTIVATIONAL INTERVIEWING versus STANDARD PRACTICE Protocol outcome 1: Hearing-specific health-related quality of life - Actual outcome: International Outcome Inventory for Hearing Aids at 3 months; Group 1: mean 30.3 (SD 4.5); n=23, Group 2: mean 27.2 (SD 3.7); n=23; IOI-HA 0-35 Top=High is good outcome; Comments: difference between intervention/control - p<.99 Baseline: intervention 28.2, 4.8; control 25.7, 3.5 Risk of bias: All domain – Very High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2; Group 2 Number missing: 2	
Protocol outcomes not reported by the study	Hearing aid use; Health-related quality of life; Adverse effects

Table 23: Intervention range and type (taken from Barker 2016[44])

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
Health system	None found	—						
Community resources	None found							
Decision support	None found							
Clinical information system	None found							
Delivery system design	Campos 2013	Remote online fitting	Face-to-face fitting	Activate - practical	Remote (online) versus face-to-face	Low	Individual	DSD format
	Cherry 1994	Telephone follow-up at 6, 9 and 12 weeks post-fitting - questions answered, trouble-shooting and counselling	Face-to-face follow-up on request	Activate - symptom	Telephone versus face-to-face	Medium versus low	Individual	DSD format and intensity
	Collins 2013	60-minute group orientation with PowerPoint presentation covering use, care and maintenance of the hearing aid	30-minute individual orientation with handout of same PowerPoint presentation	Advise	Face-to-face	Low	Group versus individual	DSD mode
	Cunningham 2001	As many post-fitting adjustments as patients requested	No post-fitting adjustments	Activate - symptom	Face-to-face	Medium versus low	Individual	DSD intensity
	Lavie 2014	Simultaneous binaural fitting	Sequential binaural fitting	Activate - practical	Face-to-face but simultaneous	Low	Individual	DSD format

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
					versus sequential			
	Ward 1981	Self-help book on hearing tactics	Single session face-to-face advice on hearing tactics	Advise	Booklet versus face-to-face	Low	Individual	DSD format
Self-management support	Fitzpatrick 2008	Auditory training - phoneme discrimination in single words, then sentences and then in presence of background noise. 13 x 1 hour	13 x 1-hour lectures on hearing loss, hearing aids and communication	Activate - symptom versus advise	Face-to-face	High	Individual	SMS content
	Kricos 1996	4-week communication training programme 8 x 1-hour including information and practice in communication skills and coping strategies for communication	8 x 1-hour analytic auditory training	Activate - psychosocial versus symptom	Face-to-face	High	Individual	SMS content
	Preminger 2010a	6 x 1-hour group communication strategy training plus psychosocial exercises addressing emotional and psychological impact of hearing loss	6 x 1-hour group communication strategy training	Activate - psychosocial plus versus psychosocial	Face-to-face	High	Group	SMS content
	Saunders 2009	Pre-fitting counselling including demo	Pre-fitting counselling with no demo	Activate - symptom versus none	Face-to-face	Low	Individual	SMS content
	Saunders 2016	20 x 30-minute sessions auditory training (LACE) over a 4-week period on PC at home	20 x 30-minute sessions over a 4-week period listening to an audio book (placebo)	Activate - symptom versus none	Remote	High	Individual	SMS content

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
Combined SMS/DSD	Abrams 1992	Group AR 90 minutes once a week for 3 weeks post-fitting. Each week lectures covering different topics relating to hearing loss and communication	No intervention post-fitting	Advise	Face-to-face	Medium	Group	SMS content DSD format DSD intensity DSD mode
	Andersson 1994	60-minute individual behavioural counselling session then 3 consecutive weeks of group or individual sessions where hearing tactics and coping strategies were taught and practised	No intervention post-fitting	Activate - psychosocial	Face-to-face	Medium	Group or Individual	SMS content DSD format DSD intensity DSD mode
	Andersson 1995	60-minute individual behavioural counselling session then 4 x 2-hour sessions including video feedback on role play, applied relaxation, information and homework	No intervention	Activate - psychosocial	Face-to-face	High	Individual	SMS content DSD format DSD intensity
	Andersson 1997	Self-help manual supplied with 1-hour face-to-face training session including relaxation training followed by telephone contact over 4 consecutive weeks	No intervention	Activate - psychosocial	Face-to-face	High	Individual	SMS content DSD intensity
	Beynon 1997	4-week communication course - information and discussion regarding hearing loss, hearing aids and communication	No intervention	Advise	Face-to-face	Medium	Group versus individual	SMS content DSD intensity DSD mode

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
	Chisolm 2004	4-week course AR - 2 hours per week with lectures covering different aspects relating to hearing loss and communication	No intervention	Advise	Face-to-face	Medium	Group versus Individual	SMS content DSD intensity DSD mode
	Eriksson-Mangold 1990	5 visits including fitting - structured guidance, use of diary with specific homework tasks, restricted HA use during first month	Standard fitting	Activate - psychosocial	Face-to-face	High	Individual	SMS content DSD intensity
	Ferguson 2016	Interactive DVD to use at home following fitting including information and exercises on hearing aid management and communication	Standard fitting	Activate - psychosocial	DVD	Medium	Individual	SMS content DSD format DSD intensity
	Gil 2010	8 x 1-hour twice a week for 4 weeks - synthetic - pointing to words, figures, digits and verbal repetition	No intervention	Activate - symptom	Face-to-face	High	Individual	SMS content DSD intensity
	Kemker 2004	2 x 1-hour sessions of hearing aid orientation - could be pre- or post-fitting. In the review we combined these groups	No intervention	Advise	Face-to-face	Medium	Individual	SMS content DSD intensity
	Kramer 2005	5 sequential videos showing listening situations and coping tactics	No intervention	Advise	Remote (video)	High	Individual	SMS content DSD format DSD intensity

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
	Kricos 1992	4-week communication training programme 8 x 1-hour including information and practice in communication skills and coping strategies for communication	No intervention	Activate - psychosocial	Face-to-face	High	Individual	SMS content DSD intensity
	Kricos 1996	4-week communication training programme 8 x 1-hour including information and practice in communication skills and coping strategies for communication	No intervention	Activate - psychosocial	Face-to-face	High	Individual	SMS content DSD intensity
	Lundberg 2011	Weekly topic-based reading tasks based on an information booklet plus 5 x 10- to 15-minute telephone calls with an audiologist to discuss the tasks	Information booklet	Activate - psychosocial versus advise	Telephone	High	Individual	SMS content DSD format DSD intensity
	Miranda 2008	7 x 50-minute weekly session of auditory training - mix of synthetic and analytic	No intervention	Activate - symptom	Face-to-face	High	Individual	SMS content DSD intensity
	Oberg 2008	Pre-fitting sound awareness training. 3 visits with different listening exercises. 1 visit without amplification and 2 with an experimental adjustable aid	No intervention	Activate - symptom	Face-to-face	Medium	Individual	SMS content DSD intensity
	Oberg 2009	Pre-fitting use of an experimental adjustable hearing aid - 3 clinic visits to adjust the aid a week apart and experience at home in	No intervention	Activate - symptom	Face-to-face	Medium	Individual	SMS content DSD intensity

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
		between						
	Olson 2013	20 x 30-minute sessions at home over 4 weeks using interactive DVD delivering synthetic auditory tasks	No intervention	Activate - symptom	Remote (DVD)	High	Individual	SMS content DSD format DSD intensity
	Preminger 2008	6 x 1-hour speech training classes including auditory and audiovisual analytic and synthetic tasks	No intervention	Activate - symptom	Face-to-face	High	Group versus None	SMS content DSD intensity DSD mode
	Preminger 2010	Group AR plus separate group for SPs 4 x 90 minutes	Group AR without group for SPs	Advise	Face-to-face	Medium	Group	SMS content DSD intensity
	Saunders 2016	10 x 30-minute auditory training sessions delivered by DVD at home over a 2-week period OR 20 x 30-minute auditory training sessions delivered by PC at home over a 4-week period	No intervention	Activate - symptom	Remote (DVD or PC based)	High	Individual	SMS content DSD intensity
	Smaldino 1988	4 sessions of rehabilitation including information on hearing and hearing aids, practice and problem-solving regarding communication and role play	No intervention	Activate - psychosocial	Remote (PC-based)	Medium	Individual	SMS content DSD intensity
	Sweetow 2006	30 minutes 5 days a week for 4 weeks at home analytic and	No intervention	Activate - symptom	Remote (PC-based)	High	Individual	SMS content

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
		synthetic auditory training, information on communication strategies						DSD format DSD intensity
	Thoren 2011	5-week online education programme including information, tasks assignments and professional contact via email	Online discussion forum with 5 weekly topics but no task assignments and no professional guidance	Advise versus Activate - psychosocial	Remote (email follow-up)	High	Individual	SMS content DSD format DSD intensity
	Thoren 2014	5-week online rehabilitation programme including self-study, training and professional coaching in hearing physiology, hearing aids, and communication strategies as well as online contact with peers	No intervention	Activate - psychosocial	Remote	High	Individual	SMS content DSD format DSD intensity
	Turbin 2006	Single session of group AR - length not clear	No intervention	Advise	Face-to-face	Low	Group versus Individual	SMS content DSD intensity DSD mode
	Vreeken 2015	Weekly home visits for 3 to 5 weeks. Participants received a handbook with background information and a checklist accompanied with exercises covering: hearing aid use, maintenance and handling; living environment; hearing assistive	No intervention	Activate - psychosocial	Face-to-face plus booklet	High	Individual	SMS content DSD format DSD intensity

CCM element	Study reference	Hearing healthcare intervention	Control intervention	Self-management support (SMS) subtype	Delivery system design (DSD) format	Delivery system design (DSD) intensity	Delivery system design (DSD) mode	Subgroup(s) compared
		devices; communication strategies						
	Ward 1978	2 treatment groups - 1 received 2 x 2-hour AR sessions, the other 4 x 2-hour sessions. Sessions including physical practice with aids and communication advice and practice. Also psychosocial aspects	No intervention	Activate - psychosocial	Face-to-face	Medium	Group	SMS content DSD intensity DSD mode
	Ward 1981	Self-help book on hearing tactics	No intervention	Advise	Booklet	Low	Individual	SMS content DSD format DSD intensity

Source: Barker 2016[44]

Table 24: Results – Comparison 1: Self-management support interventions versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Quality of life - short/medium-term	1	35	Mean Difference (IV, Random, 95% CI)	−9.10 [−21.33, 3.13]
2 Self-reported hearing handicap - short/medium-term	2	87	Mean Difference (IV, Random, 95% CI)	−12.80 [−23.11, −2.48]
3 Use of verbal communication strategy - short-term	1	52	Mean Difference (IV, Random, 95% CI)	0.72 [0.21, 1.23]

Source: Barker 2016[44]

Table 25: Results – Comparison 2: Delivery system design interventions versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Adherence - short/medium-term	2	686	Risk Ratio (M-H, Random, 95% CI)	1.02 [0.99, 1.05]
2 Daily hours of hearing aid use - short/medium-term	4	700	Mean Difference (IV, Random, 95% CI)	−0.06 [−1.06, 0.95]
3 Adverse effects - long-term	1	98	Risk Ratio (M-H, Random, 95% CI)	0.75 [0.50, 1.12]
4 Self-reported hearing handicap - short/medium-term	2	628	Mean Difference (IV, Random, 95% CI)	−0.70 [−5.22, 3.81]
5 Hearing aid benefit - short/medium-term	1	582	Mean Difference (IV, Random, 95% CI)	1.80 [−3.10, 6.70]
6 Use of verbal communication strategy	1	588	Mean Difference (IV, Random, 95% CI)	−0.10 [−0.40, 0.20]

Source: Barker 2016[44]

Table 26: Results – Comparison 3: Combined SMS/DSD interventions versus control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Adherence - short/medium-term	1	167	Risk Ratio (M-H, Random, 95% CI)	1.06 [1.00, 1.12]
2 Daily hours of hearing aid use - long-term	2	69	Mean Difference (IV, Random, 95% CI)	0.04 [−0.64, 0.73]
3 Daily hours of hearing aid use - short/medium-term - SMS content	9	534	Mean Difference (IV, Random, 95% CI)	0.19 [−0.01, 0.40]
3.1 Advise	1	44	Mean Difference (IV, Random, 95% CI)	0.08 [−1.18, 1.34]
3.2 Activate - practical	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3.3 Activate - symptoms	2	76	Mean Difference (IV, Random, 95% CI)	0.28 [−0.04, 0.59]
3.4 Activate - psychosocial	6	414	Mean Difference (IV, Random, 95% CI)	0.10 [−0.24, 0.45]
3.5 Assist	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3.6 Agree	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Daily hours of hearing aid use - short/medium-term - DSD format	9	534	Mean Difference (IV, Random, 95% CI)	0.19 [−0.01, 0.40]
4.1 Face-to-face	5	163	Mean Difference (IV, Random, 95% CI)	0.24 [−0.06, 0.54]
4.2 Telephone	1	69	Mean Difference (IV, Random, 95% CI)	0.20 [−0.30, 0.70]
4.3 Booklet	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4.4 Remote (online, PC, video/DVD)	3	302	Mean Difference (IV, Random, 95% CI)	0.08 [−0.55, 0.71]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
5 Daily hours of hearing aid use - short/medium-term - DSD intensity	9	534	Mean Difference (IV, Random, 95% CI)	0.19 [−0.01, 0.40]
5.1 Low-intensity	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5.2 Medium-intensity	4	189	Mean Difference (IV, Random, 95% CI)	0.25 [−0.01, 0.51]
5.3 High-intensity	5	345	Mean Difference (IV, Random, 95% CI)	0.03 [−0.49, 0.55]
6 Quality of life - long-term	2	69	Mean Difference (IV, Random, 95% CI)	0.32 [−0.17, 0.80]
7 Quality of life - short/medium-term - SMS content	8	530	Std. Mean Difference (IV, Random, 95% CI)	0.02 [−0.15, 0.19]
7.1 Advise	1	48	Std. Mean Difference (IV, Random, 95% CI)	0.11 [−0.46, 0.67]
7.2 Activate - practical	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7.3 Activate - symptoms	2	76	Std. Mean Difference (IV, Random, 95% CI)	−0.07 [−0.52, 0.38]
7.4 Activate - psychosocial	5	406	Std. Mean Difference (IV, Random, 95% CI)	0.04 [−0.18, 0.25]
7.5 Assist	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7.6 Agree	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
8 Quality of life - short/medium-term - DSD format	8	530	Std. Mean Difference (IV, Random, 95% CI)	0.02 [−0.15, 0.19]
8.1 Face-to-face	3	111	Std. Mean Difference (IV, Random, 95% CI)	0.10 [−0.28, 0.47]
8.2 Telephone	1	69	Std. Mean Difference (IV, Random, 95% CI)	0.30 [−0.18, 0.77]
8.3 Booklet	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
8.4 Remote	4	350	Std. Mean Difference (IV, Random, 95% CI)	−0.05 [−0.26, 0.16]
9 Quality of life - short/medium-term - DSD intensity	8	530	Std. Mean Difference (IV, Random, 95% CI)	0.02 [−0.15, 0.19]
9.1 Low-intensity	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
9.2 Medium-intensity	3	111	Std. Mean Difference (IV, Random, 95% CI)	0.10 [−0.28, 0.47]
9.3 High-intensity	5	419	Std. Mean Difference (IV, Random, 95% CI)	0.00 [−0.19, 0.20]
10 Self-reported hearing handicap - long-term	3	88	Std. Mean Difference (IV, Random, 95% CI)	−0.31 [−1.06, 0.44]
10.1 Advise	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
10.2 Activate - practical	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
10.3 Activate - symptoms	2	69	Std. Mean Difference (IV, Random, 95% CI)	0.04 [−0.43, 0.51]
10.4 Activate - psychosocial	1	19	Std. Mean Difference (IV, Random, 95% CI)	−1.27 [−2.28, −0.26]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
10.5 Assist	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
10.6 Agree	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
11 Self-reported hearing handicap - short/medium-term - SMS content	15	728	Std. Mean Difference (IV, Random, 95% CI)	−0.26 [−0.48, −0.04]
11.1 Advise	4	153	Std. Mean Difference (IV, Random, 95% CI)	−0.27 [−0.59, 0.05]
11.2 Activate - practical	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
11.3 Activate - symptoms	3	89	Std. Mean Difference (IV, Random, 95% CI)	−0.34 [−0.76, 0.08]
11.4 Activate - psychosocial	8	486	Std. Mean Difference (IV, Random, 95% CI)	−0.24 [−0.61, 0.13]
11.5 Assist	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
11.6 Agree	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
12 Self-reported hearing handicap - short/medium-term - DSD format	15	728	Std. Mean Difference (IV, Random, 95% CI)	−0.26 [−0.48, −0.04]
12.1 Face-to-face	9	289	Std. Mean Difference (IV, Random, 95% CI)	−0.16 [−0.39, 0.07]
12.2 Telephone	1	69	Std. Mean Difference (IV, Random, 95% CI)	−0.83 [−1.33, −0.34]
12.3 Booklet	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
12.4 Remote	5	370	Std. Mean Difference (IV, Random, 95% CI)	−0.28 [−0.72, 0.16]
13 Self-reported hearing handicap - short/medium-term - DSD intensity	15	728	Std. Mean Difference (IV, Random, 95% CI)	−0.26 [−0.48, −0.04]
13.1 Low-intensity	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
13.2 Medium-intensity	7	249	Std. Mean Difference (IV, Random, 95% CI)	−0.35 [−0.60, −0.10]
13.3 High-intensity	8	479	Std. Mean Difference (IV, Random, 95% CI)	−0.17 [−0.52, 0.17]
14 Hearing aid benefit - long-term	2	69	Mean Difference (IV, Random, 95% CI)	0.30 [0.02, 0.58]
15 Hearing aid benefit - short/medium-term - SMS content	7	361	Std. Mean Difference (IV, Random, 95% CI)	0.10 [−0.15, 0.36]
15.1 Advise	2	92	Std. Mean Difference (IV, Random, 95% CI)	−0.14 [−1.10, 0.83]
15.2 Activate - practical	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
15.3 Activate - symptoms	2	76	Std. Mean Difference (IV, Random, 95% CI)	0.17 [−0.28, 0.62]
15.4 Activate - psychosocial	3	193	Std. Mean Difference (IV, Random, 95% CI)	0.22 [−0.07, 0.50]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
15.5 Assist	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
15.6 Agree	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
16 Hearing aid benefit - short/medium-term - DSD format	7	361	Std. Mean Difference (IV, Random, 95% CI)	0.10 [−0.15, 0.36]
16.1 Face-to-face	3	120	Std. Mean Difference (IV, Random, 95% CI)	0.24 [−0.13, 0.60]
16.2 Telephone	1	69	Std. Mean Difference (IV, Random, 95% CI)	0.38 [−0.09, 0.86]
16.3 Booklet	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
16.4 Remote	3	172	Std. Mean Difference (IV, Random, 95% CI)	−0.12 [−0.63, 0.39]
17 Hearing aid benefit - short/medium-term - DSD intensity	7	361	Std. Mean Difference (IV, Random, 95% CI)	0.10 [−0.15, 0.36]
17.1 Low-intensity	0	0	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
17.2 Medium-intensity	3	120	Std. Mean Difference (IV, Random, 95% CI)	0.24 [−0.13, 0.60]
17.3 High-intensity	4	241	Std. Mean Difference (IV, Random, 95% CI)	0.01 [−0.41, 0.43]
18 Use of verbal communication strategy - long-term	1	34	Mean Difference (IV, Random, 95% CI)	0.30 [−0.20, 0.80]
19 Use of verbal communication strategy - short/medium-term - SMS content	4	223	Mean Difference (IV, Random, 95% CI)	0.45 [0.15, 0.74]
19.1 Advise	1	115	Mean Difference (IV, Random, 95% CI)	0.25 [−0.07, 0.57]
19.2 Activate - practical	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
19.3 Activate - symptoms	1	37	Mean Difference (IV, Random, 95% CI)	0.40 [−0.06, 0.86]
19.4 Activate - psychosocial	2	71	Mean Difference (IV, Random, 95% CI)	0.70 [0.01, 1.39]
19.5 Assist	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
19.6 Agree	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
20 Use of verbal communication strategy - short/medium-term - DSD intensity	4	223	Mean Difference (IV, Random, 95% CI)	0.45 [0.15, 0.74]
20.1 Low-intensity	1	115	Mean Difference (IV, Random, 95% CI)	0.25 [−0.07, 0.57]
20.2 Medium-intensity	2	89	Mean Difference (IV, Random, 95% CI)	0.40 [0.07, 0.72]
20.3 High-intensity	1	19	Mean Difference (IV,	

Source: Barker 2016[44]

Appendix I: Health economic evidence tables

I.1 Urgent and routine referral

I.1.1 Urgent referral

None

I.1.2 Routine referral

None

I.2 MRI

None

I.3 Subgroups

None

I.4 Early versus delayed management of hearing loss

None

I.5 Communication needs

None

I.6 Management of earwax

I.6.1 Treatment

Study	**Clegg 2010**[107]			
Study details	**Population & interventions**	**Costs**	**Health outcomes**	**Cost effectiveness**
Economic analysis: CUA (health outcome: QALYs) **Study design:** Markov state transition model **Approach to analysis:** A 7-week decision tree was followed by a lifetime model Markov **Perspective:** UK NHS and patient out of pocket expenses **Time horizon:** lifetime **Treatment effect duration:**[(a)] lifetime **Discounting:** Costs: 3.5%; Outcomes: 3.5%	**Population:** Adults aged 35–44 with earwax; not necessarily having hearing loss **Cohort settings:** Start age: 35 % male: NR **Intervention 1:** No treatment **Intervention 2:** Softeners followed by self-irrigation **Intervention 3:** Softeners followed by irrigation at primary care	**Total costs (mean per patient):** Intervention 1: £178.85 Intervention 2: £294.84 Intervention 3: £335.17 Incremental 2–1: £115.99 Incremental 3–1: £156.32 Incremental 3–2: £40.33 (95% CI: NR; p=NR) **Currency & cost year:** 2007 UK pounds **Cost components incorporated:** Softeners, antibiotics and steroids (adverse events), equipment, staff time	**QALYs (mean per patient):** Intervention 1: 20.671 Intervention 2: 20.676 Intervention 3: 20.676 Incremental (2–1): 0.0050 Incremental (3–1): 0.0050 Incremental (3–2): 0.0001 (95% CI: NR; p=NR)	**ICER (Intervention 2 versus Intervention 1):** £24.450 per QALY gained (pa) 95% CI:NR Probability Intervention 2 cost effective (£20K/30K threshold): 42%/60% **ICER (Intervention 3 versus Intervention 1):** £32.138 per QALY gained (pa) 95% CI:NR Probability Intervention 3 cost effective (£20K/30K threshold): 2%/5% **ICER (Intervention 3 versus Intervention 2):** £336.083 per QALY gained (pa) 95% CI:NR Probability Intervention 3 cost effective (£20K/30K threshold): 0%/0% **Analysis of uncertainty:** Results were subject to both deterministic and probabilistic sensitivity analysis. They did not appear to be sensitive to variation in the cost of self-irrigation. They were sensitive to variation in the estimates of clinical effectiveness of softeners, self-treatment becoming cost effective if the treatment effectiveness was increased. Both treatments became highly cost effective (£2,444 or £3,211 per QALY gained) if the disutility caused by earwax was taken to be 0.06 rather than 0.006.

Data sources
Health outcomes: Drawn from a systematic literature review conducted as part of the study. **Quality-of-life weights:** Base case utility values based on the general population; decrements specific to the health states were then applied. **Cost sources:** Standard UK NHS data sources (PSSRU, NHS drug tariff, NHS reference costs) and expert advice.
Comments
Source of funding: UK National Institute for Health Research. **Limitations:** Target population was not specifically people with hearing loss and earwax. The analysis perspective was wider than NHS and PSS. The utility values were not obtained from people with earwax but were indirect. Resource use is based on assumptions and not actual study data. Measurement of effectiveness was indirect (mild to severe hearing loss) not a direct measure of the effect of hearing loss; the value used in the base case was measured used EQ-5D which is known to be insensitive to the effect of hearing loss, rather than HUI3, which was used in a sensitivity analysis.
Overall applicability:(b) partially applicable **Overall quality:**(c) minor limitations

Abbreviations: 95% CI: 95% confidence interval; CUA: cost-utility analysis; da: deterministic analysis; ICER: incremental cost-effectiveness ratio; NR: not reported; pa: probabilistic analysis; QALYs: quality-adjusted life years

(a) For studies where the time horizon is longer than the treatment duration, an assumption needs to be made about the continuation of the study effect. For example, does a difference in utility between groups during treatment continue beyond the end of treatment and if so for how long.

(b) Directly applicable / Partially applicable / Not applicable

(c) Minor limitations / Potentially serious limitations / Very serious limitations

I.6.2 Settings

None

I.7 Sudden sensorineural hearing loss

I.7.1 Treatment

None

I.7.2 Routes of administration

None

I.8 Information and advice

None

I.9 Decision tools

None

I.10 Assistive listening devices

None

I.11 Hearing aids

I.11.1 Hearing aids versus no hearing aids

Study	Joore 2003[254]			
Study details	**Population & interventions**	**Costs**	**Health outcomes**	**Cost effectiveness**
Economic analysis: CUA (health outcome: QALYs) **Study design:** Markov state transition model based on a single before-and-after trial **Approach to analysis:** patients receiving hearing aids have appointments and are modelled as satisfied or dissatisfied	**Population:** 78 adults (18+) receiving a first prescription for hearing aid(s) **Characteristics:** Age, mean (range): 69.1 (29–96) years Male: 54% Mean hearing loss at 1 kHz, 2 kHz, 4 kHz in best ear: 47.4 dB	**Total costs (mean per patient):** Mean cost: £571 (range £358–875 when cost estimates varied) [60% hearing aids, 16% batteries and repairs, 14% appointments] **Currency & cost year:** 1998 Euros (presented here as 1998 UK pounds[(b)]	**Utility gain:** HRQoL based on EQ-5D questionnaire: Change in HRQoL (after minus before): 0.03 (95% CI: −0.03 to 0.08; p=NR) HRQoL based on EQ-5D VAS: Change in HRQoL (after minus before): 0.02 (95% CI: −0.02 to 0.05; p=NR)	**ICER (after versus before):** EQ-5D questionnaire: £11,555 per QALY gained (95% CI: NR) EQ-5D VAS: £17,358 per QALY gained (95% CI: NR) Probability intervention cost effective (£20K/30K threshold): NR **Analysis of uncertainty:** One-way deterministic sensitivity

Perspective: Netherlands health service and patients (social insurance)[(a)] **Time horizon:** lifetime **Discounting:** Costs: 5%; Outcomes: 5%	**Comparator 1 (before):** Patients have hearing, HRQoL and HSQoL measured immediately before hearing aids fitted **Comparator 2 (after):** Patients have hearing, HRQoL and HSQoL measured 4 months after baseline No control group	**Cost components incorporated:** GP appointments, audiology clinic (15% patients) or ENT (85% patients) appointments, hearing aid fitting, hearing aid(s) and replacements, batteries, repairs	HSQoL based on hearing-VAS: Change in HSQoL (after minus before): 0.27 (95% CI: 0.22 to 0.31; p=NR) **Lifetime QALY gain per person**: EQ-5D questionnaire: 0.05 QALYs (95% CI: NR; p=NR) EQ-5D VAS: 0.03 QALYs (95% CI: NR; p=NR) [It is not possible to convert HSQoL into QALYs]	analysis was conducted on key parameters using EQ-5D questionnaire measure of effect. The results were very sensitive to the utility benefit: as the range for this crossed 0 then the intervention varied from not effective or cost effective when HRQoL benefit was −0.03 to highly cost effective (£4,339 per QALY gained) when HRQoL benefit was 0.08. Varying other parameters had lesser effects on the results, the greatest change being caused by varying the cost of a hearing aid from £256 to £731, which resulted in ICERs varying from £8,194 to £15,040 per QALY gained.
Data sources				
Quality-of-life: utility measurement from within trial analysis (Netherlands patients); utility weights from EQ-5D UK tariff. **Cost sources:** Netherlands health system.				
Comments				
Source of funding: Part-funded by European Hearing Instruments Manufacturers Association, along with foundations. **Limitations:** Study conducted in Netherlands. Hearing assessment pathway similar but with some differences to UK. Payment methods different (patients responsible for some costs) but analysis includes all costs that would be covered by UK NHS. Costs are based on 1998 Dutch costs, in particular hearing aids were very much more expensive than currently in the UK; however the model also assumes hearing aids are replaced much less frequently (8-15 years) than currently in the UK, and that only 25% of people will have 2 hearing aids fitted and paid for. Benefit of hearing aids was measured by an in-trial analysis of 78 patients, using EQ-5D which is known to be insensitive to the effect of hearing loss of quality of life. This gave a benefit of hearing aids greater than that measured in the UK using EQ-5D but half to a third of the benefit measured in the UK using HUI3. **Other:** none.				
Overall applicability:[(c)] Partially applicable **Overall quality**[(d)] Potentially serious limitations				

Abbreviations: 95% CI: 95% confidence interval; CUA: cost–utility analysis; EQ-5D: EuroQol 5 dimensions (scale: 0.0 [death] to 1.0 [full health]); HRQoL: health-related quality of life; HSQoL: hearing-specific quality of life; ICER: incremental cost-effectiveness ratio; NR: not reported; QALYs: quality-adjusted life years; VAS: visual analogue scale (scale 0.0 to 1.0)

(a) The perspective is given as 'societal' including productivity but excluding non-health costs (travel and patient time). In practice productivity difference was found to be 0. In Netherlands patients contribute to the cost of their hearing aids, and so the resource costs included in this analysis are generally equivalent to those that would be covered by the UK NHS, although decision-making may be influenced by the necessity for patients to contribute to costs.

(b) Converted using 1998 purchasing power parities[425]

(c) Directly applicable / Partially applicable / Not applicable

(d) Minor limitations / Potentially serious limitations / Very serious limitations

I.11.2 1 hearing aid versus 2 hearing aids

None

I.12 Hearing aid microphones and noise reduction algorithms

I.12.1 Microphones

None

I.12.2 Noise reduction algorithms

None

I.13 Monitoring and follow-up

None

I.14 Interventions to support the use of hearing aids

Study	**Vuorialho 2006[568]**			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: CCA **Study design:** within-trial analysis **Approach to analysis:** before-and-after study **Perspective:** Finnish NHS[(a)]	**Population:** Adults newly fitted with 1 hearing aid (monaural) **Characteristics:** Start age, median: 76.7, range: 47–87 % male: 54.1% Age-related hearing loss: 73.5%	**Total costs (mean per patient):** Incremental cost of follow-up appointment (2–1): £51 (95% CI: NR; p=NR) Prior cost of fitting a new hearing aid: £621 (95% CI: NR; p=NR)	**Incremental effects** Hearing aid use[(c)(d)] Regular: +16% Occasional: −12% Non-users: −4% Handling skills Can place HA in ear:[(e)] +13.3% (p<0.05) Can use HA on phone:[(e)] +42.9% (p<0.01) Can use HA well:[(d)] +17.3% (p<0.05)	**ICER (cost per QALY gained):** N/A as quality of life did not change with intervention **Cost per hearing aid user:** Cost per regular user (before): £1,015 Cost per regular user (after): £867 Cost per additional regular

Follow-up: 12 months **Discounting:** N/A	**Comparator 1 (before):** Patients assessed 6 months after receiving new hearing aids, before follow-up counselling. **Comparator 2 (after):** Patients assessed 12 months after receiving new hearing aids, 6 months after follow-up counselling. No control group.	**Currency & cost year:** 2006 Euros (presented here as 2006 UK pounds[(b)]) **Cost components incorporated:** Salary of audiology assistant who carried out the follow-up counselling appointments[(a)]	Counselling useful:[(d)] +14.2% (p<0.01) Counselling sufficient:[(d)] +19.4% (p<0.01) <u>Quality of life</u> EQ-5D:[(d)] 0.00 [Before: 0.68 (SD 0.22); After: 0.68 (0.20)] VAS:[(d)] −0.7 (p<0.05) [Before: 65.4 (16.5); After: 64.7 (15.5)] <u>Satisfaction</u>: Satisfied with HAs:[(d)] +9.2% (p>0.05)	user: £310 **Analysis of uncertainty:** No sensitivity analysis was conducted.
Data sources				
Health outcomes: within trial analysis (Finnish public health system). **Quality-of-life:** utility measurement from within trial analysis; utility weights source not reported. **Cost sources:** within trial analysis (Finnish public health system).				
Comments				
Source of funding: Not reported. **Limitations:** Study conducted in the Finnish public healthcare system – similar to the UK. Transportation costs were included, but these have been removed for our analysis. Results not given in terms of QALYs. Results are based on a single clinical trial; this was a before-and-after study so there is no independent control group. Sensitivity analysis was not undertaken. **Other:** None.				
Overall applicability:[(f)] Partially applicable **Overall quality:**[(g)] Potentially serious limitations				

Abbreviations: CCA: cost–consequences analysis; 95% CI: 95% confidence interval; EQ-5D: EuroQol 5 dimensions (scale: 0.0 [death] to 1.0 [full health], negative values mean worse than death); HA: hearing aid; ICER: incremental cost-effectiveness ratio; N/A: not applicable; NR: not reported; QALYs: quality-adjusted life years; VAS: visual analogue scale

(a) Transportation costs were also included in the published study, but these have been removed for our analysis

(b) Converted using 2006 purchasing power parities[425]

(c) Regular: more than 2 hours per day; Occasional: less than 2 hours each day, or 2–6 hours 1–6 days per week; Non-user: seldom if ever use hearing aid

(d) Self-reported

(e) Opinion of interviewer

(f) Directly applicable / Partially applicable / Not applicable

(g) Minor limitations / Potentially serious limitations / Very serious limitations

Appendix J: GRADE tables

J.1 Urgent and routine referral

J.1.1 Urgent referral

None

J.1.2 Routine referral

None

J.2 MRI

None

J.3 Subgroups

None

J.4 Early versus delayed management of hearing loss

Table 27: Clinical evidence profile: early management group versus delayed management group 1

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Early	Delayed	Relative (95% CI)	Absolute	

SSHI (follow-up mean 12 years and 4 years; scale range 0-42; Better indicated by lower values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median SHHI score was 4.5 points lower in the early intervention group	VERY LOW
ERS (follow-up mean 12 years and 4 years; scale range 0-10; Better indicated by lower values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median ERS score was 1 point lower in the early intervention group	VERY LOW
GHSI general (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	50	50	-	The median GHSI total score was 10.5 points higher in the early intervention group	VERY LOW
GHSI social support (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	50	50	-	The median GHSI total score was 0 points higher in the early intervention group	VERY LOW
GHABP use (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP use score was 29 points higher in the early intervention group	VERY LOW

GHABP benefit (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP benefit score was 18 points higher in the early intervention group	VERY LOW
GHABP residual disability (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by lower values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP residual disability score was 3 points lower in the early intervention group	VERY LOW
GHABP satisfaction (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP satisfaction score was 23 points higher in the early intervention group	VERY LOW
EuroQol thermometer (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	50	50	-	The median EuroQol thermometer score was 2.5 points lower in the early intervention group	VERY LOW

[1] Not all pre-specified confounders accounted for and different care received, such as different types of hearing aid

[2] Downgraded by 1 increments because the majority of evidence was from an indirect population/intervention (early versus delayed defined by mode of referral for hearing aid use – early screening or standard referral to hearing aid clinic at older age)

Table 28: Clinical evidence profile: early management group versus delayed management group 2

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Early**	**Delayed**	**Relative (95% CI)**	**Absolute**	
GHSI general (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	50	50	-	The median GHSI total score was 15 points higher in the early intervention group	VERY LOW
GHSI social support (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	50	50	-	The median GHSI total score was 23 points higher in the early intervention group	VERY LOW
GHABP use (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP use score was 18.5 points higher in the early intervention group	VERY LOW
GHABP benefit (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP benefit score was 13.5 points higher in the early intervention	VERY LOW

										group	
GHABP residual disability (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by lower values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP residual disability score was 9.5 points lower in the early intervention group	VERY LOW
GHABP satisfaction (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	49	50	-	The median GHABP satisfaction score was 24 points higher in the early intervention group	VERY LOW
EuroQol thermometer (follow-up mean 12 years and 4 years; scale range 0-100; Better indicated by higher values)											
1	Observational studies	very serious[1]	no serious inconsistency	serious[2]	no serious imprecision	none	50	50	-	The median EuroQol thermometer score was 7.5 points lower in the early intervention group	VERY LOW

[1] Not all pre-specified confounders accounted for and very different duration of follow-up

[2] Downgraded by 1 increments because the majority of evidence was from an indirect population/intervention (early versus delayed defined by mode of referral for hearing aid use – early screening or standard referral to hearing aid clinic at older age)

J.5 Communication needs

None

J.6 Management of earwax

J.6.1 Treatment

J.6.1.1 Earwax softeners alone versus no treatment

Table 29: Clinical evidence profile: water ear drops (repeated application) versus no treatment for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Water ear drops (repeated application) versus no treatment	Control	Relative (95% CI)	Absolute	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	20/38 (52.6%)	31.6%	RR 1.67 (0.96 to 2.91)	212 more per 1000 (from 13 fewer to 604 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence was from an indirect population (age and other factors not defined)
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 30: Clinical evidence profile: sodium bicarbonate ear drops (repeated applications) versus no treatment for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Sodium Bicarbonate ear drops (repeated applications) versus no treatment	Control	Relative (95% CI)	Absolute	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised	serious[1]	no serious	serious[2]	serious[3]	none	18/39	31.6%	RR 1.46	145 more per 1000	VERY

	trials		inconsistency				(46.2%)		(0.82 to 2.6)	(from 57 fewer to 506 more)	LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence was from an indirect population (age and other factors not defined)
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 31: Clinical evidence profile: Chlorobutanol ear drops (repeated applications) versus no treatment for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Chlorobutanol ear drops (repeated applications) versus no treatment	Control	Relative (95% CI)	Absolute	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	very serious[3]	none	14/40 (35%)	31.6%	RR 1.11 (0.59 to 2.08)	35 more per 1000 (from 130 fewer to 341 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence was from an indirect population (age and other factors not defined)
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

J.6.1.2 Earwax softeners against each other

Table 32: Clinical evidence profile: sodium bicarbonate solution versus water (repeated applications) for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Sodium Bicarbonate solution versus Water (repeated applications)	Control	Relative (95% CI)	Absolute	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	very serious[3]	none	18/39 (46.2%)	52.6%	RR 0.88 (0.56 to 1.38)	63 fewer per 1000 (from 231 fewer to 200 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence was from an indirect population (age and other factors not defined)
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 33: Clinical evidence profile: chlorobutanol solution versus water (repeated applications) for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Chlorobutanol solution versus Water (repeated applications)	Control	Relative (95% CI)	Absolute	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	24/40 (60%)	52.6%	RR 1.14 (0.77 to 1.69)	74 more per 1000 (from 121 fewer to 363 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence was from an indirect population (age and other factors not defined)
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 34: Clinical evidence profile: chlorobutanol solution versus sodium bicarbonate solution (repeated applications) for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Chlorobutanol solution versus Sodium Bicarbonate solution (repeated applications)	Control	Relative (95% CI)	Absolute	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	24/40 (60%)	46.2%	RR 1.3 (0.85 to 1.98)	139 more per 1000 (from 69 fewer to 453 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence was from an indirect population (age and other factors not defined)
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 35: Clinical evidence profile: chlorobutanol solution versus oil (repeated applications) for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Chlorobutanol solution versus Oil (repeated applications)**	**Control**	**Relative (95% CI)**	**Absolute**	
No longer impacted wax at 5 days (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	serious[3]	none	13/35 (37.1%)	20.6%	RR 1.8 (0.82 to 3.97)	165 more per 1000 (from 37 fewer to 612 more)	VERY LOW
Adverse event: discontinued due to adverse effects (follow-up mean 5 days)											
1	randomised trials	serious[1]	no serious inconsistency	serious[2]	very serious[3]	none	1/35 (2.9%)	0%	OR 7.18 (0.14 to 362.04)	29 more per 1000 (from 48 fewer to 105 more)[4]	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 or 2 increments because the majority of evidence used intervention (Cerumol ear drops) that wasn't defined in terms of active ingredients
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[4] Approximation taken from RevMan calculator

Table 36: Clinical evidence profile: Hydrogen Peroxide Urea solution ear drops versus Chlorobutanol solution ear drops (repeated applications)

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Hydrogen Peroxide Urea solution ear drops used repeatedly**	**Chlorobutanol solution ear drops used repeatedly**	**Relative (95% CI)**	**Absolute**	
No further management of wax needed (follow-up mean 1 weeks)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	10/24 (41.7%)	10/26 (38.5%)	RR 1.08 (0.55 to 2.14)	31 more per 1000 (from 173 fewer to 438 more)	VERY LOW
Adverse event: report side-effect (follow-up mean 1 weeks)											

1	randomised trials	very serious[1,3]	no serious inconsistency	no serious indirectness	very serious[2]	none	0/24 (0%)	2/26 (7.7%)	OR 0.14 (0.01 to 2.32)[4]	65 fewer per 1000 (from 76 fewer to 85 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Of particular concern, withdrawal due to side-effects not included
[4] Peto Odds Ratio used as no events in one arm

J.6.1.3 Earwax softeners to facilitate immediate irrigation

Table 37: Clinical evidence profile: water ear drops (15 minute application) prior to irrigation versus no ear drops prior to irrigation for earwax

Quality assessment							**No of patients**		**Effect**		**Quality**
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Water ear drops (15 minute application) prior to irrigation**	**No ear drops prior to irrigation**	**Relative (95% CI)**	**Absolute**	
Attempts needed to syringe until visibly clear of wax (follow-up mean 15 minutes; range of scores: 0-unstated; Better indicated by lower values)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	22	17	-	MD 17.9 lower (36.88 lower to 1.08 higher)	LOW
Adverse outcomes for syringing (follow-up mean 15 minutes)											
1	randomised trials	very serious[1,3]	no serious inconsistency	no serious indirectness	very serious[2]	none	1/22 (4.5%)	5.9%	RR 0.77 (0.05 to 11.48)	14 fewer per 1000 (from 56 fewer to 618 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Single event in both arms was in the same participant

Table 38: Clinical evidence profile: sodium bicarbonate solution (30 minute application) prior to irrigation versus no ear drops prior to irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Sodium bicarbonate solution (30 minute application) prior to irrigation	No ear drops prior to irrigation	Relative (95% CI)	Absolute	
Wax cleared by 5 minute irrigation (follow-up mean 35 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	31/37 (83.8%)	75.7%	RR 1.11 (0.88 to 1.4)	83 more per 1000 (from 91 fewer to 303 more)	LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 39: Clinical evidence profile: hydrogen peroxide urea solution (30 minute application) prior to irrigation versus no ear drops prior to irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Hydrogen Peroxide Urea solution (30 minute application) prior to irrigation	No ear drops prior to irrigation	Relative (95% CI)	Absolute	
Wax cleared by 5 minute irrigation (follow-up mean 35 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	33/37 (89.2%)	75.7%	RR 1.18 (0.95 to 1.46)	136 more per 1000 (from 38 fewer to 348 more)	LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 40: Clinical evidence profile: olive oil (30 minute application) prior to irrigation versus no ear drops prior to irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Olive oil (30 minute application) prior to irrigation**	**No ear drops prior to irrigation**	**Relative (95% CI)**	**Absolute**	
Wax cleared by 5 minute irrigation (follow-up mean 35 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	35/37 (94.6%)	75.7%	RR 1.25 (1.03 to 1.52)	189 more per 1000 (from 23 more to 394 more)	LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 41: Clinical evidence profile: chlorobutanol solution ear drops (30 minute application) prior to irrigation versus saline ear drops (30 minute application) prior to irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Chlorobutanol solution ear drops (30 minute application) prior to irrigation**	**Saline ear drops (30 minute application) prior to irrigation**	**Relative (95% CI)**	**Absolute**	
Complete visualisation of TM after syringing (follow-up 15 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	21/32 (65.6%)	42.9%	RR 1.53 (0.93 to 2.51)	227 more per 1000 (from 30 fewer to 648 more)	LOW
Adverse events prior to syringing (follow-up mean 15 minutes)											
1	randomised	very	no serious	no serious	very serious	none	0/32	0%	See	0 fewer per 1000	LOW

	trials	serious[1]	inconsistency	indirectness	imprecision[3]		(0%)		comment	(from 59 fewer to 59 more)[4]	

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] No events in either arms, therefore assumed to cross both MIDs
[4] Estimated using RevMan calculation

Table 42: Clinical Evidence Profile: hydrogen peroxide urea solution (30 minute application) ear drops prior to irrigation versus sodium bicarbonate (30 minute application) prior to irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Hydrogen Peroxide Urea solution (30 minute application) ear drops prior to irrigation	Sodium Bicarbonate (30 minute application) prior to irrigation	Relative (95% CI)	Absolute	
Wax cleared by 5 minute irrigation (follow-up mean 35 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	33/37 (89.2%)	83.8%	RR 1.06 (0.89 to 1.28)	50 more per 1000 (from 92 fewer to 235 more)	LOW
Adverse events prior to syringing: discomfort (follow-up mean 30 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	6/37 (16.2%)	10.8%	RR 1.5 (0.46 to 4.88)	54 more per 1000 (from 58 fewer to 419 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 43: Clinical Evidence Profile: hydrogen peroxide urea solution ear drops (30 minute application) prior to irrigation versus olive oil (30 minute application) prior to irrigation for earwax

Quality assessment	No of patients	Effect	Quality

No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Hydrogen Peroxide Urea solution ear drops (30 minute application) prior to irrigation	Olive Oil (30 minute application) prior to irrigation	Relative (95% CI)	Absolute	
Wax cleared by 5 minute irrigation (follow-up mean 35 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	33/37 (89.2%)	94.6%	RR 0.94 (0.82 to 1.08)	57 fewer per 1000 (from 170 fewer to 76 more)	MODERATE
Adverse events prior to syringing: discomfort (follow-up mean 30 minutes)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	6/37 (16.2%)	10.8%	RR 1.5 (0.46 to 4.88)	54 more per 1000 (from 58 fewer to 419 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 44: Clinical Evidence Profile: Docusate solution ear drops (repeated applications) prior to delayed irrigation versus Sodium Bicarbonate solution ear drops (repeated applications) prior to delayed irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Docusate solution ear drops (repeated applications) prior to delayed irrigation**	**Sodium Bicarbonate solution ear drops (repeated applications) prior to delayed irrigation**	**Relative (95% CI)**	**Absolute**	
Successful syringing at 3 days (follow-up mean 3 days)											
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	21/25 (84%)	84.7%	RR 0.99 (0.82 to 1.2)	8 fewer per 1000 (from 152 fewer to 169 more)	HIGH
Adverse event: otitis externa (follow-up mean 3 days)											
1	randomised	serious[1]	no serious	no serious	serious[2]	none	2/26	2.4%	RR 3.18	52 more per	LOW

	trials		inconsistency	indirectness			(7.7%)		(0.56 to 18.09)	1000 (from 11 fewer to 410 more)	

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 45: Clinical Evidence Profile: Hydrogen Peroxide Urea solution prior to irrigation versus Sodium Chloride (Saline) prior to irrigation (up to 2x15 minute applications)

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Hydrogen Peroxide Urea solution up to 2x15 minute applications	Sodium Chloride (Saline) up to 2x15 minute applications	Relative (95% CI)	Absolute	
Complete visualisation of TM after syringing (1st attempt) (follow-up mean 30 minutes)											
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[1]	none	3/26 (11.5%)	2/24 (8.3%)	RR 1.38 (0.25 to 7.59)	32 more per 1000 (from 62 fewer to 549 more)	⊕⊕OO LOW
Complete visualisation of TM after syringing (2nd attempt) (follow-up mean 30 minutes)											
1	randomised trials	serious[2]	no serious inconsistency	no serious indirectness	serious[1]	none	4/26 (15.4%)	10/24 (41.7%)	RR 0.37 (0.13 to 1.02)	263 fewer per 1000 (from 363 fewer to 8 more)	⊕⊕OO LOW
Adverse events: reported side-effects from ear drops (follow-up mean 30 minutes)											
1	randomised trials	serious[2]	no serious inconsistency	no serious indirectness	very serious[1]	none	2/26 (7.7%)	1/24 (4.2%)	RR 1.85 (0.18 to 19.08)	35 more per 1000 (from 34 fewer to 753 more)	⊕OOO VERY LOW

[1] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[2] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

J.6.1.4 Earwax softeners to facilitate delayed irrigation

Table 46: Clinical Evidence Profile: olive oil ear drops (repeated applications) prior to delayed irrigation versus sodium bicarbonate solution ear drops (repeated applications) prior to delayed irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Olive oil ear drops (repeated applications) prior to delayed irrigation	Sodium Bicarbonate solution ear drops (repeated applications) prior to delayed irrigation	Relative (95% CI)	Absolute	
Successful syringing at 3 days (follow-up mean 3 days)											
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[1]	none	23/25 (92%)	84.7%	RR 1.09 (0.95 to 1.25)	76 more per 1000 (from 42 fewer to 212 more)	MODERATE
Adverse event: otitis externa (follow-up mean 3 days)											
1	randomised trials	serious[2]	no serious inconsistency	no serious indirectness	very serious[1]	none	0/25 (0%)	2.4%	OR 0.3 (0.01 to 6.24)	17 fewer per 1000 (from 24 fewer to 109 more)	VERY LOW

[1] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[2] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

Table 47: Clinical Evidence Profile: docusate solution ear drops (repeated application) prior to delayed irrigation versus oil ear drops (repeated applications) prior to delayed irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Docusate solution ear drops (repeated application) prior to delayed irrigation versus Oil ear drops (repeated	Control	Relative (95% CI)	Absolute	

							applications) prior to delayed irrigation				
Successful syringing at 3 days (follow-up mean 3 days)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	23/25 (92%)	92%	RR 1 (0.85 to 1.18)	0 fewer per 1000 (from 138 fewer to 166 more)	MODERATE
Adverse event: otitis externa (follow-up mean 3 days)											
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious imprecision[3]	none	0/25 (0%)	0%	See comment	0 fewer per 1000 (from 75 fewer to 75 more)[2]	LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Estimated using RevMan calculator
[3] No events in either arm, therefore confidence interval assumed to cross both MIDs, Downgraded by 2 increments as the confidence interval crossed both MIDs

Table 48: Clinical Evidence Profile: water (single application) prior to immediate irrigation versus oil ear drops (repeated applications) prior to delayed irrigation for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Water (single application) prior to immediate irrigation**	**Oil ear drops (repeated applications) prior to delayed irrigation**	**Relative (95% CI)**	**Absolute**	
Wax cleared at up to five syringes (follow-up 0-3 days[1])											
1	randomised trials	very serious[2]	no serious inconsistency	no serious indirectness	no serious imprecision	none	21/22 (95.5%)	95.5%	RR 1.04 (0.92 to 1.19)	38 more per 1000 (from 76 fewer to 181 more)	LOW
Ease of syringing - number of syringes needed to clear (follow-up 0-3 days[1]; range of scores: 1-6; Better indicated by lower values)											
1	randomised trials	very serious[2]	no serious inconsistency	no serious indirectness	serious[3]	none	22	20	-	MD 0.6 higher (0.32 lower to 1.52 higher)	VERY LOW

[1] One arm had immediate irrigation, the other had after three days
[2] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 49: Clinical Evidence Profile: home syringing kit with ear drops versus ear drops plus irrigation in GP clinic for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic	Control	Relative (95% CI)	Absolute	
No impacted wax at follow-up (one to two weeks) (follow-up 1-2 weeks)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	50/104 (48.1%)	62.8%	RR 0.77 (0.6 to 0.98)	144 fewer per 1000 (from 13 fewer to 251 fewer)	LOW
Change in symptom score (scale 0-6, 6 high) (follow-up 1-2 days; Better indicated by lower values)											
1	randomised trials	serious[1]	no serious inconsistency	serious[3]	serious[2]	none	110	108	-	MD 0.45 lower (0.8 to 0.1 lower)	VERY LOW
Consulted again with wax-related symptoms in next two years (follow-up mean 2 years)											
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	70/117 (59.8%)	72.7%	RR 0.82 (0.68 to 0.99)	131 fewer per 1000 (from 7 fewer to 233 fewer)	VERY LOW
Adverse event: otitis externa at follow-up (follow-up 1-2 weeks)											
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	1/97 (1%)	1.1%	RR 0.97 (0.06 to 15.27)	0 fewer per 1000 (from 10 fewer to 157 more)	VERY LOW
Adverse event: perforation at follow-up (follow-up 1-2 weeks)											
1	randomised trials	very serious[1]	no serious inconsistency	serious[4]	very serious[2]	none	1/97 (1%)	1.1%	RR 0.97 (0.06 to 15.27)	0 fewer per 1000 (from 10 fewer to 157 more)	VERY LOW

Adverse event: discomfort during treatment (follow-up 1-2 weeks)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	43/110 (39.1%)	32.4%	RR 1.21 (0.84 to 1.73)	68 more per 1000 (from 52 fewer to 237 more)	LOW
Adverse event: dizziness during treatment (follow-up 1-2 weeks)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	14/110 (12.7%)	13%	RR 0.98 (0.49 to 1.96)	3 fewer per 1000 (from 66 fewer to 125 more)	VERY LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Downgraded by 1 or 2 increments because the majority of evidence was based on a scale that had not been externally validated
[4] Downgraded by 1 or 2 increments because the outcome was shown to be unreliable (inability to ascertain lack of ear drum perforation prior to intervention)

Table 50: Clinical Evidence Profile: clinic irrigation following ear drops versus ear drops alone for earwax

Quality assessment							No of patients		Effect		Quality
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Clinic irrigation following ear drops**	**Ear drops alone**	**Relative (95% CI)**	**Absolute**	
Hearing improved by at least 10 dB HL (assessed with: PTA)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	18/53 (34%)	1.6%	RR 20.72 (2.86 to 150.01)	316 more per 1000 (from 30 more to 1000 more)	MODERATE
Improvement in hearing - Improvement in hearing (Better indicated by lower values)											
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	53	61	-	MD 6.9 higher (3.8 to 10 higher)	LOW

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

J.6.2 Settings

None

J.7 Sudden sensorineural hearing loss

J.7.1 Treatment

Table 51: Clinical evidence profile: First-line treatment – steroid (oral/IT) versus placebo (oral/IT) [Prednisolone versus placebo]

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Steroid	Placebo	Relative (95% CI)	Absolute		
Change in PTA - Day 8 (follow-up 8 days; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	47	46	-	MD 0.9 lower (11.73 lower to 9.93 higher)	⊕⊕OO LOW	CRITICAL
Change in PTA - Day 90 (follow-up 90 days; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	47	46	-	MD 3.9 higher (8.57 lower to 16.37 higher)	⊕⊕OO LOW	CRITICAL
Recovery - Day 8 (oral) (follow-up 8 days[2])												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	53/51 (103.9%)	17.3%	RR 1.25 (0.56 to 2.75)	43 more per 1000 (from 76 fewer to 303 more)	⊕OOO VERY LOW	CRITICAL
Recovery - 1 month (IT) (follow-up 1 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	19/25 (76%)	20%	RR 3.8 (1.68 to 8.58)	560 more per 1000 (from 136 more to 1000 more)	⊕⊕⊕O MODERATE	CRITICAL
Recovery - Day 90 (oral) (follow-up 90 days[2])												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	18/51 (35.3%)	34.6%	RR 1.02 (0.6 to 1.73)	7 more per 1000 (from 138 fewer to 253 more)	⊕OOO VERY LOW	CRITICAL
Adverse events (follow-up 90 days)												

1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	15/51 (29.4%)	21.2%	RR 1.39 (0.71 to 2.73)	83 more per 1000 (from 61 fewer to 367 more)	⊕OOO VERY LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] The recovery data are based on the same dataset as the change in PTA, but presented as a dichotomous outcome
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 52: Clinical evidence profile: First-line treatment – steroid (oral/IT) versus steroid (oral) [dexamethasone versus prednisolone]

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Dexamethasone**	**Prednisolone**	**Relative (95% CI)**	**Absolute**		
PTA Final score (Better indicated by lower values)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	53	53	-	MD 6.64 lower (17.58 lower to 4.3 higher)	⊕⊕OO LOW	CRITICAL
Recovery - symmetrical hearing, interaural hearing difference of <20 dB HL (follow-up 12 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	22/36 (61.1%)	54.3%	RR 1.13 (0.75 to 1.68)	71 more per 1000 (from 136 fewer to 369 more)	⊕OOO VERY LOW	CRITICAL
Recovery - Recovery of hearing to within 5% points of the contraleral SDS or within 5 dB of the contralateral PTA (follow-up 7 weeks (4 weeks after last injection))												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	5/17 (29.4%)	16.7%	RR 1.76 (0.5 to 6.28)	127 more per 1000 (from 84 fewer to 882 more)	⊕OOO VERY LOW	CRITICAL
Speech discrimination of 100% (recognised all words at their optimum sound level) (follow-up 12 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23/36 (63.9%)	57.1%	RR 1.12 (0.77 to 1.63)	69 more per 1000 (from 131 fewer to 360 more)	⊕OOO VERY LOW	CRITICAL
Mean speech discrimination (% words successfully discriminated) (follow-up 7 weeks (4 weeks after last injection); Better indicated by lower values)												

1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	17	18	-	MD 6 higher (20.88 lower to 32.88 higher)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 53: Clinical evidence profile: First-line treatment – steroid (oral) plus steroid (IT) versus steroid (oral/IT) [prednisolone oral plus dexamethasone IT versus placebo oral/IT plus dexamethasone oral/IT]

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Dual steroids (oral plus IT)**	**Single steroid (oral/IT)**	**Relative (95% CI)**	**Absolute**		
PTA Final score - oral versus oral plus IT (follow-up 7 weeks (4 weeks after last injection); Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	18	-	MD 24 lower (42.39 to 5.61 lower)	⊕⊕OO LOW	CRITICAL
PTA Final score - IT versus oral plus IT (follow-up 7 weeks (4 weeks after last injection); Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	17	-	MD 16 lower (31.72 to 0.28 lower)	⊕⊕OO LOW	CRITICAL
Recovery (follow-up 7-12 weeks)												
2	randomised trials	serious[1]	serious[3]	no serious indirectness	serious[2]	none	25/76 (32.9%)	24.8%	RR 1.37 (0.87 to 2.15)	92 more per 1000 (from 32 fewer to 285 more)	⊕OOO VERY LOW	CRITICAL
Mean speech discrimination (% words successfully discriminated) - Oral versus oral plus IT (follow-up 7 weeks (4 weeks after last injection); Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	18	-	MD 31 higher (7.76 to 54.24 higher)	⊕⊕OO LOW	CRITICAL

Mean speech discrimination (% words successfully discriminated) - IT versus oral plus IT (follow-up 7 weeks (4 weeks after last injection); Better indicated by lower values)											
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	16	17	-	MD 25 higher (4.11 to 45.89 higher)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Downgraded by 1 or 2 increments because of heterogeneity unexplained by subgroup analysis.

Table 54: Clinical evidence profile: First-line treatment – steroid (oral/IV) plus antiviral (oral/IV) versus steroid (oral/IV) [prednisolone oral or hydrocortisone IV plus acyclovir or valacyclovir versus prednisolone oral or hydrocortisone IV]

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Steroid plus antiviral**	**Steroid**	**Relative (95% CI)**	**Absolute**		
PTA Final score (follow-up 6 weeks; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	39	29	-	MD 6.4 higher (9 lower to 21.8 higher)	⊕OOO VERY LOW	CRITICAL
Recovery - within 10 dB of non-affected ear (follow-up 6 weeks)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	15/39 (38.5%)	48.3%	RR 0.8 (0.46 to 1.38)	97 fewer per 1000 (from 261 fewer to 184 more)	⊕OOO VERY LOW	CRITICAL
Improvement (follow-up 6 weeks)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	23/29 (79.3%)	77.4%	RR 1.02 (0.79 to 1.34)	15 more per 1000 (from 163 fewer to 263 more)	⊕OOO VERY LOW	CRITICAL
Mean speech discrimination (% words successfully discriminated) (follow-up 6 weeks; Better indicated by lower values)												

1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	39	29	-	MD 4.6 higher (15.51 lower to 24.71 higher)	⊕OOO VERY LOW	CRITICAL
Adverse events (follow-up 7 days)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/21 (9.5%)	27.3%	RR 0.35 (0.08 to 1.54)	177 fewer per 1000 (from 251 fewer to 147 more)	⊕OOO VERY LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 55: Clinical evidence profile: Second-line treatment – steroid versus placebo or no treatment [Prednisolone or dexamethasone versus placebo or no treatment]

Quality assessment							**No of patients**		**Effect**		**Quality**	**Importance**
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Second-line treatment: steroid**	**Second-line treatment: placebo /no treatment**	**Relative (95% CI)**	**Absolute**		
PTA Final score (follow-up 8 weeks; Better indicated by lower values)												
4	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	75	73	-	MD 11.44 lower (19.47 to 3.41 lower)	⊕OOO VERY LOW	CRITICAL
Recovery - Successful treatment according to Ho et al, complete and marked recovery: 6 PTA≤25 dB and 6PTA improvement >30 dB (follow-up 2 weeks)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	2/10 (20%)	0%	POR 8.26 (0.48 to 142.43)	-	⊕OOO VERY LOW	CRITICAL
Improvement (follow-up 6 weeks)												

1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	12/27 (44.4%)	10.7%	RR 4.15 (1.31 to 13.09)	337 more per 1000 (from 33 more to 1000 more)	⊕⊕⊕⊕ HIGH	CRITICAL
Speech discrimination (change in maximum % speech discrimination for monosyllables) (follow-up 2 weeks; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	11	10	-	MD 19.9 higher (0.41 to 39.39 higher)	⊕⊕OO LOW	CRITICAL
Adverse events: perforation of tympanic membrane (follow-up 6 weeks)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	very serious[2]	none	1/27 (3.7%)	0%	POR 7.67 (0.15, 386.69)	-	⊕⊕OO LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

J.7.2 Routes of administration

Table 56: Clinical evidence profile: Steroid (IT) versus steroid (oral) [IT prednisolone, methylprednisolone or dexamethasone versus oral prednisolone]

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	IT	Oral steroid	Relative (95% CI)	Absolute		
PTA improvement (follow-up 3 weeks - 6 months; Better indicated by higher values)												
5	randomised trials	very serious[1]	serious[2]	no serious indirectness	no serious imprecision	none	213	204	-	MD 1.19 higher (3.41 lower to 5.78 higher)	⊕OOO VERY LOW	CRITICAL
Recovery (follow-up 17-60 days)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	8/40 (20%)	24.1%	RR 0.84 (0.37 to 1.91)	39 fewer per 1000 (from 152 fewer to 219 more)	⊕OOO VERY LOW	CRITICAL
Word recognition score improvement - 2 months (follow-up 2 months; Better indicated by lower values)												

1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	129	121	-	MD 0.4 lower (8.8 lower to 8 higher)	⊕⊕⊕O MODERATE	CRITICAL
Word recognition score improvement - 6 months (follow-up 6 months; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	129	121	-	MD 0.6 lower (9.29 lower to 8.09 higher)	⊕⊕OO LOW	CRITICAL
Patients with adverse events (follow-up 2-6 months)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	116/129 (89.9%)	87.6%	RR 1.03 (0.94 to 1.12)	26 more per 1000 (from 53 fewer to 105 more)	⊕⊕⊕⊕ HIGH	IMPORTANT
Serious adverse events - Treatment-related serious adverse events (follow-up 2 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	0/129 (0%)	0.8%	RR 0.31 (0.01 to 7.61)	6 fewer per 1000 (from 8 fewer to 53 more)	⊕OOO VERY LOW	IMPORTANT
Adverse events - Mood change (follow-up 2-6 months)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	14/148 (9.5%)	42.3%	RR 0.22 (0.13 to 0.37)	330 fewer per 1000 (from 266 fewer to 368 fewer)	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Blood glucose problem (follow-up 2-6 months)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[3]	none	24/148 (16.2%)	29.9%	RR 0.54 (0.35 to 0.85)	138 fewer per 1000 (from 45 fewer to 194 fewer)	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Sleep change (follow-up 2-6 months)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	10/148 (6.8%)	33.2%	RR 0.19 (0.1 to 0.36)	269 fewer per 1000 (from 212 fewer to 299 fewer)	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Increased appetite (follow-up 2-6 months)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	7/148 (4.7%)	24.1%	RR 0.2 (0.09 to 0.44)	193 fewer per 1000 (from 135 fewer to 219 fewer)	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Earache (follow-up 2-6 months)												

2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	74/148 (50%)	1.7%	RR 15.68 (6.22 to 39.49)	250 more per 1000 (from 89 more to 654 more)	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Injection site pain (follow-up 2-6 months)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	37/148 (25%)	0%	RR 36.8 (4.99 to 271.62)	-	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Mouth dryness/thirst (follow-up 2-6 months)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	5/148 (3.4%)	24.9%	RR 0.15 (0.06 to 0.35)	212 fewer per 1000 (from 162 fewer to 234 fewer)	⊕⊕⊕O MODERATE	IMPORTANT
Adverse events - Weight gain (follow-up 2-6 months)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	7/148 (4.7%)	16.6%	RR 0.28 (0.13 to 0.61)	120 fewer per 1000 (from 65 fewer to 144 fewer)	⊕⊕OO LOW	IMPORTANT
Adverse events - Dizziness/vertigo (follow-up 6 months)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	35/129 (27.1%)	10.7%	RR 2.53 (1.41 to 4.54)	164 more per 1000 (from 44 more to 379 more)	⊕⊕⊕⊕ HIGH	IMPORTANT
Adverse events - Ear infection (follow-up 6 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	7/129 (5.4%)	1.7%	RR 3.28 (0.7 to 15.49)	39 more per 1000 (from 5 fewer to 246 more)	⊕OOO VERY LOW	IMPORTANT
Adverse events - Tympanic membrane perforation (follow-up 6 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[3]	none	5/129 (3.9%)	0%	OR 7.17 (1.22 to 42.01)	-	⊕OOO VERY LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 or 2 increments because of heterogeneity, I2>50%, p<0.04, unexplained by subgroup analysis.
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 57: Clinical evidence profile: Steroid (IV) versus steroid (oral) [IV methylprednisolone followed by oral prednisolone versus oral prednisolone]

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	IV	Oral steroid	Relative (95% CI)	Absolute		
PTA improvement (follow-up 3 months; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	29	31	-	MD 5.4 higher (12.35 lower to 23.15 higher)	⊕OOO VERY LOW	CRITICAL
Recovery - Complete recovery: return to within 10 dB HL of the unaffected ear and recovery of WRS to within 5%-10% of the unaffected ear (follow-up 3 months)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	7/29 (24.1%)	19.4%	RR 1.25 (0.47 to 3.28)	48 more per 1000 (from 103 fewer to 442 more)	⊕OOO VERY LOW	CRITICAL
Word recognition score % improvement (follow-up 3 months; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	29	31	-	MD 4.52 lower (25.69 lower to 16.65 higher)	⊕OOO VERY LOW	CRITICAL
Adverse events or complications (follow-up 3 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/29 (0%)	0%	not pooled	not pooled	⊕⊕⊕O MODERATE	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 58: Clinical evidence profile: Dual steroid (IT plus oral) versus steroid (oral) [IT dexamethasone or methylprednisolone plus oral prednisolone versus oral prednisolone]

Quality assessment	No of patients	Effect	Quality	Importance

No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Dual	Oral steroids	Relative (95% CI)	Absolute		
PTA change or final score - Oral every day (follow-up 10 days - 7 weeks; Better indicated by lower values)												
4	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	87	90	-	MD 15.39 lower (18.3 to 12.48 lower)	⊕OOO VERY LOW	CRITICAL
PTA change score - Oral every other day (follow-up 10 days; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	15	16	-	MD 2.45 lower (5.00 lower to 0.10 higher)	⊕OOO VERY LOW	CRITICAL
Complete recovery (follow-up 3-12 weeks)												
4	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	47/133 (35.3%)	27.2%	RR 1.4 (0.86 to 2.27)	109 more per 1000 (from 38 fewer to 345 more)	⊕OOO VERY LOW	CRITICAL
Speech discrimination score improvement or final score - Oral every day (follow-up 10 days - 7 weeks; Better indicated by lower values)												
3	randomised trials	very serious[1]	serious[3]	no serious indirectness	no serious imprecision	none	67	70	-	MD 6.50 higher (1.78 to 11.23 higher)	⊕OOO VERY LOW	CRITICAL
Speech discrimination score improvement score - Oral every other day (follow-up 10 days; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	15	16	-	MD 7.29 lower (9.08 lower to 5.50 lower)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Significant heterogeneity unexplained by pre-defined subgroups

Table 59: Clinical evidence profile: Dual steroid (IT plus oral) versus steroid (IT) [IT dexamethasone plus oral prednisolone versus IT dexamethasone]

Quality assessment	No of patients	Effect	Quality	Importance

No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Dual**	**IT steroids**	**Relative (95% CI)**	**Absolute**		
PTA improvement or final score (follow-up 3-7 weeks; Better indicated by lower values)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[1,2]	none	36	37	-	MD 12.35 lower (22.44 to 2.27 lower)	⊕OOO VERY LOW	CRITICAL
Complete recovery (follow-up 7 weeks)												
2	randomised trials	very serious[1]	no serious inconsistency	Serious[3]	Serious[2]	none	18/36 (50%)	22%	RR 2.33 (1.18 to 4.62)	295 more per 1000 (from 40 more to 804 more)	⊕OOO VERY LOW	CRITICAL
Speech discrimination score improvement or final score (follow-up 7 weeks; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	Serious[3]	Serious[2]	none	16	17	-	MD 25 higher (4.11 to 45.89 higher)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Intratympanic dosing not representative of UK practice

Table 60: Clinical evidence summary: Dual steroid (IT plus oral) plus antiviral versus single steroid (oral) plus antiviral [IT dexamethasone plus oral prednisolone plus oral acyclovir versus oral prednisolone plus oral acyclovir] for poor prognosis cases

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Dual steroid plus antiviral**	**Single steroid plus antiviral**	**Relative (95% CI)**	**Absolute**		
Improvement in PTA (follow-up 1 month; Better indicated by lower values)												

1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	36	41	-	MD 8.8 higher (0.91 lower to 18.51 higher)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

J.8 Information and advice

None

J.9 Decision tools

None

J.10 Assistive listening devices

Table 61: Clinical evidence profile: ALD versus no ALD

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Assistive listening devices	No assistive listening devices	Relative (95% CI)	Absolute		
Number of communication breakdowns (Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	7	5	-	MD 11.03 lower (16.77 to 5.29 lower)	LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

J.11 Hearing aids

J.11.1 Hearing aids versus no hearing aids

Table 62: Clinical evidence profile: hearing aids versus no hearing aids for mild to moderate hearing loss in adults

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Hearing aids**	**no hearing aids or placebo hearing aids**	**Relative (95% CI)**	**Absolute (95% CI)**		
Hearing-specific health-related quality of life (follow-up: range 6 weeks to 16 weeks; assessed with: HHIE (range 0 to 100))[a]												
3	randomised trials	serious [b,c,d,e]	not serious	not serious	not serious	none	385	337	-	mean 26 lower (42 lower to 11 lower)	⊕⊕⊕○ MODERATE	
Health-related quality of life (follow-up: range 2 months to 16 weeks; assessed with: WHO-DAS II (range 0 to 100) or SELF (range 54 to 216))												
2	randomised trials	serious [b,e]	not serious	not serious	not serious	none	281	287	-	SMD 0.38 SD lower (0.55 lower to 0.21 lower)	⊕⊕⊕○ MODERATE	
Listening difficulty (follow-up: range 6 weeks to 2 months; assessed with: PHAP (range 0 to 1) or APHAB (range 0 to 100))												

Quality assessment							№ of patients		Effect		Quality	Importance
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Hearing aids**	**no hearing aids or placebo hearing aids**	**Relative (95% CI)**	**Absolute (95% CI)**		
2	randomised trials	serious[b,c,d,e]	not serious	not serious	not serious	none	293	241	-	SMD 1.88 SD lower (3.24 lower to 0.52 lower)	⊕⊕⊕◯ MODERATE	
Adverse effect - noise-induced hearing loss												
1	randomised trials	not serious	not serious	serious[f]	very serious[f]	none	Adverse effects related to pain were measured in one study: none were reported.				⊕◯◯◯ VERY LOW	
Adverse effect - noise-induced hearing loss												
1	randomised trials	not serious	not serious	serious[f]	very serious[f]	none	Adverse effects related to noise-induced hearing loss were measured in one study: none were reported.				⊕◯◯◯ VERY LOW	

Abbreviations: **CI:** Confidence interval; **SMD:** Standardised mean difference; **RR:** Risk ratio

Explanations

[a] Hearing Handicap Inventory for the Elderly (HHIE), Self Evaluation of Life Function (SELF), World Health Organisation Disability Assessment Schedule II (WHO-DAS II) , Profile of Hearing Aid Performance (PHAP), Abbreviated Profile of Hearing Aid Benefit (APHAB)

[b] Quality of evidence downgraded by 1 level because unclear or high risk of selection, performance and detection bias.

[c] We considered downgrading for inconsistency due to observed statistical heterogeneity but did not apply this. The data consistently showed large beneficial effects of using hearing aids for mild to moderate hearing loss despite the apparent differences in study designs and populations. Our confidence in the size of the effect is not affected.

[d] We considered downgrading due to indirectness as some data were obtained after a short follow-up period (six weeks) but did not apply this. Large beneficial effects were observed regardless of duration of follow-up.

[e] We considered downgrading due to indirectness as some analyses included data from male military veterans but we did not apply this. Effect sizes were consistent within each outcome despite differences in study samples and designs (small beneficial effect for HRQoL; large beneficial effect for hearing-specific HRQoL and listening ability).

[f] Very serious imprecision as the sample size was very small. There was serious indirectness because only people with mild to moderate Alzheimer's disease were included in the study

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Hearing aids versus no/placebo hearing aids**	**Control**	**Relative (95% CI)**	**Absolute**		
Hearing-specific health-related quality of life -												
1	randomised trials	serious	no serious inconsistency	serious	serious	none	104	50	-	MD 10.54 lower (15.26 to 5.82 lower)	⊕OOO	CRITICAL
Hearing-specific												
2	randomised trials	serious	no serious inconsistency	no serious indirectness	no serious imprecision	none	281	287	-	MD 33.43	⊕⊕⊕O	CRITICAL
Health-related quality of life (WHO Disability Assessment Schedule 2.0 (range 0-100, lower is better))												
1	randomised trials	serious	no serious inconsistency	no serious indirectness	serious	none	189	191	-	MD 6.46 lower (9.38 to 3.54 lower)	⊕⊕OO	CRITICAL
Health-related quality of life (Self-evaluation of Life Function (range 0-100, lower is better))												
1	randomised trials	serious	no serious inconsistency	no serious indirectness	serious	none	92	96	-	MD 4.8 lower (10.09 lower to 0.49 higher)	⊕⊕OO	CRITICAL
Listening ability (Profile of hearing aid performance (PHAP, range 0-1, lower is better))												
1	randomised trials	serious	no serious inconsistency	no serious indirectness	no serious imprecision	none	104	50	-	MD 0.15 lower (0.2 to 0.1 lower)	⊕⊕⊕O	IMPORTANT
Listening ability (Abbreviated profile of hearing aid benefit (APHAB, range 0-100, lower is better))												
1	randomised trials	serious	no serious inconsistency	no serious indirectness	no	none	189	191	-	MD 33.1 lower (35.68 to 30.52 lower)	⊕⊕⊕O	IMPORTANT

J.11.2 1 hearing aid versus 2 hearing aids

None

J.12 Hearing aid microphones and noise reduction algorithms

J.12.1 Microphones

Table 63: Clinical evidence profile: directional microphones versus omnidirectional microphones

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Directional microphones**	**Omnidirectional microphones**	**Relative (95% CI)**	**Absolute**		
Self-perceived level of ability to tell the direction of sounds (localisation disability) (follow-up mean 3 months; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[1]	none	19	19	-	MD 0.08 lower (67.97 lower to 67.81 higher)	VERY LOW	IMPORTANT
Self-perceived amount of withdrawal from activities of daily living (localisation handicap) (follow-up mean 3 months; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[1]	none	19	19	-	MD 0.05 higher (12.66 lower to 12.76 higher)	VERY LOW	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias or by 2 increments if the majority of the evidence was at very high risk of bias.

[2] Downgraded by 1 increment if the confidence interval crossed 1 MID or by 2 increments if the confidence interval crossed both MIDs.

J.12.2 Noise reduction algorithms

None

J.13 Monitoring and follow-up

None

J.14 Interventions to support the use of hearing aids

Table 64: Clinical evidence profile: self-management support interventions versus control

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Self-management support interventions versus control**	**Control**	**Relative (95% CI)**	**Absolute**		
Adherence												
0	No evidence available	-	-	-	-	-	-	-	-	-	-	-
Hearing aid use (>8 h/day) (follow-up 8-10 weeks)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	4/20 (20%)	5%	RR 4 (0.49 to 32.72)	150 more per 1000 (from 25 fewer to 1000 more)	VERY LOW	
Adverse effects												
0	No evidence available	-	-	-	-	-	-	-	-	-	-	-
Quality of life - short/medium-term (follow-up 0–12 months; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	17	18	-	MD 9.1 lower (21.33 lower to 3.13 higher)	VERY LOW	
Self-reported hearing handicap - short/medium-term (follow-up 0–12 months; Better indicated by lower values)												
2	randomised	serious[1]	no serious	no serious	serious[2]	none	43	44	-	MD 12.8 lower (23.11	LOW	

	trials		inconsistency	indirectness						to 2.48 lower)		
Hearing aid benefit												
0	No evidence available	-	-	-	-	-	-	-	-	-	-	-
Use of verbal communication strategy - short-term (follow-up 0–12 months; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	26	26	-	MD 0.72 higher (0.21 to 1.23 higher)	LOW	

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 65: Clinical evidence profile: delivery system design interventions versus control

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Delivery system design interventions versus control	Control	Relative (95% CI)	Absolute		
Adherence - short/medium-term (follow-up 0–12 months)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	329/342 (96.2%)	92.8%	RR 1.02 (0.99 to 1.05)	19 more per 1000 (from 9 fewer to 46 more)	HIGH	
Daily hours of hearing aid use - short/medium-term (follow-up 0–12 months; Better indicated by higher values)												
4	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	358	342	-	MD 0.06 lower (1.06 lower to 0.95 higher)	HIGH	
Adverse effects - long-term (follow-up ≥1 year)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	21/49 (42.9%)	57.1%	RR 0.75 (0.5 to	143 fewer per 1000 (from 285	LOW	

									1.12)	fewer to 69 more)		
Quality of life												
0	No evidence available	-	-	-	-	-	-	-	-	-	-	-
Self-reported hearing handicap - short/medium-term (follow-up 0–12 months; Better indicated by lower values)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	303	325	-	MD 0.7 lower (5.22 lower to 3.81 higher)	HIGH	
Hearing aid benefit - short/medium-term (follow-up mean 6 months; Better indicated by higher values)												
1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	282	300	-	MD 1.8 higher (3.1 lower to 6.7 higher)	HIGH	
Use of verbal communication strategy (follow-up 0–12 months; Better indicated by higher values)												
1	randomised trials	no serious risk of bias	no serious inconsistency	serious[3]	no serious imprecision	none	284	304	-	MD 0.1 lower (0.4 lower to 0.2 higher)	MODERATE	

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[34] Downgraded by 1 increment because the outcome did not cover all aspects of communication

Table 66: Clinical evidence profile: self-management support and delivery system design interventions versus control

Quality assessment							**No of patients**		**Effect**		**Quality**	**Importance**
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Combined SMS/DSD interventions versus control**	**Control**	**Relative (95% CI)**	**Absolute**		
Adherence - short/medium-term (follow-up 5-8 weeks)												

1	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	79/79 (100%)	94.3%	RR 1.06 (1 to 1.12)	57 more per 1000 (from 0 more to 113 more)	⊕⊕⊕⊕ HIGH	
Daily hours of hearing aid use - long-term (follow-up ≥1 year; Better indicated by higher values)												
2	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	very serious[2]	none	33	36	-	MD 0.04 higher (0.64 lower to 0.73 higher)	⊕OOO VERY LOW	
Daily hours of hearing aid use - short/medium-term (follow-up 0–12 months; Better indicated by higher values)												
9	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	266	268	-	MD 0.19 higher (0.01 lower to 0.4 higher)	⊕⊕⊕⊕ HIGH	
Quality of life - long-term (follow-up ≥1 year; Better indicated by higher values)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[2]	none	33	36	-	MD 0.32 higher (0.17 lower to 0.8 higher)	⊕⊕⊕O MODERATE	
Quality of life - short/medium-term (follow-up 0–12 months; Better indicated by higher values)												
8	randomised trials	serious[3]	no serious inconsistency	no serious indirectness	no serious imprecision	none	257	273	-	SMD 0.02 higher (0.15 lower to 0.19 higher)	⊕⊕⊕O MODERATE	
Self-reported hearing handicap - long-term - Activate - symptoms (follow-up ≥1 year; Better indicated by lower values)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[2]	none	33	36	-	MD 0.11 lower (6.02 lower to 5.80 higher)	⊕⊕⊕O MODERATE	
Self-reported hearing handicap - long-term - Activate - psychosocial (follow-up ≥1 year; Better indicated by lower values)												
1	randomised trials	serious[3]	no serious inconsistency	no serious indirectness	serious[2]	None	9	10	-	MD 8.30 lower (13.72 to 2.88 lower)	⊕⊕OO LOW	
Self-reported hearing handicap - short/medium-term (follow-up 0–12 months; Better indicated by lower values)												
14	randomised trials	serious[3]	serious[1]	no serious indirectness	no serious imprecision	None	332	349	-	SMD 0.26 lower (0.5to 0.02 lower)	⊕⊕OO LOW	

Hearing aid benefit - long-term (follow-up ≥1 year; Better indicated by lower values)												
2	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	serious[2]	none	33	36	-	MD 0.3 higher (0.02 to 0.58 higher)	⊕⊕⊕O MODERATE	
Hearing aid benefit - short/medium-term (follow-up 0–12 months; Better indicated by lower values)												
7	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	185	176	-	SMD 0.1 higher (0.15 lower to 0.36 higher)	⊕⊕⊕⊕ HIGH	
Use of verbal communication strategy - long-term (follow-up ≥1 year; Better indicated by higher values)												
1	randomised trials	no serious risk of bias	no serious inconsistency	serious[4]	serious[2]	none	16	18	-	MD 0.3 higher (0.2 lower to 0.8 higher)	⊕⊕OO LOW	
Use of verbal communication strategy - short/medium-term (follow-up 0–12 months; Better indicated by higher values)												
4	randomised trials	serious[1]	no serious inconsistency	serious[2]	serious[4]	none	110	113	-	MD 0.45 higher (0.15 to 0.74 higher)	⊕OOO VERY LOW	

[1] Downgraded by 1 or 2 increments because the point estimate varies widely across studies and I^2>50%, unexplained by subgroup analysis.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[4] Downgraded by 1 increment because of lack of a global measure of communication

Table 67: Clinical evidence profile: Motivational interviewing versus usual care for first time hearing aid users

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Motivational interviewing versus usual care**	**Control**	**Relative (95% CI)**	**Absolute**		

International Outcome Inventory for Hearing Aids (Better indicated by lower values)												
1	randomised trials	Very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	23	23	-	MD 3.1 higher (0.72 to 5.48 higher)	VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 68: Clinical evidence profile: Motivational interviewing versus usual care in those reporting use of ≤4hours/day

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Motivational interviewing (use <4h)**	**Control**	**Relative (95% CI)**	**Absolute**		
Change in hearing aid use (follow-up 1 month; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	19	17	-	MD 3.2 higher (1.03 to 5.37 higher)	⊕⊕OO LOW	CRITICAL
Change in IOI-HA (follow-up 1 month; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	19	17	-	MD 0.8 higher (3.61 lower to 5.21 higher)	⊕OOO VERY LOW	CRITICAL
Change in IOI-HA-SO (follow-up 1 month; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	19	17	-	MD 2.9 higher (4.8 lower to 10.6 higher)	⊕⊕OO LOW	CRITICAL
Change in WHO DASII (follow-up 1 month; Better indicated by lower values)												
1	randomised	serious[3]	no serious	no serious	serious[2]	none	19	17	-	MD 0.9 lower (3.08	⊕⊕OO	CRITICAL

	trials		inconsistency	indirectness						lower to 1.28 higher)	LOW	
Change in HADS - Anxiety score (follow-up 1 month; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	19	17	-	MD 0.27 higher (1.16 lower to 1.7 higher)	⊕OOO VERY LOW	CRITICAL
Change in HADS - Depression score (follow-up 1 month; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	19	17	-	MD 0.1 lower (1.77 lower to 1.57 higher)	⊕⊕OO LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 69: Clinical evidence profile: Motivational engagement versus usual care

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Motivational engagement versus usual care**	**Control**	**Relative (95% CI)**	**Absolute**		
Hearing aid use (hours/day) (follow-up 10 weeks; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 1.28 higher (1.54 lower to 4.1 higher)	VERY LOW	CRITICAL
Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids - Overall (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												
1	randomised	very	no serious	no serious	serious[2]	none	28	25	-	MD 3.93 higher (2.93	VERY	CRITICAL

	trials	serious[1]	inconsistency	indirectness						lower to 10.79 higher)	LOW	
Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - Aided listening (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	28	25	-	MD 0.81 higher (7.05 lower to 8.67 higher)	VERY LOW	CRITICAL
Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids - Advanced handling (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 10.44 higher (4.93 lower to 25.81 higher)	VERY LOW	CRITICAL
Glasgow Hearing Aid Benefit Profile - Overall (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 1.94 lower (11.36 lower to 7.48 higher)	VERY LOW	CRITICAL
Glasgow Hearing Aid Benefit Profile - Benefit (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 2.43 lower (14.11 lower to 9.25 higher)	VERY LOW	CRITICAL
Glasgow Hearing Aid Benefit Profile - Satisfaction (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 4.92 higher (6 lower to 15.84 higher)	VERY LOW	CRITICAL
Glasgow Hearing Aid Benefit Profile - Residual disability (follow-up 10 weeks; range of scores: 0-100; Better indicated by higher values)												

1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 1.11 higher (6.34 lower to 8.56 higher)	VERY LOW	CRITICAL
Short form Patient Activation Measure (follow-up 10 weeks; range of scores: 0-100; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	28	25	-	MD 1.84 higher (6.36 lower to 10.04 higher)	VERY LOW	CRITICAL
Hospital Anxiety and Depression scale - Overall (follow-up 10 weeks; range of scores: 0-56; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 1.01 lower (2.72 lower to 0.7 higher)	VERY LOW	CRITICAL
Hospital Anxiety and Depression scale - Anxiety (follow-up 10 weeks; range of scores: 0-56; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 1.08 lower (2.95 lower to 0.79 higher)	VERY LOW	CRITICAL
Hospital Anxiety and Depression scale - Depression (follow-up 10 weeks; range of scores: 0-56; Better indicated by lower values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 0.5 lower (2.4 lower to 1.4 higher)	VERY LOW	CRITICAL
Satisfaction with Amplification in Daily Life - Overall (follow-up 10 weeks; range of scores: 1-7; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 0.4 higher (0.01 to 0.79 higher)	VERY LOW	CRITICAL
Satisfaction with Amplification in Daily Life - Positive effect (follow-up 10 weeks; range of scores: 1-7; Better indicated by higher values)												

1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	28	25	-	MD 0.3 higher (0.14 lower to 0.74 higher)	VERY LOW	CRITICAL
Satisfaction with Amplification in Daily Life - Negative features (follow-up 10 weeks; range of scores: 1-7; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 0.72 higher (0.02 to 1.42 higher)	VERY LOW	CRITICAL
Satisfaction with Amplification in Daily Life - Personal image (follow-up 1-7; range of scores: 1-7; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 0.43 higher (0.18 lower to 1.04 higher)	VERY LOW	CRITICAL
Satisfaction with Amplification in Daily Life - Service and cost (follow-up 10 weeks; range of scores: 1-7; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	28	25	-	MD 0.09 higher (0.33 lower to 0.51 higher)	VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Appendix K: Forest plots

K.1 Urgent and routine referral

K.1.1 Urgent referral

None

K.1.2 Routine referral

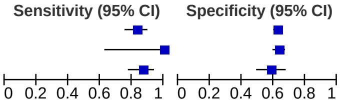
None

7 K.2 MRI

Figure 20: Sensitivity and specificity of pure tone audiometry thresholds for causative lesions in sensorineural hearing loss

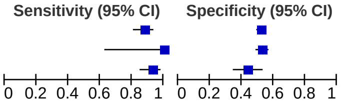
PTA: ≥20 dB at any single frequency between 0.5–4 kHz (DOH)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	109	606	22	1014	0.83 [0.76, 0.89]	0.63 [0.60, 0.65]
Kumar 2016	8	274	0	474	1.00 [0.63, 1.00]	0.63 [0.60, 0.67]
Saliba 2011	73	53	11	75	0.87 [0.78, 0.93]	0.59 [0.50, 0.67]



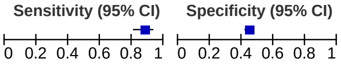
PTA: ≥15 dB at any single frequency between 0.5–4 kHz (Nashville)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	115	776	16	844	0.88 [0.81, 0.93]	0.52 [0.50, 0.55]
Kumar 2016	8	353	0	395	1.00 [0.63, 1.00]	0.53 [0.49, 0.56]
Saliba 2011	78	72	6	56	0.93 [0.85, 0.97]	0.44 [0.35, 0.53]



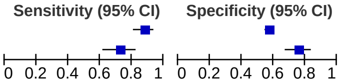
PTA: ≥15 dB at any single frequency (AMCLASS-B-Urben)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	115	896	16	724	0.88 [0.81, 0.93]	0.45 [0.42, 0.47]



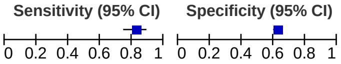
PTA: ≥15 dB asymmetry at 3 kHz (Rule 3000)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	115	692	16	928	0.88 [0.81, 0.93]	0.57 [0.55, 0.60]
Saliba 2011	61	31	23	97	0.73 [0.62, 0.82]	0.76 [0.67, 0.83]



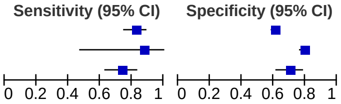
PTA: ≥20 dB asymmetry at 4 kHz (Rule 4000)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	108	606	23	1014	0.82 [0.75, 0.89]	0.63 [0.60, 0.65]



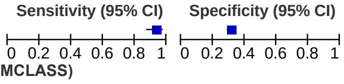
PTA: ≥20 dB at two adjacent frequencies (Sunderland)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	108	631	23	989	0.82 [0.75, 0.89]	0.61 [0.59, 0.63]
Kumar 2016	7	154	1	594	0.88 [0.47, 1.00]	0.79 [0.76, 0.82]
Saliba 2011	62	38	22	90	0.74 [0.63, 0.83]	0.70 [0.62, 0.78]



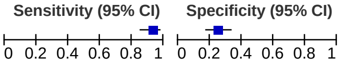
PTA: ≥10 dB at two adjacent frequencies (AMCLASS-A-Urben)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	122	1108	9	512	0.93 [0.87, 0.97]	0.32 [0.29, 0.34]



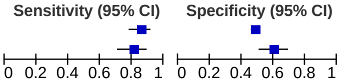
PTA: ≥15 dB at any single frequency or ≥10 dB at two adjacent frequencies (AMCLASS)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Saliba 2011	78	96	6	32	0.93 [0.85, 0.97]	0.25 [0.18, 0.33]



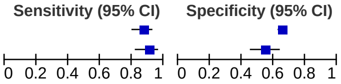
PTA: ≥15 dB at two or more adjacent frequencies (Cueva)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	112	832	19	788	0.85 [0.78, 0.91]	0.49 [0.46, 0.51]
Saliba 2011	68	51	16	77	0.81 [0.71, 0.89]	0.60 [0.51, 0.69]



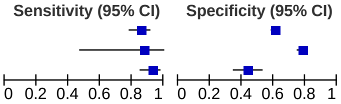
PTA: ≥ 15 dB between ears averaging 0.5–3 kHz (AAO-HNS)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	114	561	17	1059	0.87 [0.80, 0.92]	0.65 [0.63, 0.68]
Saliba 2011	76	58	8	70	0.90 [0.82, 0.96]	0.55 [0.46, 0.64]



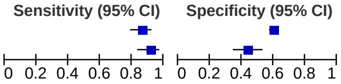
PTA: ≥ 15 dB between ears averaging 0.5–8 kHz (Oxford)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	112	631	19	989	0.85 [0.78, 0.91]	0.61 [0.59, 0.63]
Kumar 2016	7	164	1	584	0.88 [0.47, 1.00]	0.78 [0.75, 0.81]
Saliba 2011	78	72	6	56	0.93 [0.85, 0.97]	0.44 [0.35, 0.53]



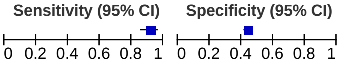
PTA: ≥ 15 dB between ears averaging 1–8 kHz (Seattle)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	113	648	18	972	0.86 [0.79, 0.92]	0.60 [0.58, 0.62]
Saliba 2011	77	72	7	56	0.92 [0.84, 0.97]	0.44 [0.35, 0.53]



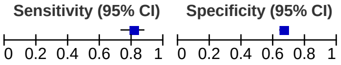
PTA: ≥ 10 dB between ears averaging 1–8 kHz (Mangham)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	120	903	11	717	0.92 [0.85, 0.96]	0.44 [0.42, 0.47]



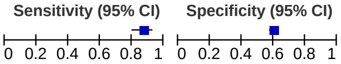
PTA: ≥ 20 dB between ears averaging 1–8 kHz (Schlauch and Levine)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	106	545	25	1075	0.81 [0.73, 0.87]	0.66 [0.64, 0.69]



PTA: ≥ 15 dB between ears averaging 0.25–8 kHz (Sheppard)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	114	646	17	974	0.87 [0.80, 0.92]	0.60 [0.58, 0.63]



PTA: ≥ 15 dB if better ear is ≤ 30 dB hearing loss average at frequencies 0.25–8 kHz; or ≥ 20 dB if better ear is >30 dB hearing

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheng 2012	110	544	21	1076	0.84 [0.77, 0.90]	0.66 [0.64, 0.69]

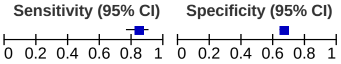


Figure 21: Sensitivity and specificity of pure tone audiometry shapes for vestibular schwannoma in sensorineural hearing loss

High frequency sloping loss

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	1	33	12	455	0.08 [0.00, 0.36]	0.93 [0.91, 0.95]

High frequency steep loss

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	2	79	11	408	0.15 [0.02, 0.45]	0.84 [0.80, 0.87]

Flat loss

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	5	102	8	385	0.38 [0.14, 0.68]	0.79 [0.75, 0.83]

Total deafness

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	2	56	11	431	0.15 [0.02, 0.45]	0.89 [0.85, 0.91]

Low frequency loss

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	0	94	13	393	0.00 [0.00, 0.25]	0.81 [0.77, 0.84]

Basin-shaped loss

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	3	39	10	448	0.23 [0.05, 0.54]	0.92 [0.89, 0.94]

Mountain-shaped loss

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Suzuki 2010	0	59	13	428	0.00 [0.00, 0.25]	0.88 [0.85, 0.91]

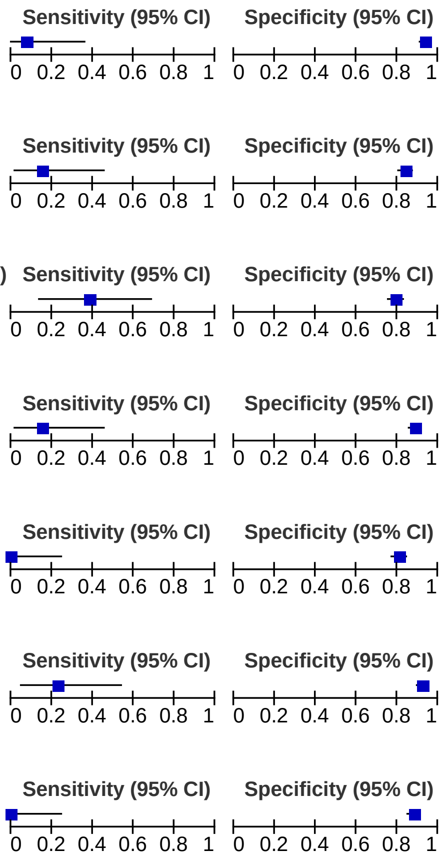


Figure 22: Sensitivity and specificity of auditory brainstem responses for causative lesions in sensorineural hearing loss

Abnormal ABR (for all pathology)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cueva 2004	22	73	9	208	0.71 [0.52, 0.86]	0.74 [0.68, 0.79]

Abnormal ABR (for VS + CPA meningioma)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Rupa 2003	6	24	0	42	1.00 [0.54, 1.00]	0.64 [0.51, 0.75]

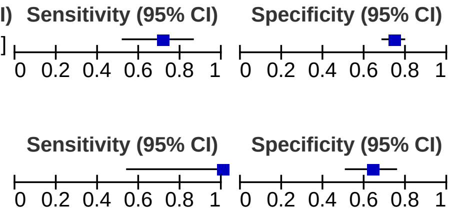
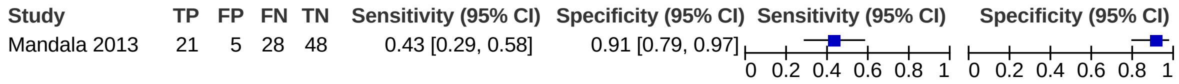
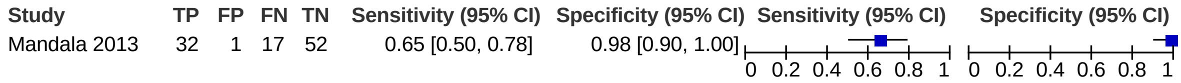


Figure 23: Sensitivity and specificity of caloric irrigation for vestibular schwannoma in sensorineural hearing loss



Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Mandala 2013	21	5	28	48	0.43 [0.29, 0.58]	0.91 [0.79, 0.97]

Figure 24: Sensitivity and specificity of hyperventilation test for vestibular schwannoma in sensorineural hearing loss



Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Mandala 2013	32	1	17	52	0.65 [0.50, 0.78]	0.98 [0.90, 1.00]

K.3 Subgroups

None

K.4 Early versus delayed management of hearing loss

None

K.5 Communication needs

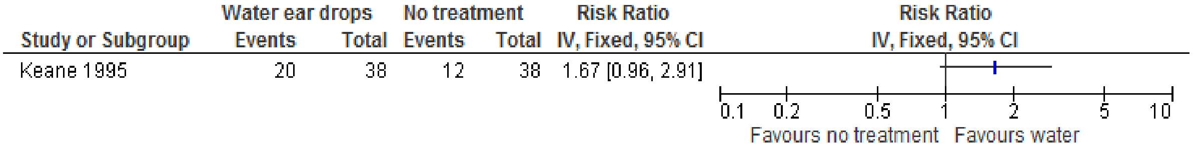
None

K.6 Management of earwax

K.6.1 Treatment

K.6.1.1 Earwax softeners: ear drops applied repeatedly versus no intervention

Figure 25: Water ear drops (repeated applications) versus no treatment, outcome: No longer impacted wax at 5 days



	Water ear drops		No treatment		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Keane 1995	20	38	12	38	1.67 [0.96, 2.91]

Figure 26: Sodium Bicarbonate solution (repeated applications) versus no treatment, outcome: No longer impacted wax at 5 days

	Sodium bcarbonate		No treatment		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Keane 1995	18	39	12	38	1.46 [0.82, 2.60]

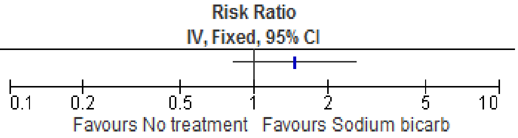
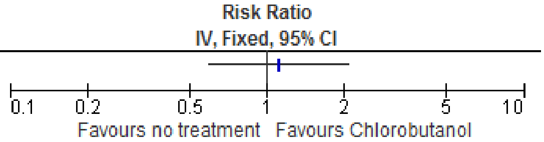


Figure 27: Chlorobutanol solution (repeated applications) versus no treatment, outcome: No longer impacted wax at 5 days

	Chlorobutanol		No treatment		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Keane 1995	14	40	12	38	1.11 [0.59, 2.08]



K.6.1.2 Earwax softeners: comparing two ear drops applied repeatedly against each other

Figure 28: Sodium Bicarbonate solution versus Water (repeated application), outcome: No longer impacted wax at 5 days

	Sodium bicarbonate		Water		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Keane 1995	18	39	20	38	0.88 [0.56, 1.38]

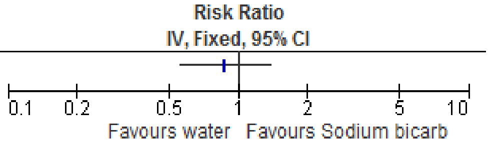


Figure 29: Chlorobutanol solution versus Water (repeated application), outcome: No longer impacted wax at 5 days

	Chlorobutanol		Water		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Keane 1995	24	40	20	38	1.14 [0.77, 1.69]

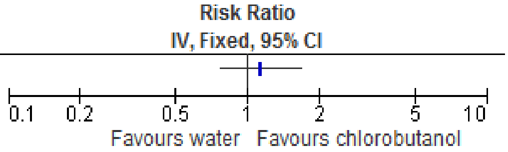


Figure 30: Chlorobutanol solution versus Sodium Bicarbonate solution (repeated applications), outcome: No longer impacted wax at 5 days

	Chlorobutanol		Sodium bicarbonate		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Keane 1995	24	40	18	39	1.30 [0.85, 1.98]

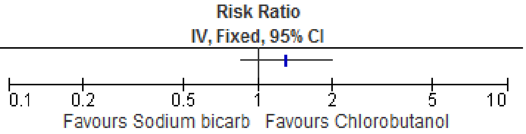
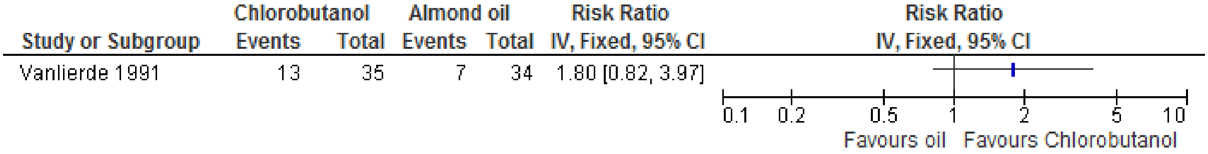
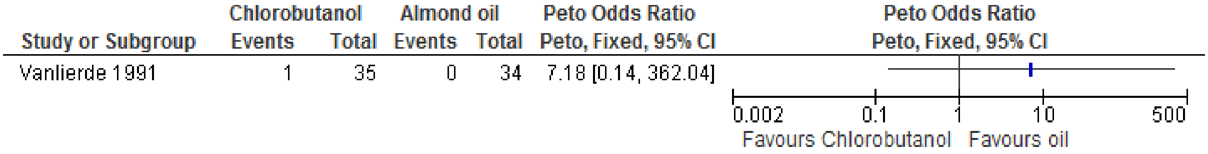


Figure 31: Chlorobutanol solution versus Oil (repeated applications), outcome: No longer impacted wax at 5 days



Study or Subgroup	Chlorobutanol Events	Chlorobutanol Total	Almond oil Events	Almond oil Total	Risk Ratio IV, Fixed, 95% CI
Vanlierde 1991	13	35	7	34	1.80 [0.82, 3.97]

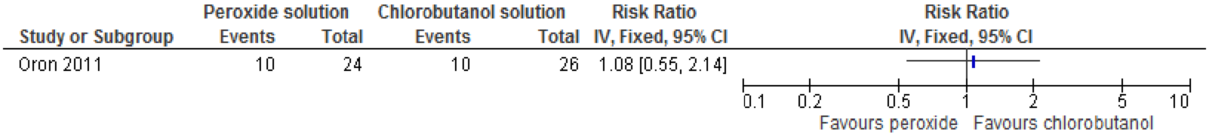
Figure 32: Chlorobutanol solution versus Oil (repeated applications), outcome: Adverse event: discontinued due to adverse effects



Study or Subgroup	Chlorobutanol Events	Chlorobutanol Total	Almond oil Events	Almond oil Total	Peto Odds Ratio Peto, Fixed, 95% CI
Vanlierde 1991	1	35	0	34	7.18 [0.14, 362.04]

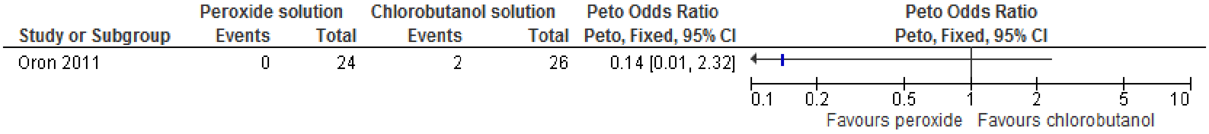
Nb Peto Odds used instead of Risk Ratio due to small numbers

Figure 33: Hydrogen Peroxide Urea solution versus Chlorobutanol solution (repeated applications), outcome: No further management of wax needed at 1 week



Study or Subgroup	Peroxide solution Events	Peroxide solution Total	Chlorobutanol solution Events	Chlorobutanol solution Total	Risk Ratio IV, Fixed, 95% CI
Oron 2011	10	24	10	26	1.08 [0.55, 2.14]

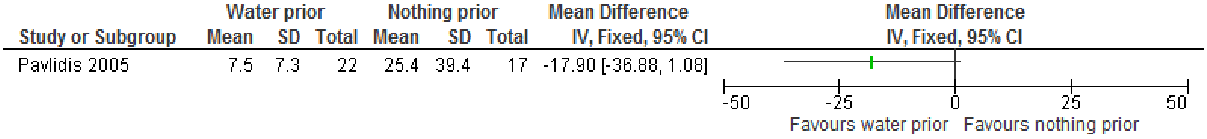
Figure 34: Hydrogen Peroxide Urea solution versus Chlorobutanol solution, outcome: reported side-effects at 1 week



Study or Subgroup	Peroxide solution Events	Peroxide solution Total	Chlorobutanol solution Events	Chlorobutanol solution Total	Peto Odds Ratio Peto, Fixed, 95% CI
Oron 2011	0	24	2	26	0.14 [0.01, 2.32]

K.6.1.3 Earwax softeners to facilitate immediate irrigation: versus no intervention

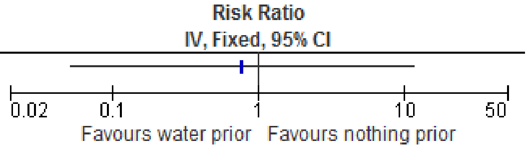
Figure 35: Water ear drops (15 minute application) prior to irrigation versus no ear drops prior to irrigation, outcome: Attempts needed to syringe until visibly clear of wax



Study or Subgroup	Water prior Mean	Water prior SD	Water prior Total	Nothing prior Mean	Nothing prior SD	Nothing prior Total	Mean Difference IV, Fixed, 95% CI
Pavlidis 2005	7.5	7.3	22	25.4	39.4	17	-17.90 [-36.88, 1.08]

Figure 36: Water ear drops (15 minute application) prior to irrigation versus no ear drops prior to irrigation, outcome: Adverse outcomes for syringing

	Water prior		Nothing prior		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Pavlidis 2005	1	22	1	17	0.77 [0.05, 11.48]



Due to randomisation at level of ear, the adverse effect in each arm was the same person

Figure 37: Sodium bicarbonate solution (30 minute application) prior to irrigation versus no ear drops prior to irrigation, outcome: Wax cleared by 5 minute irrigation

	Sodium bicarb		No eardrops		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Hinchcliffe 1955	31	37	28	37	1.11 [0.88, 1.40]

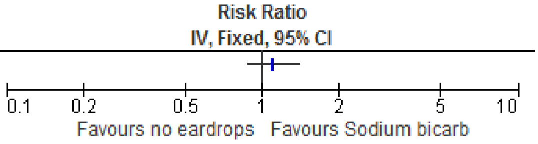


Figure 38: Hydrogen Peroxide Urea solution (30 minute application) prior to irrigation versus no ear drops prior to irrigation, outcome: Wax cleared by 5 minute irrigation

	H.Peroxide Urea soln		No ear drops		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Hinchcliffe 1955	33	37	28	37	1.18 [0.95, 1.46]

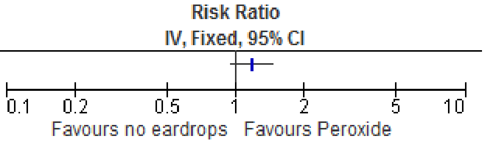
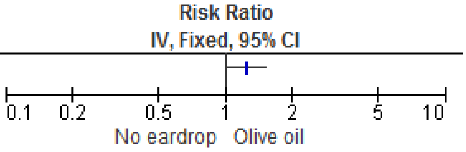


Figure 39: Olive oil (30 minute application) prior to irrigation versus no ear drops prior to irrigation, outcome: Wax cleared by 5 minute irrigation

	Olive oil eardrops		No eardrop		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Hinchcliffe 1955	35	37	28	37	1.25 [1.03, 1.52]



K.6.1.4 Earwax softeners to facilitate immediate irrigation: comparing ear drops against each other

Figure 40: Chlorobutanol solution ear drops (30 minute application) prior to irrigation versus Saline ear drops (30 minute application) prior to irrigation, outcome: Complete visualisation of TM after syringing

	Chlorobutanol eardrops		Saline eardrops		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Caballero 2009	21	32	12	28	1.53 [0.93, 2.51]

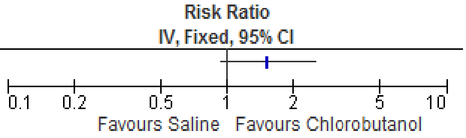
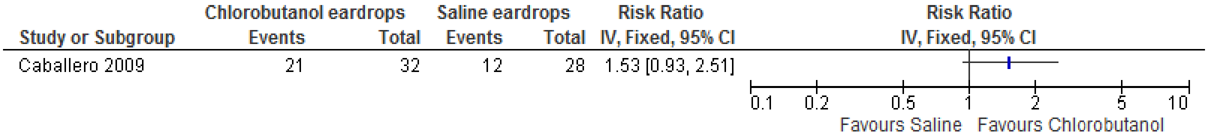
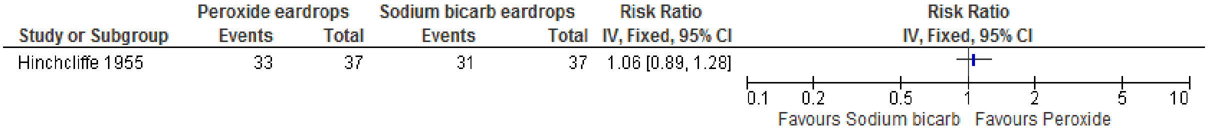


Figure 41: Chlorobutanol solution ear drops (30 minute application) prior to irrigation versus Saline ear drops (30 minute application) prior to irrigation, outcome: Adverse events prior to syringing



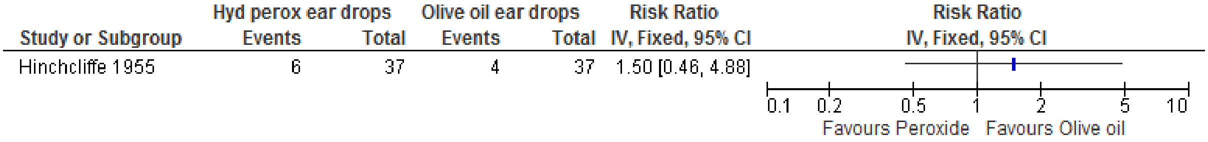
	Chlorobutanol eardrops		Saline eardrops		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Caballero 2009	21	32	12	28	1.53 [0.93, 2.51]	

Figure 42: Hydrogen Peroxide Urea solution (30 minute application) ear drops prior to irrigation versus Sodium Bicarbonate (30 minute application) prior to irrigation, outcome: Wax cleared by 5 minute irrigation



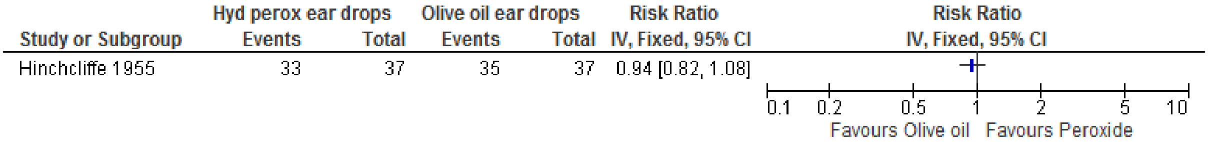
	Peroxide eardrops		Sodium bicarb eardrops		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Hinchcliffe 1955	33	37	31	37	1.06 [0.89, 1.28]	

Figure 43: Hydrogen Peroxide Urea solution ear drops (30 minute application) prior to irrigation versus Sodium Bicarbonate solution ear drops (30 minute application) prior to irrigation, outcome: Adverse events prior to syringing: Discomfort



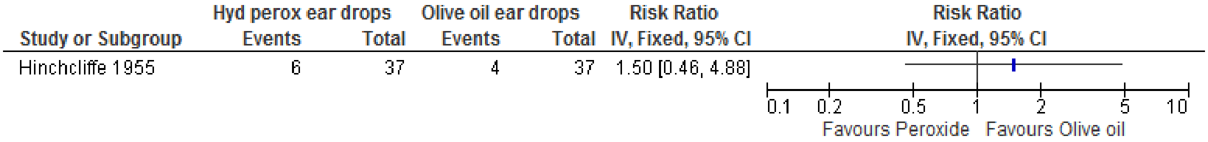
	Hyd perox ear drops		Olive oil ear drops		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Hinchcliffe 1955	6	37	4	37	1.50 [0.46, 4.88]	

Figure 44: Hydrogen Peroxide Urea solution ear drops (30 minute application) prior to irrigation versus Olive Oil (30 minute application) prior to irrigation, outcome: Wax cleared by 5 minute irrigation



	Hyd perox ear drops		Olive oil ear drops		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Hinchcliffe 1955	33	37	35	37	0.94 [0.82, 1.08]	

Figure 45: Hydrogen Peroxide Urea solution ear drops (30 minute application) prior to irrigation versus Olive Oil (30 minute application) prior to irrigation, outcome: Adverse events prior to syringing: discomfort



	Hyd perox ear drops		Olive oil ear drops		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI	IV, Fixed, 95% CI
Hinchcliffe 1955	6	37	4	37	1.50 [0.46, 4.88]	

Figure 46: Hydrogen Peroxide Urea solution (15 minute application) ear drops prior to irrigation versus Saline (15 minute application) prior to irrigation, outcome: Complete visualisation of tympanic membrane after syringing (1st attempt)

	Peroxide		Sodium Chloride (Saline)		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Roland 2004	3	26	2	24	1.38 [0.25, 7.59]

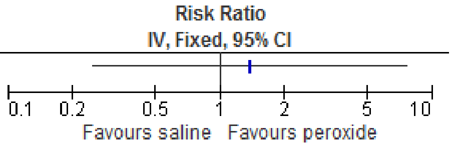


Figure 47: Hydrogen Peroxide Urea solution (15 minute application) ear drops prior to irrigation up to twice versus Saline (15 minute application) prior to irrigation up to twice, outcome: Complete visualisation of tympanic membrane after syringing (2nd attempt)

	Peroxide		Sodium Chloride (Saline)		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Roland 2004	4	26	10	24	0.37 [0.13, 1.02]

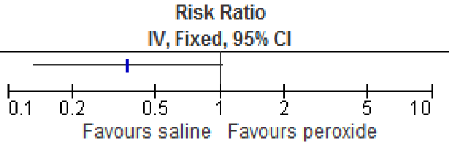
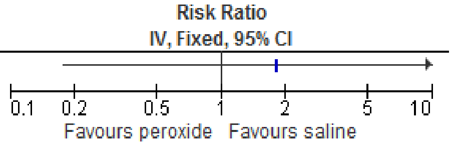


Figure 48: Hydrogen Peroxide Urea solution (15 minute application) ear drops prior to irrigation up to twice versus Saline (15 minute application) prior to irrigation up to twice, outcome: Adverse events: reported side-effects from ear drops

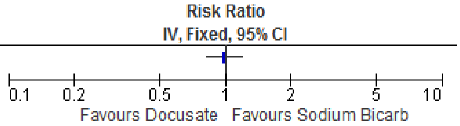
	Peroxide		Sodium Chloride (Saline)		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Roland 2004	2	26	1	24	1.85 [0.18, 19.08]



K.6.1.5 Earwax softeners to facilitate delayed irrigation: comparing ear drops against each other

Figure 49: Docusate solution ear drops (repeated applications) prior to delayed irrigation versus Sodium Bicarbonate solution ear drops (repeated applications) prior to delayed irrigation, outcome: Successful syringing at 3 days

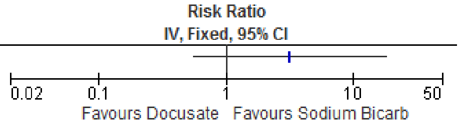
	Docusate soln ear drops		S.Bicarb soln ear drops		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Fraser 1970	21	25	105	124	0.99 [0.82, 1.20]



Nb All pts had bilateral occlusion and received Sodium Bicarbonate in one ear and one of five ear drops in the other – hence large numbers for Sodium Bicarbonate

Figure 50: Docusate versus Sodium Bicarbonate (repeated applications) to facilitate syringing, outcome: Adverse event: otitis externa

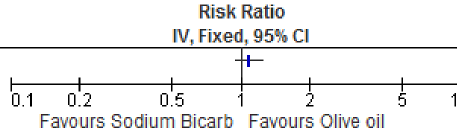
	Docusate soln ear drops		S.Bicarb soln ear drops		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Fraser 1970	2	26	3	124	3.18 [0.56, 18.09]



Nb All pts had bilateral occlusion and received Sodium Bicarbonate in one ear and one of five ear drops in the other – hence large numbers for Sodium Bicarbonate

Figure 51: Olive oil ear drops (repeated applications) prior to delayed irrigation versus Sodium Bicarbonate solution ear drops (repeated applications) prior to delayed irrigation, outcome: Successful syringing at 3 days

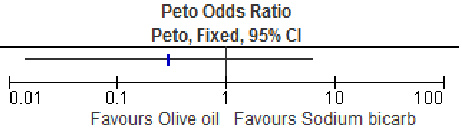
	Olive oil ear drops		S.Bicarb soln ear drops		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Fraser 1970	23	25	105	124	1.09 [0.95, 1.25]



Nb All pts had bilateral occlusion and received Sodium Bicarbonate in one ear and one of five ear drops in the other – hence large numbers for Sodium Bicarbonate

Figure 52: Olive oil ear drops (repeated applications) prior to delayed irrigation versus Sodium Bicarbonate solution ear drops (repeated applications) prior to delayed irrigation, outcome: Adverse event: otitis externa

	Olive oil ear drops		S.Bicarb soln ear drops		Peto Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Peto, Fixed, 95% CI
Fraser 1970	0	25	3	124	0.30 [0.01, 6.24]



1. *All pts had bilateral occlusion and received Sodium Bicarbonate in one ear and one of five ear drops in the other – hence large numbers for Sodium Bicarbonate; 2. Peto Odds used instead of Risk Ratio due to small numbers*

Figure 53: Docusate solution ear drops (repeated application) prior to delayed irrigation versus Olive oil ear drops (repeated applications) prior to delayed irrigation, outcome: Successful syringing at 3 days

	Docusate		Olive oil		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Fraser 1970	23	25	23	25	1.00 [0.85, 1.18]

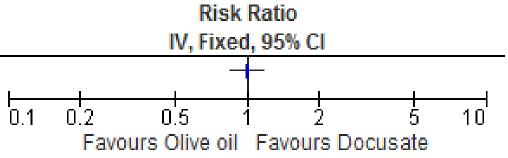
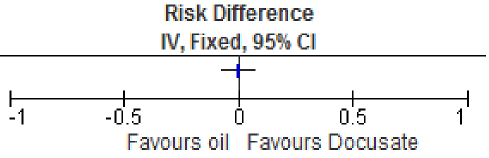


Figure 54: Docusate solution ear drops (repeated application) prior to delayed irrigation versus Olive oil ear drops (repeated applications) prior to delayed irrigation, outcome: Successful syringing at 3 days, outcome: Adverse event: otitis externa

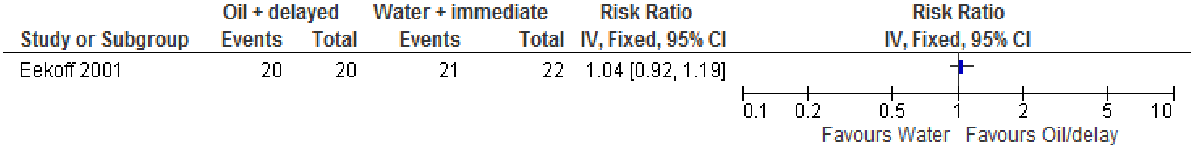
	Docusate soln		Olive oil		Risk Difference
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Fraser 1970	0	25	0	25	0.00 [-0.07, 0.07]



Nb No events either arm

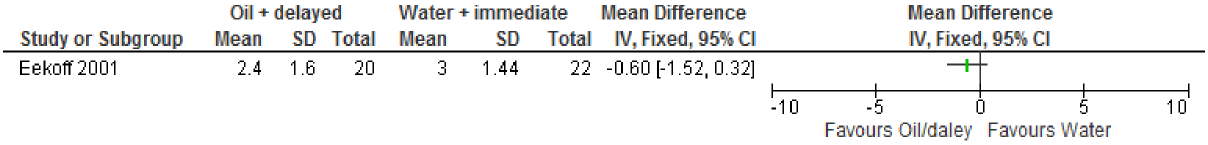
K.6.1.6 Earwax softeners to facilitate irrigation: ear drops applied once versus ear drops applied repeatedly

Figure 55: Oil ear drops (repeated applications) versus Water (single application) to facilitate syringing, outcome: Wax cleared at up to 5 syringes



	Oil + delayed		Water + immediate		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Eekoff 2001	20	20	21	22	1.04 [0.92, 1.19]

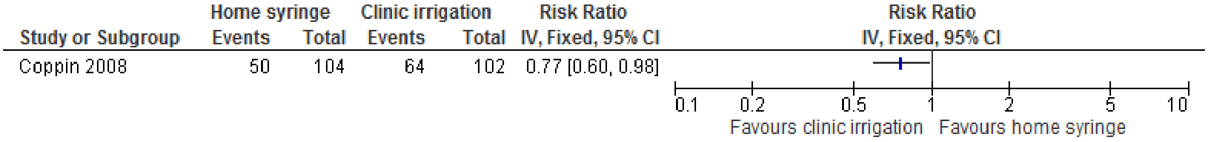
Figure 56: Oil ear drops (repeated applications) versus Water (single application) to facilitate syringing, outcome: Ease of syringing - number of syringes needed to clear (1 to 5, 6 = unable)



	Oil + delayed			Water + immediate			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Eekoff 2001	2.4	1.6	20	3	1.44	22	-0.60 [-1.52, 0.32]

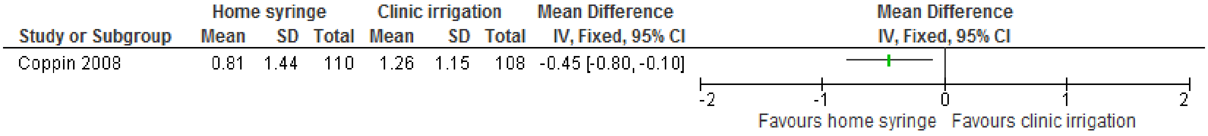
K.6.1.7 Irrigation: Home syringing kit with ear drops versus ear drops followed by irrigation in GP clinic

Figure 57: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: No impacted wax at follow-up (1 to 2 weeks)



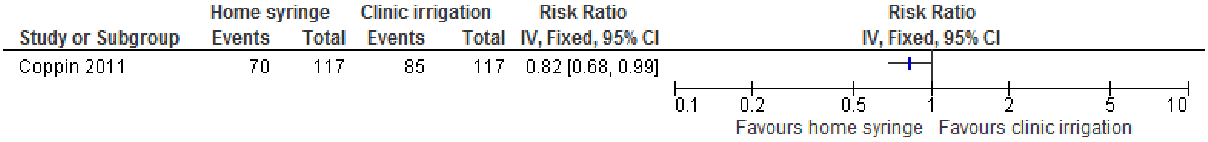
	Home syringe		Clinic irrigation		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Coppin 2008	50	104	64	102	0.77 [0.60, 0.98]

Figure 58: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: Change in symptom score (scale 0-6, 6 = worse symptoms)



	Home syringe			Clinic irrigation			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Coppin 2008	0.81	1.44	110	1.26	1.15	108	-0.45 [-0.80, -0.10]

Figure 59: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: Consulted again with wax-related symptoms in next two years



	Home syringe		Clinic irrigation		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Coppin 2011	70	117	85	117	0.82 [0.68, 0.99]

Figure 60: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: Adverse event: otitis externa at follow-up

	Home syringe		Clinic irrigation		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Coppin 2008	1	97	1	94	0.97 [0.06, 15.27]

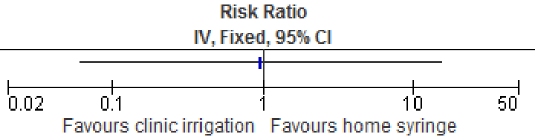


Figure 61: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: Adverse event: perforation at follow-up

	Home syringe		Clinic irrigation		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Coppin 2008	1	97	1	94	0.97 [0.06, 15.27]

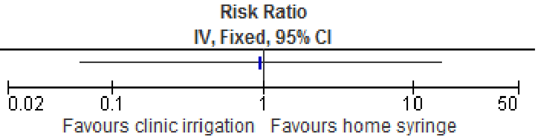


Figure 62: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: Adverse event: discomfort during treatment

	Home syringe		Clinic irrigation		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Coppin 2008	43	110	35	108	1.21 [0.84, 1.73]

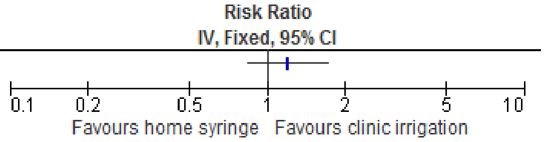
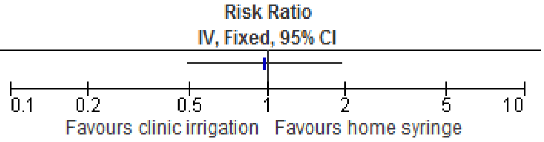


Figure 63: Home syringing kit with ear drops versus ear drops plus irrigation in GP clinic, outcome: Adverse event: dizziness during treatment

	Home syringe		Clinic irrigation		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Coppin 2008	14	110	14	108	0.98 [0.49, 1.96]



K.6.1.8 Irrigation: GP clinic irrigation post unspecified ear drops (3 days) by versus ear drops alone (3 days)

Figure 64: Clinic irrigation versus ear drops alone, outcome: Hearing improved by at least 10 dB HL

	Ear drops + Irrigation		Ear drops alone		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	IV, Fixed, 95% CI
Memel 2002	18	53	1	61	20.72 [2.86, 150.01]

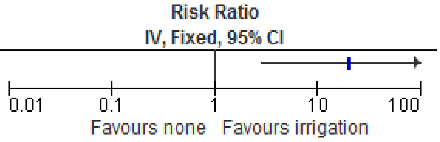
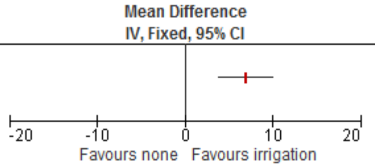


Figure 65: Clinic irrigation following ear drops versus ear drops alone, outcome: Improvement in hearing (dB HL)

			Ear drops alone	Ear drops plus irrigation	Mean Difference
Study or Subgroup	Mean Difference	SE	Total	Total	IV, Fixed, 95% CI
21.2.1 Improvement in hearing					
Memel 2002	6.9	1.5817	53	61	6.90 [3.80, 10.00]



K.6.2 Settings

None

K.7 Sudden sensorineural hearing loss

K.7.1 Treatment

K.7.1.1 First-line treatment – steroid (oral or IT) versus placebo (oral or IT)

Figure 66: Steroid (oral, prednisolone) versus placebo (oral)- change in PTA

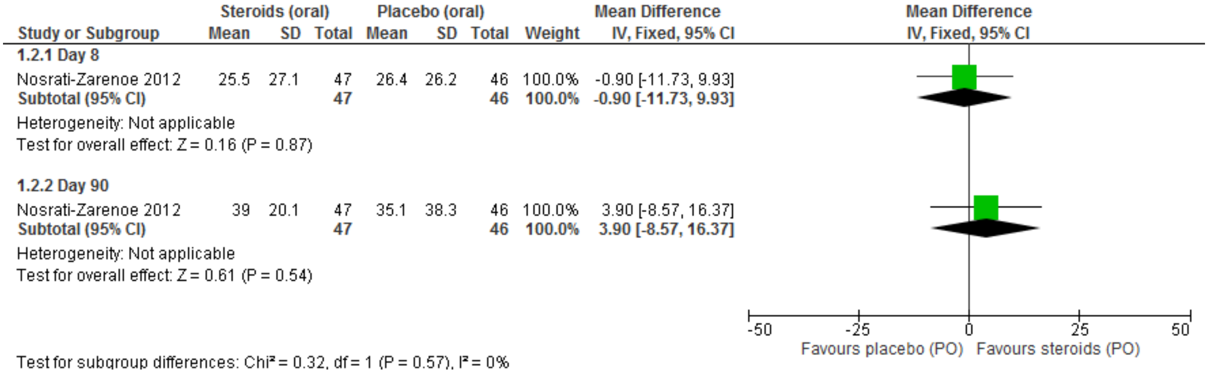


Figure 67: Steroid (oral/IT, prednisolone) versus placebo (oral/IT) - Recovery

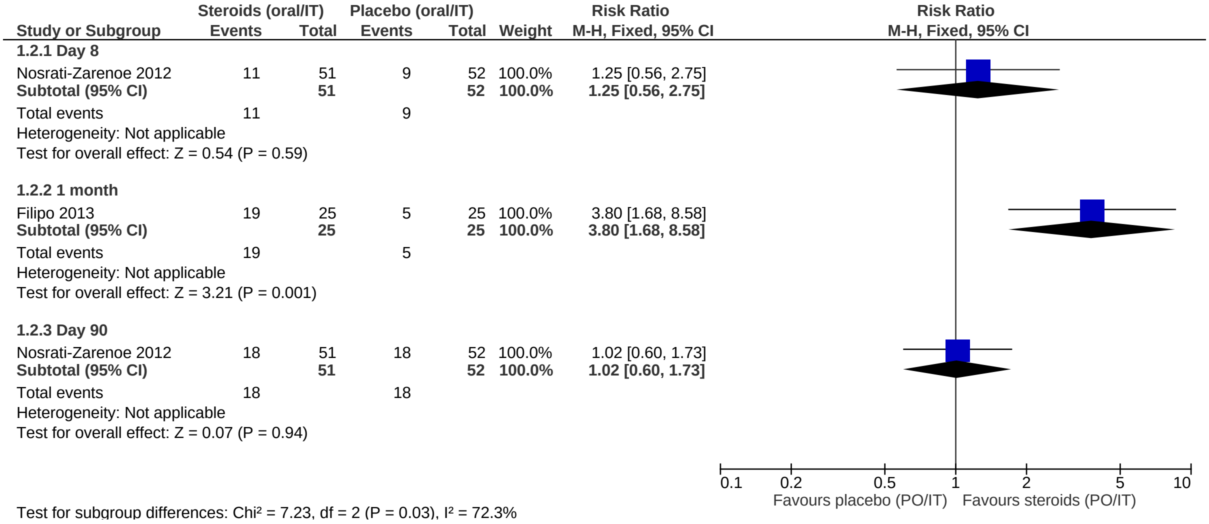
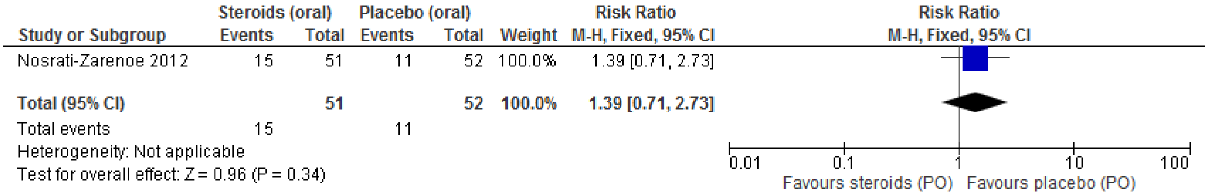


Figure 68: Steroid (oral, prednisolone) versus placebo (oral)- Adverse events

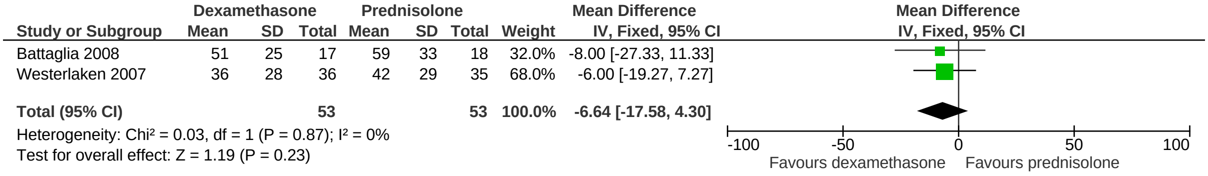


	Steroids (oral)		Placebo (oral)			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
Nosrati-Zarenoe 2012	15	51	11	52	100.0%	1.39 [0.71, 2.73]
Total (95% CI)		**51**		**52**	**100.0%**	**1.39 [0.71, 2.73]**
Total events	15		11			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.96 (P = 0.34)

K.7.1.2 First-line treatment – steroid (oral or IT) versus steroid (oral)

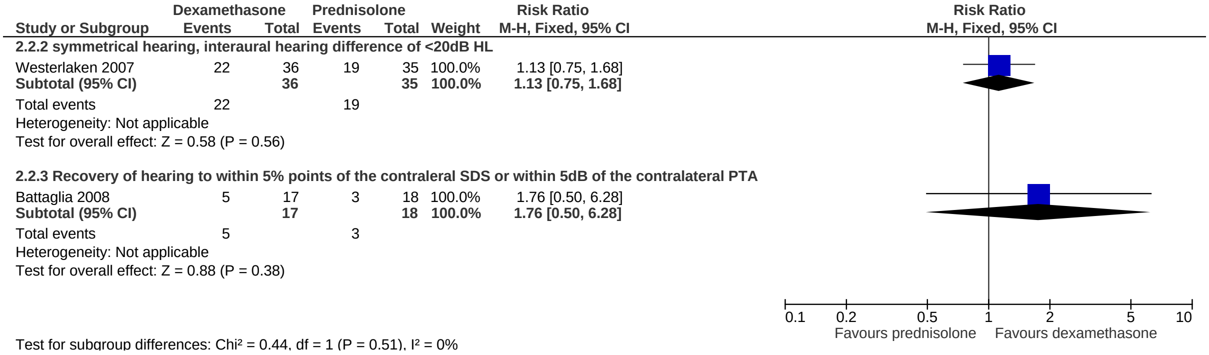
Figure 69: Steroid (oral/IT, dexamethasone) versus steroid (oral, prednisolone) – PTA final score



	Dexamethasone			Prednisolone				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Battaglia 2008	51	25	17	59	33	18	32.0%	-8.00 [-27.33, 11.33]
Westerlaken 2007	36	28	36	42	29	35	68.0%	-6.00 [-19.27, 7.27]
Total (95% CI)			**53**			**53**	**100.0%**	**-6.64 [-17.58, 4.30]**

Heterogeneity: $Chi^2 = 0.03$, df = 1 (P = 0.87); $I^2 = 0\%$
Test for overall effect: Z = 1.19 (P = 0.23)

Figure 70: Steroid (oral/IT, dexamethasone) versus steroid (oral, prednisolone) – Recovery



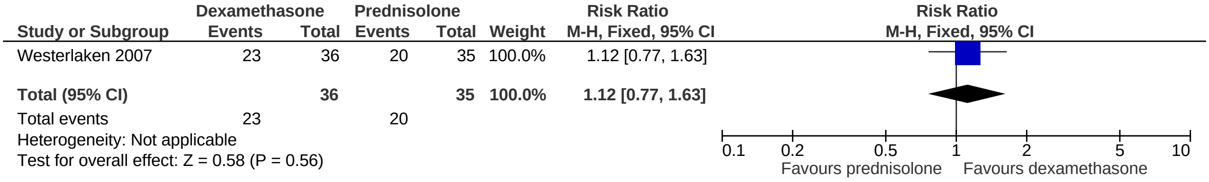
	Dexamethasone		Prednisolone			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
2.2.2 symmetrical hearing, interaural hearing difference of <20dB HL						
Westerlaken 2007	22	36	19	35	100.0%	1.13 [0.75, 1.68]
Subtotal (95% CI)		**36**		**35**	**100.0%**	**1.13 [0.75, 1.68]**
Total events	22		19			
2.2.3 Recovery of hearing to within 5% points of the contraleral SDS or within 5dB of the contralateral PTA						
Battaglia 2008	5	17	3	18	100.0%	1.76 [0.50, 6.28]
Subtotal (95% CI)		**17**		**18**	**100.0%**	**1.76 [0.50, 6.28]**
Total events	5		3			

2.2.2: Heterogeneity: Not applicable
Test for overall effect: Z = 0.58 (P = 0.56)

2.2.3: Heterogeneity: Not applicable
Test for overall effect: Z = 0.88 (P = 0.38)

Test for subgroup differences: $Chi^2 = 0.44$, df = 1 (P = 0.51), $I^2 = 0\%$

Figure 71: Steroid (oral, dexamethasone) versus steroid (oral, prednisolone) – Speech discrimination of 100%



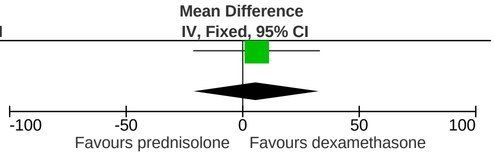
	Dexamethasone		Prednisolone			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
Westerlaken 2007	23	36	20	35	100.0%	1.12 [0.77, 1.63]
Total (95% CI)		**36**		**35**	**100.0%**	**1.12 [0.77, 1.63]**
Total events	23		20			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.58 (P = 0.56)

Figure 72: Steroid (IT, dexamethasone plus placebo oral) versus steroid (oral, prednisolone plus placebo IT) – Speech discrimination

	Dexamethasone			Prednisolone				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Battaglia 2008	60	37	17	54	44	18	100.0%	6.00 [-20.88, 32.88]
Total (95% CI)			**17**			**18**	**100.0%**	**6.00 [-20.88, 32.88]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.44 (P = 0.66)



K.7.1.3 First-line treatment –Dual steroid (oral plus IT) versus single steroid (oral or IT)

Figure 73: Dual steroid (oral prednisolone plus IT dexamethasone) versus single steroid (oral prednisolone or IT dexamethasone plus placebo IT or oral– PTA final score

	Dual steroid (oral +IT)			Single steroid (oral or IT)				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
3.1.1 oral vs oral + IT								
Battaglia 2008	35	21	16	59	33	18	100.0%	-24.00 [-42.39, -5.61]
Subtotal (95% CI)			**16**			**18**	**100.0%**	**-24.00 [-42.39, -5.61]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 2.56 (P = 0.01)								
3.1.2 IT vs oral + IT								
Battaglia 2008	35	21	16	51	25	17	100.0%	-16.00 [-31.72, -0.28]
Subtotal (95% CI)			**16**			**17**	**100.0%**	**-16.00 [-31.72, -0.28]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.99 (P = 0.05)								

Test for subgroup differences: Chi² = 0.42, df = 1 (P = 0.52), I² = 0%

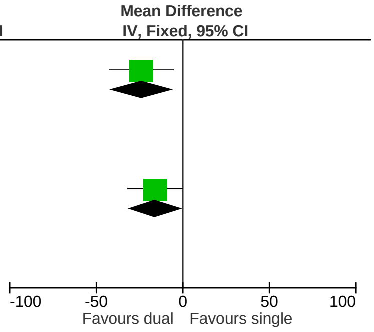


Figure 74: Dual steroid (oral prednisolone plus IT dexamethasone) versus single steroid (oral prednisolone or IT dexamethasone plus placebo IT or oral – Recovery

	Dual steroid (oral +IT)		Single steroid (oral or IT)			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
Ahn 2008	15	60	16	60	76.1%	0.94 [0.51, 1.72]
Battaglia 2008	10	16	8	35	23.9%	2.73 [1.33, 5.60]
Total (95% CI)		**76**		**95**	**100.0%**	**1.37 [0.87, 2.15]**
Total events	25		24			

Heterogeneity: Chi² = 5.07, df = 1 (P = 0.02); I² = 80%
Test for overall effect: Z = 1.35 (P = 0.18)

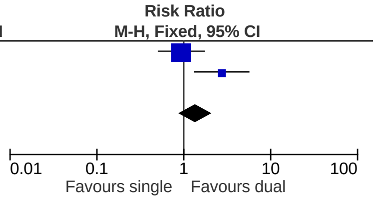
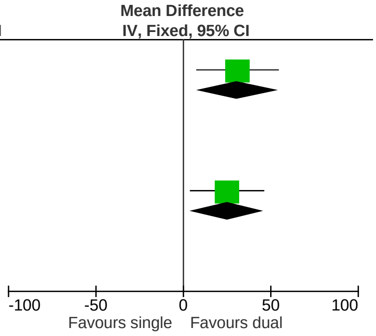


Figure 75: Dual steroid (oral prednisolone) plus steroid (IT dexamethasone) versus single steroid (oral prednisolone or IT dexamethasone plus placebo IT or oral) – Speech discrimination

	Dual steroid (oral +IT)			Single steroid (oral or IT)				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
3.4.1 Oral vs oral + IT								
Battaglia 2008	85	23	16	54	44	18	100.0%	31.00 [7.76, 54.24]
Subtotal (95% CI)			**16**			**18**	**100.0%**	**31.00 [7.76, 54.24]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 2.61 (P = 0.009)								
3.4.2 IT vs oral + IT								
Battaglia 2008	85	23	16	60	37	17	100.0%	25.00 [4.11, 45.89]
Subtotal (95% CI)			**16**			**17**	**100.0%**	**25.00 [4.11, 45.89]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 2.35 (P = 0.02)								

Test for subgroup differences: Chi² = 0.14, df = 1 (P = 0.71), I² = 0%



K.7.1.4 First-line treatment – steroid (IV or oral) plus antiviral (IV or oral) versus steroid (IV or oral)

Figure 76: Steroid (oral) plus antiviral (oral) versus steroid (oral plus placebo) – PTA final score

	Steroid + antiviral			Steroid + placebo				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
Tucci 2002	44.4	32.5	39	38	31.7	29	100.0%	6.40 [-9.00, 21.80]
Total (95% CI)			**39**			**29**	**100.0%**	**6.40 [-9.00, 21.80]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.81 (P = 0.42)								

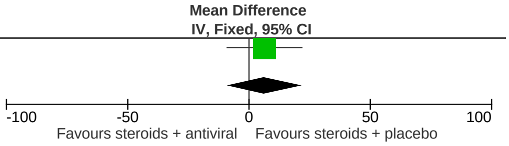


Figure 77: Steroid (oral) plus antiviral (oral) versus steroid (oral plus placebo) – Recovery

	Steroid + antiviral		Steroid + placebo			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Fixed, 95% CI**
Tucci 2002	15	39	14	29	100.0%	0.80 [0.46, 1.38]
Total (95% CI)		**39**		**29**	**100.0%**	**0.80 [0.46, 1.38]**
Total events	15		14			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.81 (P = 0.42)						

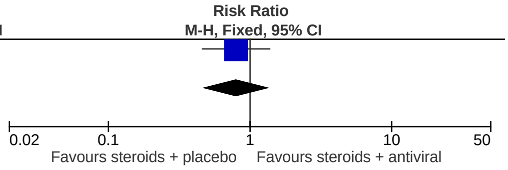


Figure 78: Steroid (IV, hydrocortisone) plus antiviral (IV, acyclovir) versus steroid (IV, hydrocortisone) – Improvement

	Steroid + antiviral		Steroid			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Fixed, 95% CI**
Uri 2003	23	29	24	31	100.0%	1.02 [0.79, 1.34]
Total (95% CI)		**29**		**31**	**100.0%**	**1.02 [0.79, 1.34]**
Total events	23		24			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.18 (P = 0.86)						

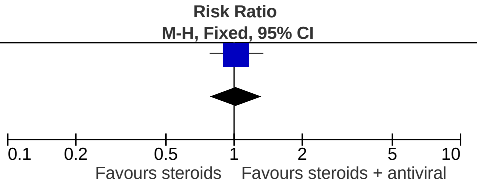


Figure 79: Steroid (oral) plus antiviral (oral) versus steroid (oral plus placebo) – Speech discrimination

	Steroid + antiviral			Steroid + placebo				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
Tucci 2002	64	41.5	39	59.4	42.1	29	100.0%	4.60 [-15.51, 24.71]
Total (95% CI)			**39**			**29**	**100.0%**	**4.60 [-15.51, 24.71]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.45 (P = 0.65)								

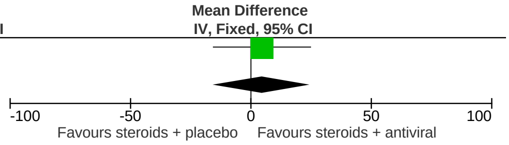
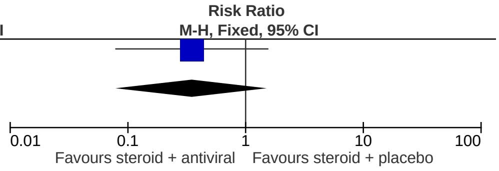


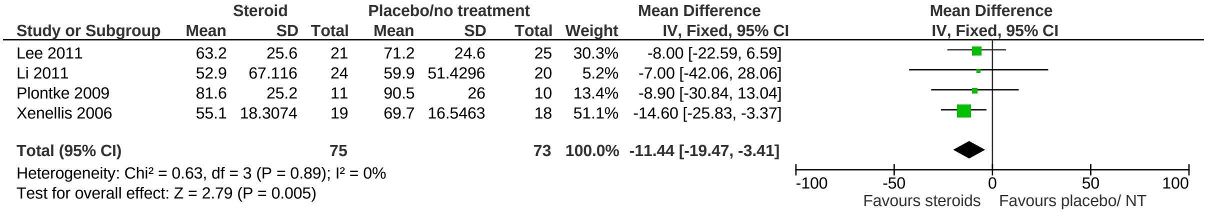
Figure 80: Steroid (IV) plus antiviral (IV) versus steroid (IV plus placebo) – adverse events

	Steroid + antiviral		Steroid + placebo			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Fixed, 95% CI**
Stokroos 1998	2	21	6	22	100.0%	0.35 [0.08, 1.54]
Total (95% CI)		**21**		**22**	**100.0%**	**0.35 [0.08, 1.54]**
Total events	2		6			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.39 (P = 0.16)						



K.7.1.5 Second-line treatment – steroid (IT) versus placebo (IT) or no treatment

Figure 81: Steroid (IT) versus placebo or no treatment – PTA final score

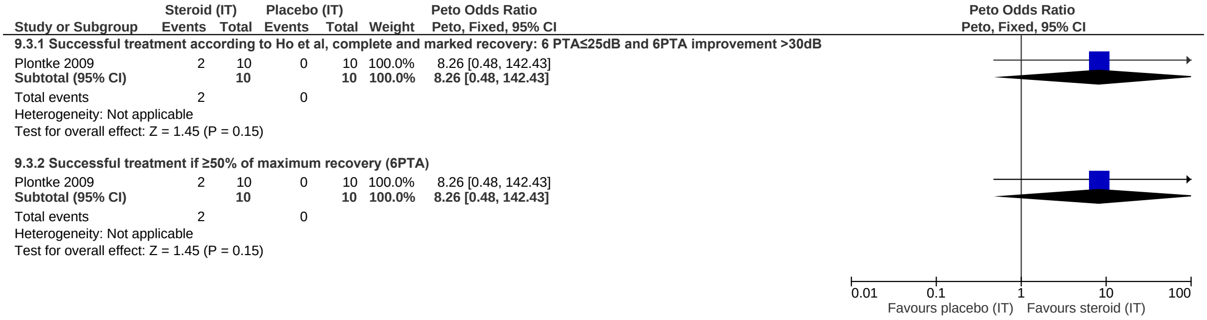


	Steroid			Placebo/no treatment				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Lee 2011	63.2	25.6	21	71.2	24.6	25	30.3%	-8.00 [-22.59, 6.59]
Li 2011	52.9	67.116	24	59.9	51.4296	20	5.2%	-7.00 [-42.06, 28.06]
Plontke 2009	81.6	25.2	11	90.5	26	10	13.4%	-8.90 [-30.84, 13.04]
Xenellis 2006	55.1	18.3074	19	69.7	16.5463	18	51.1%	-14.60 [-25.83, -3.37]
Total (95% CI)			**75**			**73**	**100.0%**	**-11.44 [-19.47, -3.41]**

Heterogeneity: Chi² = 0.63, df = 3 (P = 0.89); I² = 0%
Test for overall effect: Z = 2.79 (P = 0.005)

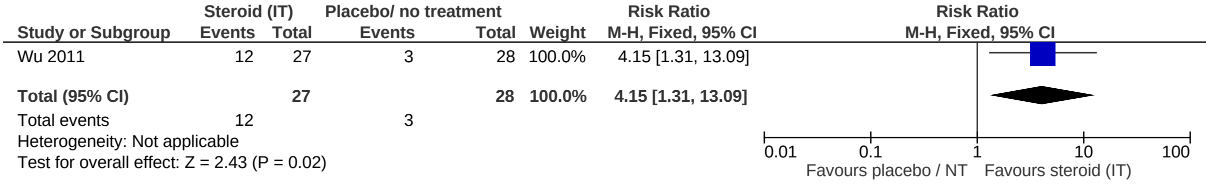
Lee 2011: Dexamethasone versus no treatment; Li 2011 prednisolone versus no treatment, Xenellis 2006 prednisolone versus no treatment; Plontke dexamethasone versus placebo

Figure 82: Steroid (IT, dexamethasone) versus placebo (IT) – Recovery



	Steroid (IT)		Placebo (IT)			Peto Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	Peto, Fixed, 95% CI
9.3.1 Successful treatment according to Ho et al, complete and marked recovery: 6 PTA≤25dB and 6PTA improvement >30dB						
Plontke 2009	2	10	0	10	100.0%	8.26 [0.48, 142.43]
Subtotal (95% CI)		**10**		**10**	**100.0%**	**8.26 [0.48, 142.43]**
Total events	2		0			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.45 (P = 0.15)						
9.3.2 Successful treatment if ≥50% of maximum recovery (6PTA)						
Plontke 2009	2	10	0	10	100.0%	8.26 [0.48, 142.43]
Subtotal (95% CI)		**10**		**10**	**100.0%**	**8.26 [0.48, 142.43]**
Total events	2		0			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.45 (P = 0.15)						

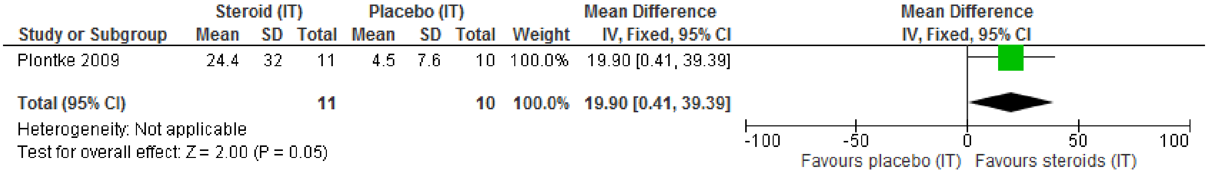
Figure 83: Steroid (IT) versus placebo (IT) or no treatment – Improvement



	Steroid (IT)		Placebo/ no treatment			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
Wu 2011	12	27	3	28	100.0%	4.15 [1.31, 13.09]
Total (95% CI)		**27**		**28**	**100.0%**	**4.15 [1.31, 13.09]**
Total events	12		3			

Heterogeneity: Not applicable
Test for overall effect: Z = 2.43 (P = 0.02)

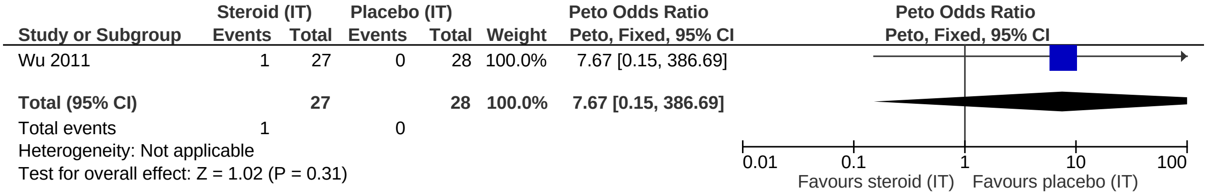
Figure 84: Steroid (IT, dexamethasone) versus placebo (IT) – Speech discrimination (maximum change)



	Steroid (IT)			Placebo (IT)				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Plontke 2009	24.4	32	11	4.5	7.6	10	100.0%	19.90 [0.41, 39.39]
Total (95% CI)			**11**			**10**	**100.0%**	**19.90 [0.41, 39.39]**

Heterogeneity: Not applicable
Test for overall effect: Z = 2.00 (P = 0.05)

Figure 85: Steroid (IT, dexamethasone) versus placebo (IT) – Adverse events: perforation of tympanic membrane



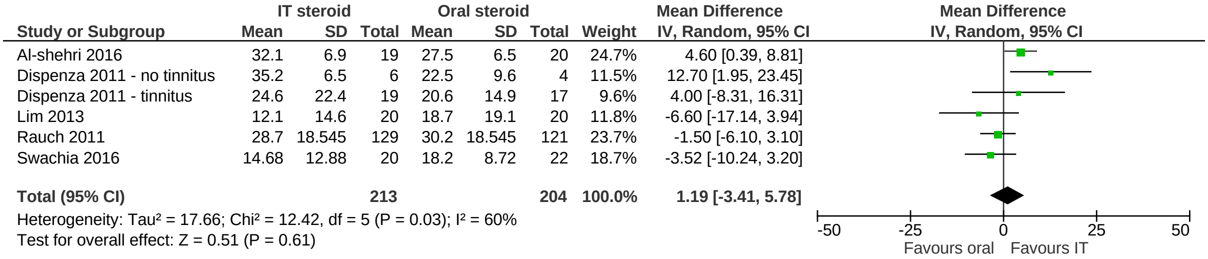
	Steroid (IT)		Placebo (IT)			Peto Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	Peto, Fixed, 95% CI
Wu 2011	1	27	0	28	100.0%	7.67 [0.15, 386.69]
Total (95% CI)		**27**		**28**	**100.0%**	**7.67 [0.15, 386.69]**
Total events	1		0			

Heterogeneity: Not applicable
Test for overall effect: Z = 1.02 (P = 0.31)

K.7.2 Routes of administration

K.7.2.1 IT versus oral steroid

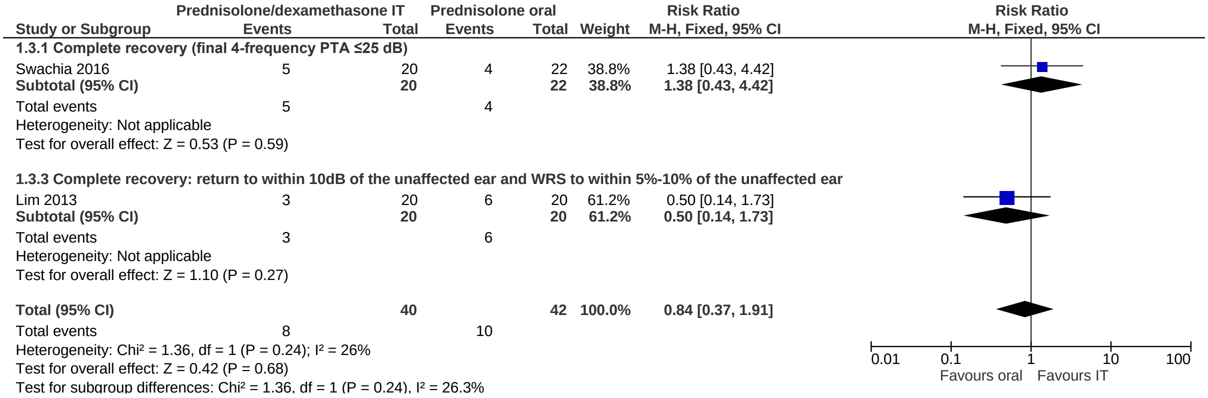
Figure 86: IT prednisolone, methylprednisolone or dexamethasone versus oral prednisolone – PTA improvement



	IT steroid			Oral steroid				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Al-shehri 2016	32.1	6.9	19	27.5	6.5	20	24.7%	4.60 [0.39, 8.81]
Dispenza 2011 - no tinnitus	35.2	6.5	6	22.5	9.6	4	11.5%	12.70 [1.95, 23.45]
Dispenza 2011 - tinnitus	24.6	22.4	19	20.6	14.9	17	9.6%	4.00 [-8.31, 16.31]
Lim 2013	12.1	14.6	20	18.7	19.1	20	11.8%	-6.60 [-17.14, 3.94]
Rauch 2011	28.7	18.545	129	30.2	18.545	121	23.7%	-1.50 [-6.10, 3.10]
Swachia 2016	14.68	12.88	20	18.2	8.72	22	18.7%	-3.52 [-10.24, 3.20]
Total (95% CI)			**213**			**204**	**100.0%**	**1.19 [-3.41, 5.78]**

Heterogeneity: Tau² = 17.66; Chi² = 12.42, df = 5 (P = 0.03); I² = 60%
Test for overall effect: Z = 0.51 (P = 0.61)

Figure 87: IT methylprednisolone or dexamethasone versus oral prednisolone – recovery

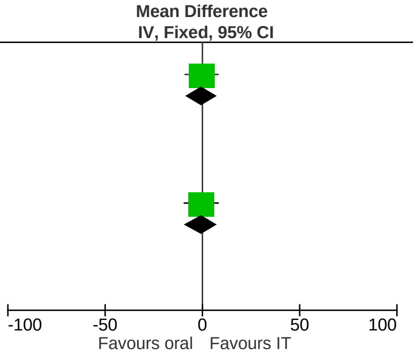


	Prednisolone/dexamethasone IT		Prednisolone oral			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
1.3.1 Complete recovery (final 4-frequency PTA ≤25 dB)						
Swachia 2016	5	20	4	22	38.8%	1.38 [0.43, 4.42]
Subtotal (95% CI)		**20**		**22**	**38.8%**	**1.38 [0.43, 4.42]**
Total events	5		4			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.53 (P = 0.59)						
1.3.3 Complete recovery: return to within 10dB of the unaffected ear and WRS to within 5%-10% of the unaffected ear						
Lim 2013	3	20	6	20	61.2%	0.50 [0.14, 1.73]
Subtotal (95% CI)		**20**		**20**	**61.2%**	**0.50 [0.14, 1.73]**
Total events	3		6			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.10 (P = 0.27)						
Total (95% CI)		**40**		**42**	**100.0%**	**0.84 [0.37, 1.91]**
Total events	8		10			

Heterogeneity: Chi² = 1.36, df = 1 (P = 0.24); I² = 26%
Test for overall effect: Z = 0.42 (P = 0.68)
Test for subgroup differences: Chi² = 1.36, df = 1 (P = 0.24), I² = 26.3%

Figure 88: IT methylprednisolone versus oral prednisolone – word recognition score improvement

	IT steroid			Oral steroid				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
1.5.1 2 months								
Rauch 2011	33.8	34.4407	129	34.2	33.3345	121	100.0%	-0.40 [-8.80, 8.00]
Subtotal (95% CI)			**129**			**121**	**100.0%**	**-0.40 [-8.80, 8.00]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.09 (P = 0.93)								
1.5.2 6 months								
Rauch 2011	35.3	34.4407	129	35.9	35.5568	121	100.0%	-0.60 [-9.29, 8.09]
Subtotal (95% CI)			**129**			**121**	**100.0%**	**-0.60 [-9.29, 8.09]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.14 (P = 0.89)								



Test for subgroup differences: Chi² = 0.00, df = 1 (P = 0.97), I² = 0%

Figure 89: IT methylprednisolone versus oral prednisolone – patients with adverse events

	IT steroid		Oral steroid			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**
Rauch 2011	116	129	106	121	99.2%	1.03 [0.94, 1.12]
Swachia 2016	7	20	5	22	0.8%	1.54 [0.58, 4.08]
Total (95% CI)		**149**		**143**	**100.0%**	**1.03 [0.94, 1.12]**
Total events	123		111			

Heterogeneity: Tau² = 0.00; Chi² = 0.81, df = 1 (P = 0.37); I² = 0%
Test for overall effect: Z = 0.65 (P = 0.51)

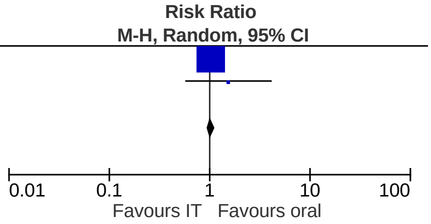


Figure 90: IT methylprednisolone versus oral prednisolone – serious adverse events

	IT steroid		Oral steroid			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Fixed, 95% CI**
Rauch 2011	0	129	1	121		0.31 [0.01, 7.61]

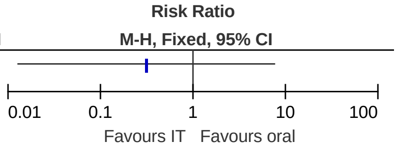
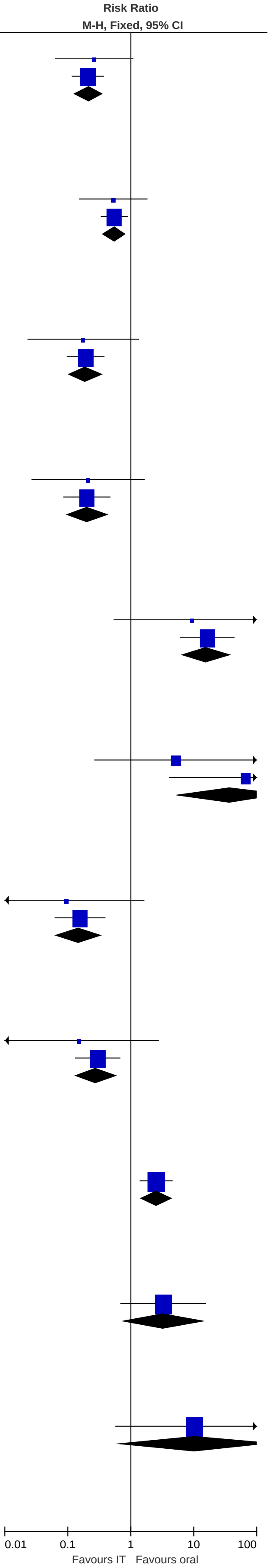


Figure 91: IT methylprednisolone versus oral prednisolone – adverse events

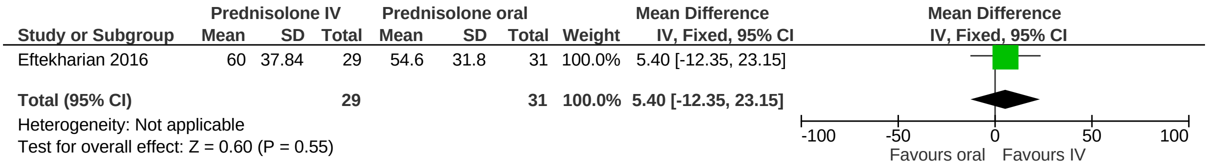
	IT steroid		Oral steroid			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Fixed, 95% CI**
1.8.1 Mood change						
Al-shehri 2016	2	19	8	20	12.3%	0.26 [0.06, 1.08]
Rauch 2011	12	129	54	121	87.7%	0.21 [0.12, 0.37]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**0.22 [0.13, 0.37]**
Total events	14		62			
Heterogeneity: Chi^2 = 0.09, df = 1 (P = 0.76); I^2 = 0%						
Test for overall effect: Z = 5.66 (P < 0.00001)						
1.8.2 Blood glucose problem						
Al-shehri 2016	3	19	6	20	13.6%	0.53 [0.15, 1.81]
Rauch 2011	21	129	36	121	86.4%	0.55 [0.34, 0.88]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**0.54 [0.35, 0.85]**
Total events	24		42			
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.95); I^2 = 0%						
Test for overall effect: Z = 2.68 (P = 0.007)						
1.8.3 Sleep change						
Al-shehri 2016	1	19	6	20	11.4%	0.18 [0.02, 1.32]
Rauch 2011	9	129	44	121	88.6%	0.19 [0.10, 0.38]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**0.19 [0.10, 0.36]**
Total events	10		50			
Heterogeneity: Chi^2 = 0.01, df = 1 (P = 0.93); I^2 = 0%						
Test for overall effect: Z = 5.10 (P < 0.00001)						
1.8.4 Increased appetite						
Al-shehri 2016	1	19	5	20	14.4%	0.21 [0.03, 1.64]
Rauch 2011	6	129	28	121	85.6%	0.20 [0.09, 0.47]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**0.20 [0.09, 0.44]**
Total events	7		33			
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.97); I^2 = 0%						
Test for overall effect: Z = 4.00 (P < 0.0001)						
1.8.5 Earache						
Al-shehri 2016	4	19	0	20	10.6%	9.45 [0.54, 164.49]
Rauch 2011	70	129	4	121	89.4%	16.41 [6.18, 43.59]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**15.68 [6.22, 39.49]**
Total events	74		4			
Heterogeneity: Chi^2 = 0.13, df = 1 (P = 0.72); I^2 = 0%						
Test for overall effect: Z = 5.84 (P < 0.00001)						
1.8.6 Injection site pain						
Al-shehri 2016	2	19	0	20	48.6%	5.25 [0.27, 102.74]
Rauch 2011	35	129	0	121	51.4%	66.63 [4.13, 1074.35]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**36.80 [4.99, 271.61]**
Total events	37		0			
Heterogeneity: Chi^2 = 1.82, df = 1 (P = 0.18); I^2 = 45%						
Test for overall effect: Z = 3.54 (P = 0.0004)						
1.8.7 Mouth dryness/thirst						
Al-shehri 2016	0	19	5	20	14.8%	0.10 [0.01, 1.62]
Rauch 2011	5	129	30	121	85.2%	0.16 [0.06, 0.39]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**0.15 [0.06, 0.35]**
Total events	5		35			
Heterogeneity: Chi^2 = 0.11, df = 1 (P = 0.74); I^2 = 0%						
Test for overall effect: Z = 4.32 (P < 0.0001)						
1.8.8 Weight gain						
Al-shehri 2016	0	19	3	20	13.1%	0.15 [0.01, 2.72]
Rauch 2011	7	129	22	121	86.9%	0.30 [0.13, 0.67]
Subtotal (95% CI)		**148**		**141**	**100.0%**	**0.28 [0.13, 0.61]**
Total events	7		25			
Heterogeneity: Chi^2 = 0.20, df = 1 (P = 0.65); I^2 = 0%						
Test for overall effect: Z = 3.20 (P = 0.001)						
1.8.9 Dizziness/vertigo						
Rauch 2011	35	129	13	121	100.0%	2.53 [1.41, 4.54]
Subtotal (95% CI)		**129**		**121**	**100.0%**	**2.53 [1.41, 4.54]**
Total events	35		13			
Heterogeneity: Not applicable						
Test for overall effect: Z = 3.10 (P = 0.002)						
1.8.10 Ear infection						
Rauch 2011	7	129	2	121	100.0%	3.28 [0.70, 15.49]
Subtotal (95% CI)		**129**		**121**	**100.0%**	**3.28 [0.70, 15.49]**
Total events	7		2			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.50 (P = 0.13)						
1.8.11 Typanic membrane perforation						
Rauch 2011	5	129	0	121	100.0%	10.32 [0.58, 184.73]
Subtotal (95% CI)		**129**		**121**	**100.0%**	**10.32 [0.58, 184.73]**
Total events	5		0			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.59 (P = 0.11)						



Test for subgroup differences: Chi^2 = 143.11, df = 10 (P < 0.00001), I^2 = 93.0%

K.7.2.2 IV versus oral steroid

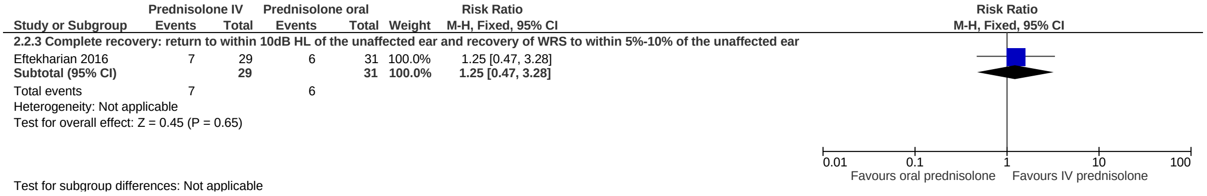
Figure 92: IV methylprednisolone followed by oral prednisolone versus oral prednisolone – PTA improvement



	Prednisolone IV			Prednisolone oral				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Eftekharian 2016	60	37.84	29	54.6	31.8	31	100.0%	5.40 [-12.35, 23.15]
Total (95% CI)			**29**			**31**	**100.0%**	**5.40 [-12.35, 23.15]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.60 (P = 0.55)

Figure 93: IV methylprednisolone followed by oral prednisolone versus oral prednisolone – recovery

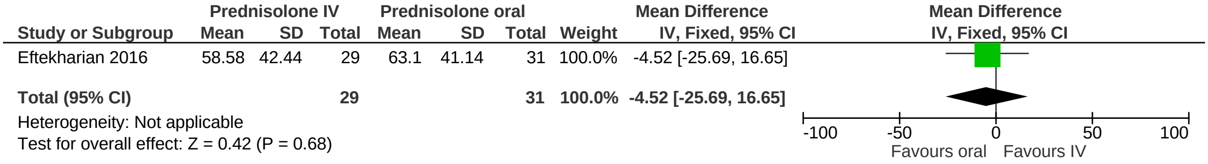


	Prednisolone IV		Prednisolone oral			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
2.2.3 Complete recovery: return to within 10dB HL of the unaffected ear and recovery of WRS to within 5%-10% of the unaffected ear						
Eftekharian 2016	7	29	6	31	100.0%	1.25 [0.47, 3.28]
Subtotal (95% CI)		**29**		**31**	**100.0%**	**1.25 [0.47, 3.28]**
Total events	7		6			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.45 (P = 0.65)

Test for subgroup differences: Not applicable

Figure 94: IV methylprednisolone followed by oral prednisolone versus oral prednisolone – word recognition score improvement (%)



	Prednisolone IV			Prednisolone oral				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Eftekharian 2016	58.58	42.44	29	63.1	41.14	31	100.0%	-4.52 [-25.69, 16.65]
Total (95% CI)			**29**			**31**	**100.0%**	**-4.52 [-25.69, 16.65]**

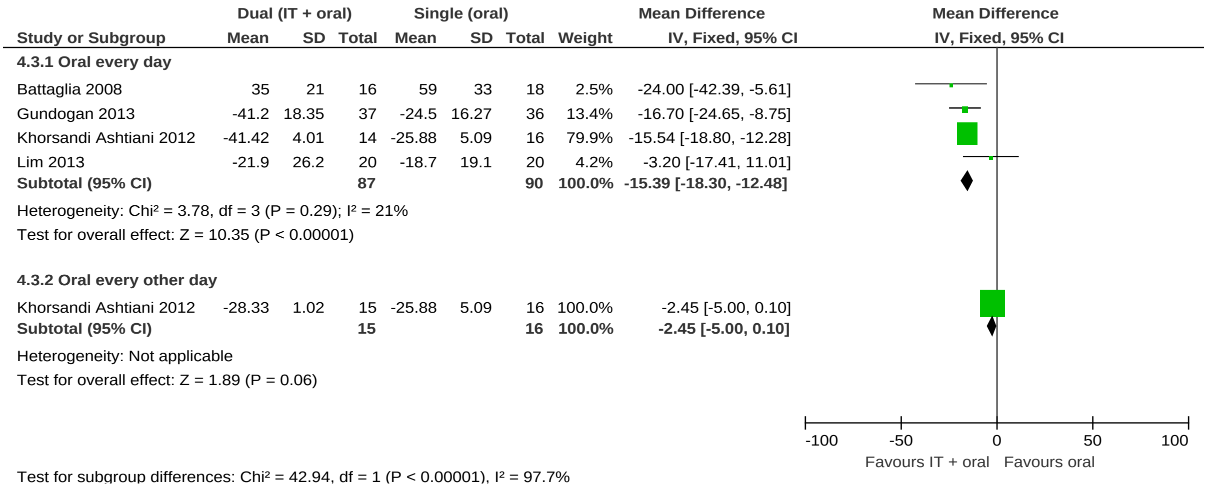
Heterogeneity: Not applicable
Test for overall effect: Z = 0.42 (P = 0.68)

Figure 95: IV methylprednisolone followed by oral prednisolone versus oral prednisolone – adverse events or complications

No events

K.7.2.3 Dual versus oral steroid

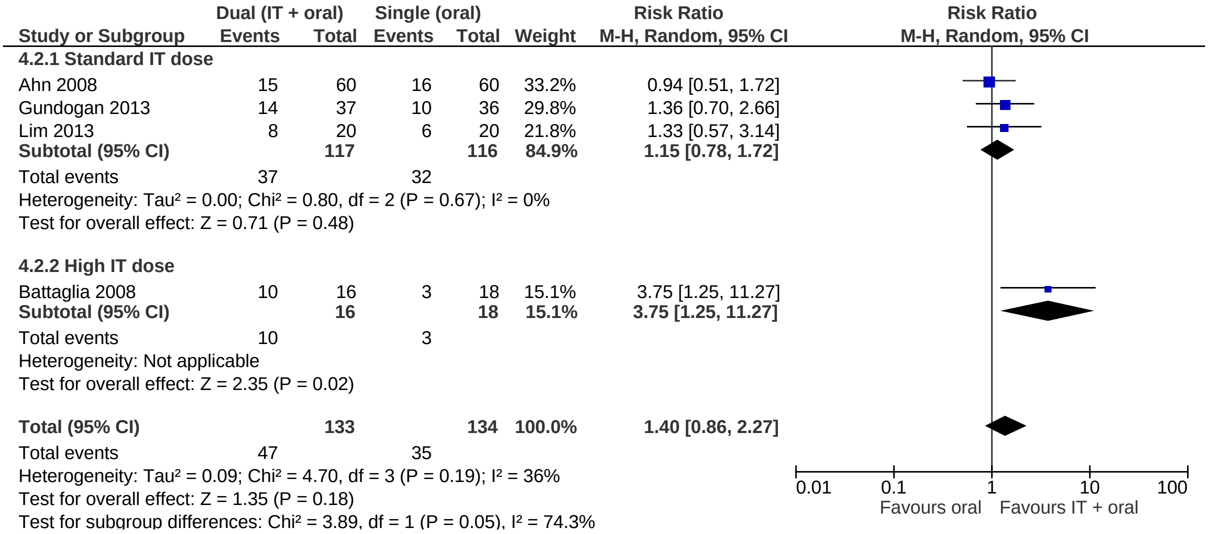
Figure 96: IT dexamethasone or methylprednisolone plus oral prednisolone versus oral prednisolone – PTA change or final score



	Dual (IT + oral)			Single (oral)				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
4.3.1 Oral every day								
Battaglia 2008	35	21	16	59	33	18	2.5%	-24.00 [-42.39, -5.61]
Gundogan 2013	-41.2	18.35	37	-24.5	16.27	36	13.4%	-16.70 [-24.65, -8.75]
Khorsandi Ashtiani 2012	-41.42	4.01	14	-25.88	5.09	16	79.9%	-15.54 [-18.80, -12.28]
Lim 2013	-21.9	26.2	20	-18.7	19.1	20	4.2%	-3.20 [-17.41, 11.01]
Subtotal (95% CI)			**87**			**90**	**100.0%**	**-15.39 [-18.30, -12.48]**
Heterogeneity: Chi² = 3.78, df = 3 (P = 0.29); I² = 21%								
Test for overall effect: Z = 10.35 (P < 0.00001)								
4.3.2 Oral every other day								
Khorsandi Ashtiani 2012	-28.33	1.02	15	-25.88	5.09	16	100.0%	-2.45 [-5.00, 0.10]
Subtotal (95% CI)			**15**			**16**	**100.0%**	**-2.45 [-5.00, 0.10]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.89 (P = 0.06)								
Test for subgroup differences: Chi² = 42.94, df = 1 (P < 0.00001), I² = 97.7%								

Note: Battaglia study used high dose IT dexamethasone

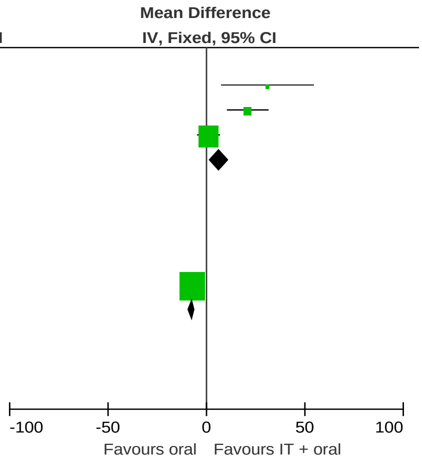
Figure 97: IT dexamethasone or methylprednisolone plus oral prednisolone versus oral prednisolone – recovery



	Dual (IT + oral)		Single (oral)			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**
4.2.1 Standard IT dose						
Ahn 2008	15	60	16	60	33.2%	0.94 [0.51, 1.72]
Gundogan 2013	14	37	10	36	29.8%	1.36 [0.70, 2.66]
Lim 2013	8	20	6	20	21.8%	1.33 [0.57, 3.14]
Subtotal (95% CI)		**117**		**116**	**84.9%**	**1.15 [0.78, 1.72]**
Total events	37		32			
Heterogeneity: Tau² = 0.00; Chi² = 0.80, df = 2 (P = 0.67); I² = 0%						
Test for overall effect: Z = 0.71 (P = 0.48)						
4.2.2 High IT dose						
Battaglia 2008	10	16	3	18	15.1%	3.75 [1.25, 11.27]
Subtotal (95% CI)		**16**		**18**	**15.1%**	**3.75 [1.25, 11.27]**
Total events	10		3			
Heterogeneity: Not applicable						
Test for overall effect: Z = 2.35 (P = 0.02)						
Total (95% CI)		**133**		**134**	**100.0%**	**1.40 [0.86, 2.27]**
Total events	47		35			
Heterogeneity: Tau² = 0.09; Chi² = 4.70, df = 3 (P = 0.19); I² = 36%						
Test for overall effect: Z = 1.35 (P = 0.18)						
Test for subgroup differences: Chi² = 3.89, df = 1 (P = 0.05), I² = 74.3%						

Figure 98: IT dexamethasone or methylprednisolone plus oral prednisolone versus oral prednisolone – change or final speech discrimination score

	Dual (IT + oral)			Single (oral)				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
4.5.3 Oral every day								
Battaglia 2008	85	23	16	54	44	18	4.1%	31.00 [7.76, 54.24]
Gundogan 2013	41.08	21.98	37	20.1	22.69	36	21.2%	20.98 [10.73, 31.23]
Khorsandi Ashtiani 2012	19.33	9.91	14	18.3	3.5	16	74.6%	1.03 [-4.44, 6.50]
Subtotal (95% CI)			**67**			**70**	**100.0%**	**6.50 [1.78, 11.23]**
Heterogeneity: Chi² = 15.78, df = 2 (P = 0.0004); I² = 87%								
Test for overall effect: Z = 2.70 (P = 0.007)								
4.5.4 Oral every other day								
Khorsandi Ashtiani 2012	11.01	0.98	15	18.3	3.5	16	100.0%	-7.29 [-9.08, -5.50]
Subtotal (95% CI)			**15**			**16**	**100.0%**	**-7.29 [-9.08, -5.50]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 8.00 (P < 0.00001)								



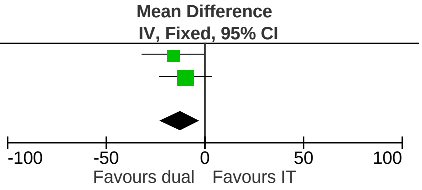
Test for subgroup differences: Chi² = 28.66, df = 1 (P < 0.00001), I² = 96.5%

Note: Battaglia study used high dose IT dexamethasone

K.7.2.4 Dual versus IT steroid

Figure 99: IT dexamethasone plus oral prednisolone versus IT dexamethasone – PTA improvement or final score

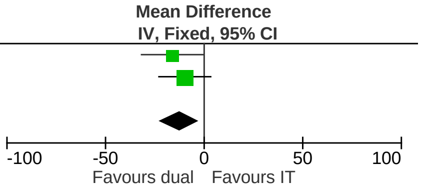
	Dual (IT + oral)			Single (IT)				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
Battaglia 2008	35	21	16	51	25	17	41.2%	-16.00 [-31.72, -0.28]
Lim 2013	-21.9	26.2	20	-12.1	14.6	20	58.8%	-9.80 [-22.94, 3.34]
Total (95% CI)			**36**			**37**	**100.0%**	**-12.35 [-22.44, -2.27]**
Heterogeneity: Chi² = 0.35, df = 1 (P = 0.55); I² = 0%								
Test for overall effect: Z = 2.40 (P = 0.02)								



Note: Battaglia study used high dose IT dexamethasone

Figure 100: IT dexamethasone plus oral prednisolone versus IT dexamethasone – recovery

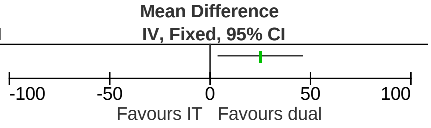
	Dual (IT + oral)			Single (IT)				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
Battaglia 2008	35	21	16	51	25	17	41.2%	-16.00 [-31.72, -0.28]
Lim 2013	-21.9	26.2	20	-12.1	14.6	20	58.8%	-9.80 [-22.94, 3.34]
Total (95% CI)			**36**			**37**	**100.0%**	**-12.35 [-22.44, -2.27]**
Heterogeneity: Chi² = 0.35, df = 1 (P = 0.55); I² = 0%								
Test for overall effect: Z = 2.40 (P = 0.02)								



Note: Battaglia study used high dose IT dexamethasone

Figure 101: IT dexamethasone plus oral prednisolone versus IT dexamethasone – speech discrimination final score

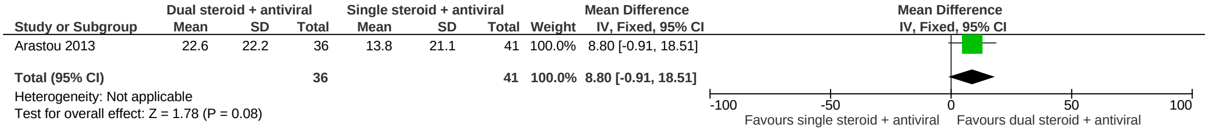
	Dual (IT + oral)			Single (IT)				Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Fixed, 95% CI**
Battaglia 2008	85	23	16	60	37	17		25.00 [4.11, 45.89]



Note: Study used high dose IT dexamethasone

K.7.2.5 Dual steroid plus antiviral versus single steroid plus antiviral

Figure 102: IT dexamethasone plus oral prednisolone plus oral acyclovir versus oral prednisolone plus oral acyclovir – PTA improvement



	Dual steroid + antiviral			Single steroid + antiviral				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Arastou 2013	22.6	22.2	36	13.8	21.1	41	100.0%	8.80 [-0.91, 18.51]
Total (95% CI)			**36**			**41**	**100.0%**	**8.80 [-0.91, 18.51]**

Heterogeneity: Not applicable
Test for overall effect: Z = 1.78 (P = 0.08)

K.8 Information and advice

None

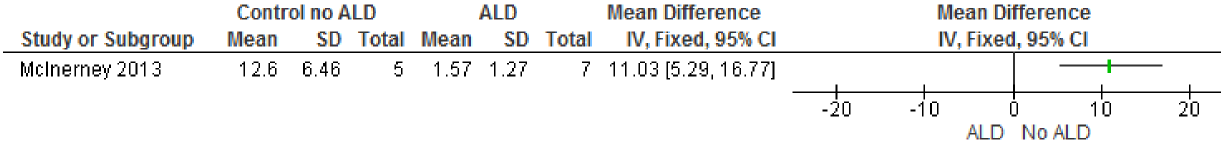
K.9 Decision tools

None

K.10 Assistive listening devices

K.10.1 Assistive listening devices versus no assistive listening devices in people with hearing loss

Figure 103: ALD ('Sonic Ear') versus no ALD; outcome: number of communication breakdowns



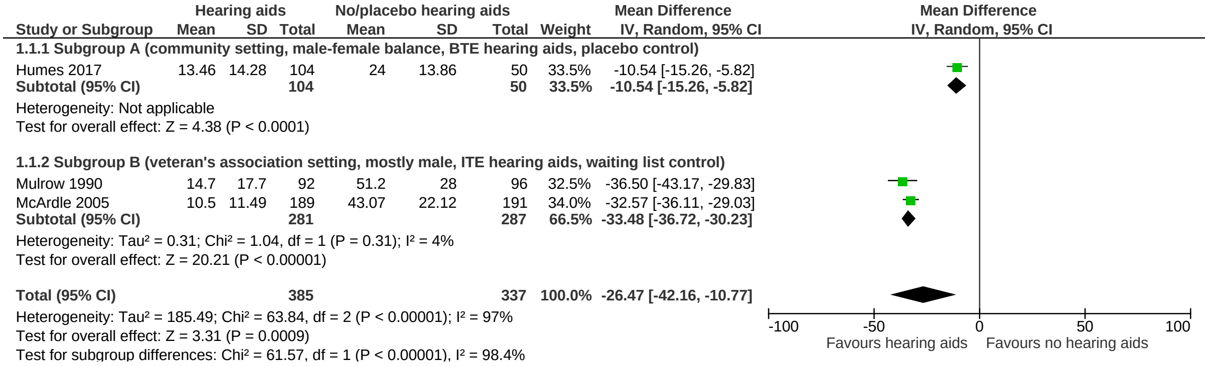
	Control no ALD			ALD			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
McInerney 2013	12.6	6.46	5	1.57	1.27	7	11.03 [5.29, 16.77]

K.11 Hearing aids

K.11.1 Hearing aids versus no hearing aids

K.11.1.1 Hearing-specific health-related quality of life

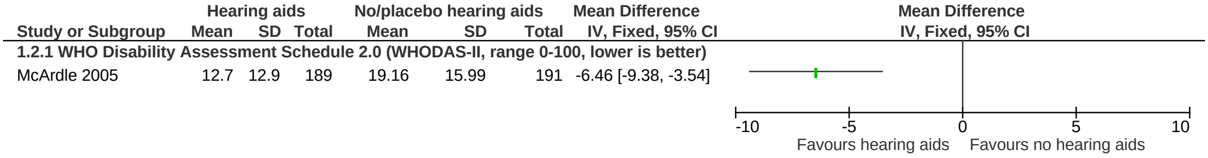
Figure 104: Hearing aids versus no hearing aid or placebo



	Hearing aids			No/placebo hearing aids				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
1.1.1 Subgroup A (community setting, male-female balance, BTE hearing aids, placebo control)								
Humes 2017	13.46	14.28	104	24	13.86	50	33.5%	-10.54 [-15.26, -5.82]
Subtotal (95% CI)			**104**			**50**	**33.5%**	**-10.54 [-15.26, -5.82]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 4.38 (P < 0.0001)								
1.1.2 Subgroup B (veteran's association setting, mostly male, ITE hearing aids, waiting list control)								
Mulrow 1990	14.7	17.7	92	51.2	28	96	32.5%	-36.50 [-43.17, -29.83]
McArdle 2005	10.5	11.49	189	43.07	22.12	191	34.0%	-32.57 [-36.11, -29.03]
Subtotal (95% CI)			**281**			**287**	**66.5%**	**-33.48 [-36.72, -30.23]**
Heterogeneity: Tau^2 = 0.31; Chi^2 = 1.04, df = 1 (P = 0.31); I^2 = 4%								
Test for overall effect: Z = 20.21 (P < 0.00001)								
Total (95% CI)			**385**			**337**	**100.0%**	**-26.47 [-42.16, -10.77]**
Heterogeneity: Tau^2 = 185.49; Chi^2 = 63.84, df = 2 (P < 0.00001); I^2 = 97%								
Test for overall effect: Z = 3.31 (P = 0.0009)								
Test for subgroup differences: Chi^2 = 61.57, df = 1 (P < 0.00001), I^2 = 98.4%								

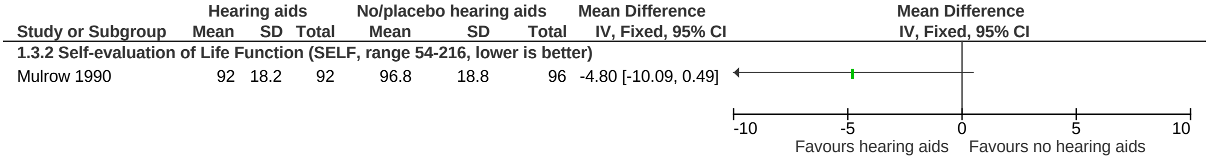
K.11.1.2 Health-related quality of life

Figure 105: Hearing aids versus no hearing aid or placebo



	Hearing aids			No/placebo hearing aids			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
1.2.1 WHO Disability Assessment Schedule 2.0 (WHODAS-II, range 0-100, lower is better)							
McArdle 2005	12.7	12.9	189	19.16	15.99	191	-6.46 [-9.38, -3.54]

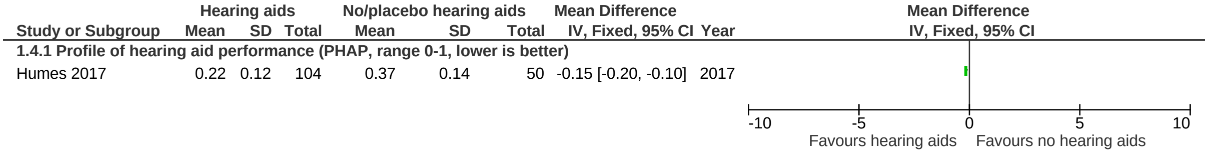
Figure 106: Hearing aids versus no hearing aid or placebo



	Hearing aids			No/placebo hearing aids			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
1.3.2 Self-evaluation of Life Function (SELF, range 54-216, lower is better)							
Mulrow 1990	92	18.2	92	96.8	18.8	96	-4.80 [-10.09, 0.49]

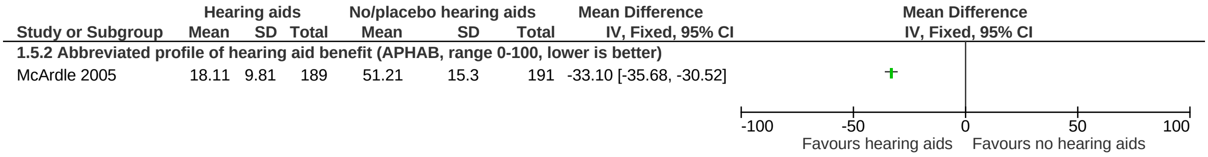
K.11.1.3 Listening ability

Figure 107: Hearing aids versus no hearing aid or placebo



	Hearing aids			No/placebo hearing aids			Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI	Year
1.4.1 Profile of hearing aid performance (PHAP, range 0-1, lower is better)								
Humes 2017	0.22	0.12	104	0.37	0.14	50	-0.15 [-0.20, -0.10]	2017

Figure 108: Hearing aids versus no hearing aid/placebo



Study or Subgroup	Hearing aids Mean	Hearing aids SD	Hearing aids Total	No/placebo hearing aids Mean	No/placebo hearing aids SD	No/placebo hearing aids Total	Mean Difference IV, Fixed, 95% CI
1.5.2 Abbreviated profile of hearing aid benefit (APHAB, range 0-100, lower is better)							
McArdle 2005	18.11	9.81	189	51.21	15.3	191	-33.10 [-35.68, -30.52]

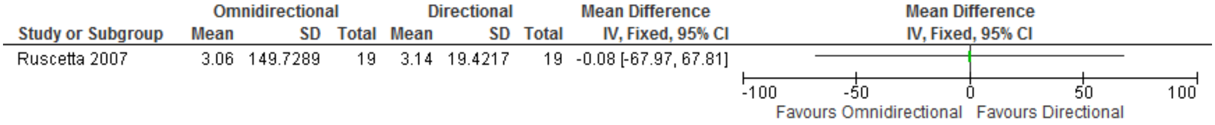
K.11.2 1 hearing aid versus 2 hearing aids

None

K.12 Hearing aid microphones and noise reduction algorithms

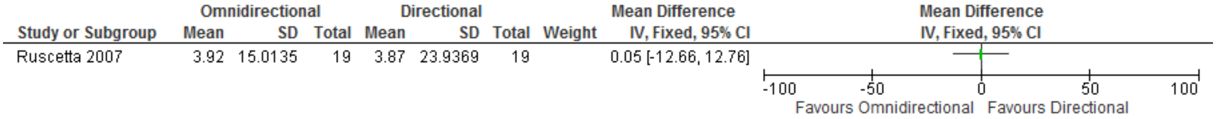
K.12.1 Microphones

Figure 109: Directional versus omnidirectional microphones in people with hearing loss; outcome: self-perceived level of ability to tell the direction of sounds (localisation disability)



Study or Subgroup	Omnidirectional Mean	Omnidirectional SD	Omnidirectional Total	Directional Mean	Directional SD	Directional Total	Mean Difference IV, Fixed, 95% CI
Ruscetta 2007	3.06	149.7289	19	3.14	19.4217	19	-0.08 [-67.97, 67.81]

Figure 110: Directional versus omnidirectional microphones in people with hearing loss; outcome: self-perceived level of amount of withdrawal from activities of daily living (localisation handicap)



Study or Subgroup	Omnidirectional Mean	Omnidirectional SD	Omnidirectional Total	Directional Mean	Directional SD	Directional Total	Weight	Mean Difference IV, Fixed, 95% CI
Ruscetta 2007	3.92	15.0135	19	3.87	23.9369	19		0.05 [-12.66, 12.76]

K.12.2 Noise reduction algorithms

None

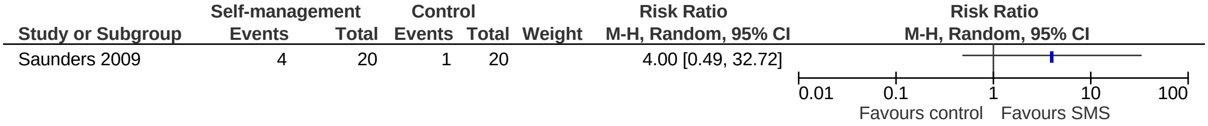
K.13 Monitoring and follow-up

None

K.14 Interventions to support the use of hearing aids

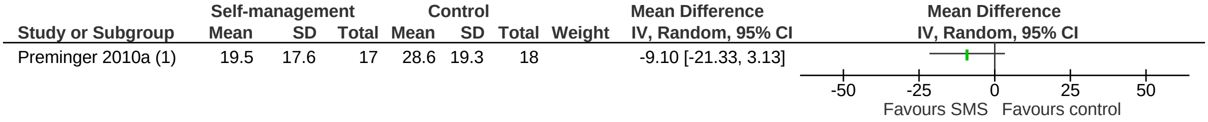
K.14.1 Aftercare: self-management support interventions versus control

Figure 111: Self-management support interventions versus control, outcome: hearing aid use (>8 h/day) – short/medium term



	Self-management		Control			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI
Saunders 2009	4	20	1	20		4.00 [0.49, 32.72]

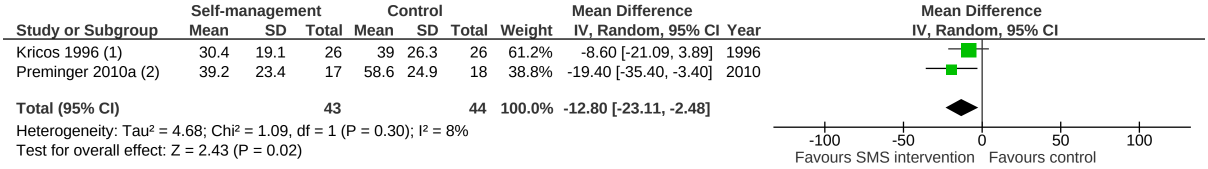
Figure 112: Self-management support interventions versus control, outcome: quality of life – short/medium term



	Self-management			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Preminger 2010a (1)	19.5	17.6	17	28.6	19.3	18		-9.10 [-21.33, 3.13]

Footnotes
(1) Medium term data, WHO-DAS II - lower score = better QoL

Figure 113: Self-management support interventions versus control, outcome: self-reported hearing handicap – short/medium term

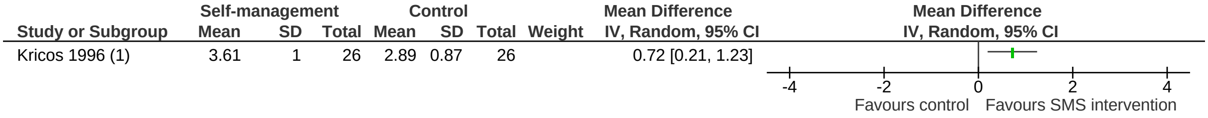


	Self-management			Control				Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
Kricos 1996 (1)	30.4	19.1	26	39	26.3	26	61.2%	-8.60 [-21.09, 3.89]	1996
Preminger 2010a (2)	39.2	23.4	17	58.6	24.9	18	38.8%	-19.40 [-35.40, -3.40]	2010
Total (95% CI)			**43**			**44**	**100.0%**	**-12.80 [-23.11, -2.48]**	

Heterogeneity: Tau² = 4.68; Chi² = 1.09, df = 1 (P = 0.30); I² = 8%
Test for overall effect: Z = 2.43 (P = 0.02)

Footnotes
(1) High risk of bias
(2) Medium term data, high risk of bias

Figure 114: Self-management support interventions versus control, outcome: use of verbal communication stretegy – short/medium term



	Self-management			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Kricos 1996 (1)	3.61	1	26	2.89	0.87	26		0.72 [0.21, 1.23]

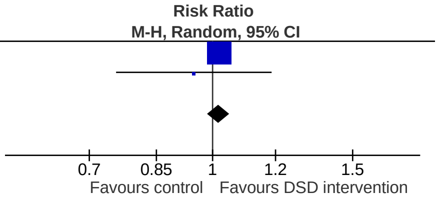
Footnotes
(1) High risk of bias

K.14.2 Aftercare: delivery system design interventions versus control

Figure 115: Delivery system design interventions versus control, outcome: adherence – short/medium term

	DSD intervention		Control			Risk Ratio	
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**	**Year**
Collins 2013 (1)	311	321	307	323	98.0%	1.02 [0.99, 1.05]	2013
Campos 2013 (2)	18	21	19	21	2.0%	0.95 [0.76, 1.18]	2013
Total (95% CI)		**342**		**344**	**100.0%**	**1.02 [0.99, 1.05]**	
Total events	329		326				

Heterogeneity: Tau² = 0.00; Chi² = 0.43, df = 1 (P = 0.51); I² = 0%
Test for overall effect: Z = 1.11 (P = 0.27)

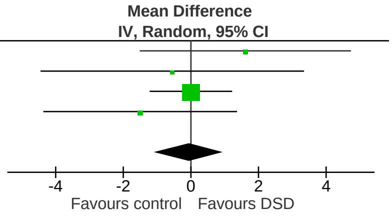


Footnotes
(1) Group vs individual fitting (medium term)
(2) Remote online fitting vs face-to-face fitting (short term)

Figure 116: Delivery system design interventions versus control, outcome: daily hours of hearing aid use – short/medium term

	DSD intervention			Control				Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
Cherry 1994 (1)	8.36	5.84	30	6.75	6.41	30	10.5%	1.61 [-1.49, 4.71]	1994
Cunningham 2001 (2)	8.67	2.65	9	9.22	5.31	9	6.7%	-0.55 [-4.43, 3.33]	2001
Collins 2013 (3)	10.2	7.3697	298	10.2	7.3697	282	70.3%	0.00 [-1.20, 1.20]	2013
Campos 2013 (4)	5.4	4.9	21	6.9	4.5	21	12.5%	-1.50 [-4.35, 1.35]	2013
Total (95% CI)			**358**			**342**	**100.0%**	**-0.06 [-1.06, 0.95]**	

Heterogeneity: Tau² = 0.00; Chi² = 2.17, df = 3 (P = 0.54); I² = 0%
Test for overall effect: Z = 0.11 (P = 0.91)



Footnotes
(1) Medium term data
(2) Medium term data
(3) Medium term data - Standard deviations calculated from mean difference and CIs reported in study
(4) Short term data - measured with data-logging

Figure 117: Delivery system design interventions versus control, outcome: adverse effects – long term

	DSD intervention		Control			Risk Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**
Cherry 1994	21	49	28	49		0.75 [0.50, 1.12]

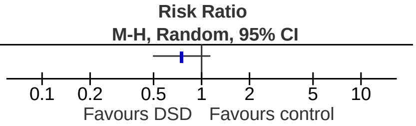
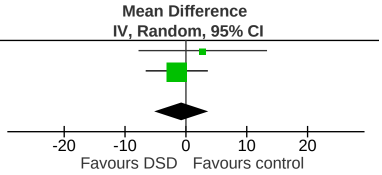


Figure 118: Delivery system design interventions versus control, outcome: self-reported hearing handicap – short/medium term

	DSD intervention			Control				Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
Cherry 1994 (1)	26.85	17.92	26	24.08	20.45	26	18.6%	2.77 [-7.68, 13.22]	1994
Collins 2013 (2)	13.5	30.5905	277	15	30.5905	299	81.4%	-1.50 [-6.50, 3.50]	2013
Total (95% CI)			**303**			**325**	**100.0%**	**-0.70 [-5.22, 3.81]**	

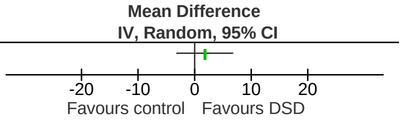
Heterogeneity: Tau² = 0.00; Chi² = 0.52, df = 1 (P = 0.47); I² = 0%
Test for overall effect: Z = 0.31 (P = 0.76)



Footnotes
(1) Medium term data
(2) Medium term data - SDs calculated from reported CIs and p-value

Figure 119: Delivery system design interventions versus control, outcome: hearing aid benefit – short/medium term

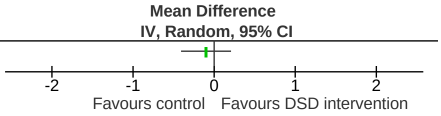
	DSD intervention			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Collins 2013 (1)	68.8	30.142	282	67	30.142	300		1.80 [-3.10, 6.70]



Footnotes
(1) Measured using Outer EAR, SDs calculated from p-value and confidence intervals

Figure 120: Delivery system design interventions versus control, outcome: use of verbal communication strategy – short/medium term

	DSD intervention			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Collins 2013 (1)	2.3	1.8547	284	2.4	1.8547	304		-0.10 [-0.40, 0.20]



Footnotes
(1) SDs calculated based on p-value and CIs

K.14.3 Aftercare: combined SMS/DSD interventions versus control

Figure 121: Combined SMS/DSD interventions versus control, outcome: adherence – short/medium term

	SMS/DSD intervention		Control			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI
Ferguson 2016	79	79	83	88		1.06 [1.00, 1.12]

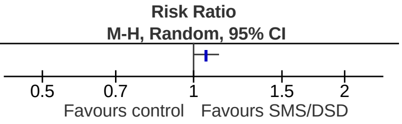


Figure 122: Combined SMS/DSD interventions versus control, outcome: daily hours of hearing aid use – long term

	SMS/DSD intervention			Control				Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
Oberg 2008	3.7	0.9	16	4	1	18	50.8%	-0.30 [-0.94, 0.34]	2008
Oberg 2009	4.1	1	17	3.7	1	18	49.2%	0.40 [-0.26, 1.06]	2009
Total (95% CI)			**33**			**36**	**100.0%**	**0.04 [-0.64, 0.73]**	

Heterogeneity: Tau² = 0.13; Chi² = 2.22, df = 1 (P = 0.14); I² = 55%
Test for overall effect: Z = 0.13 (P = 0.90)

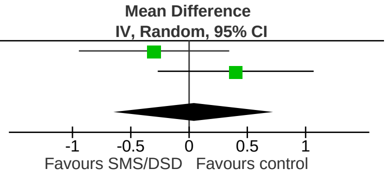
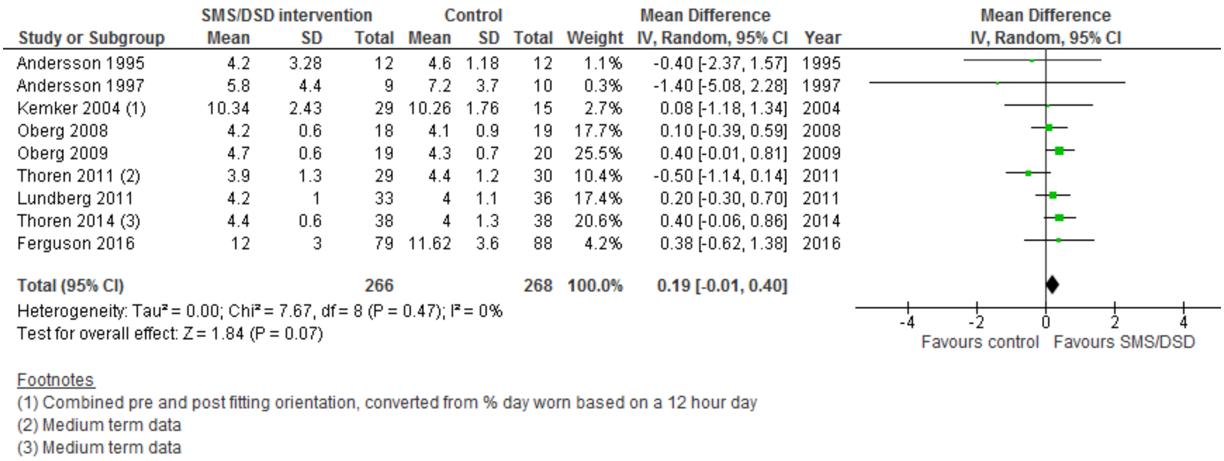


Figure 123: Combined SMS/DSD interventions versus control, outcome: daily hours of hearing aid use – short/medium term

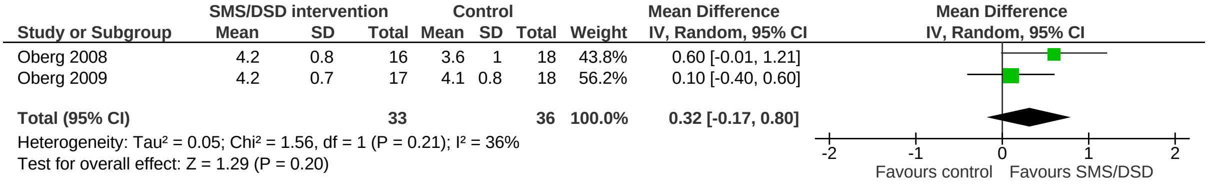


	SMS/DSD intervention			Control				Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
Andersson 1995	4.2	3.28	12	4.6	1.18	12	1.1%	-0.40 [-2.37, 1.57]	1995
Andersson 1997	5.8	4.4	9	7.2	3.7	10	0.3%	-1.40 [-5.08, 2.28]	1997
Kemker 2004 (1)	10.34	2.43	29	10.26	1.76	15	2.7%	0.08 [-1.18, 1.34]	2004
Oberg 2008	4.2	0.6	18	4.1	0.9	19	17.7%	0.10 [-0.39, 0.59]	2008
Oberg 2009	4.7	0.6	19	4.3	0.7	20	25.5%	0.40 [-0.01, 0.81]	2009
Thoren 2011 (2)	3.9	1.3	29	4.4	1.2	30	10.4%	-0.50 [-1.14, 0.14]	2011
Lundberg 2011	4.2	1	33	4	1.1	36	17.4%	0.20 [-0.30, 0.70]	2011
Thoren 2014 (3)	4.4	0.6	38	4	1.3	38	20.6%	0.40 [-0.06, 0.86]	2014
Ferguson 2016	12	3	79	11.62	3.6	88	4.2%	0.38 [-0.62, 1.38]	2016
Total (95% CI)			**266**			**268**	**100.0%**	**0.19 [-0.01, 0.40]**	

Heterogeneity: Tau² = 0.00; Chi² = 7.67, df = 8 (P = 0.47); I² = 0%
Test for overall effect: Z = 1.84 (P = 0.07)

Footnotes
(1) Combined pre and post fitting orientation, converted from % day worn based on a 12 hour day
(2) Medium term data
(3) Medium term data

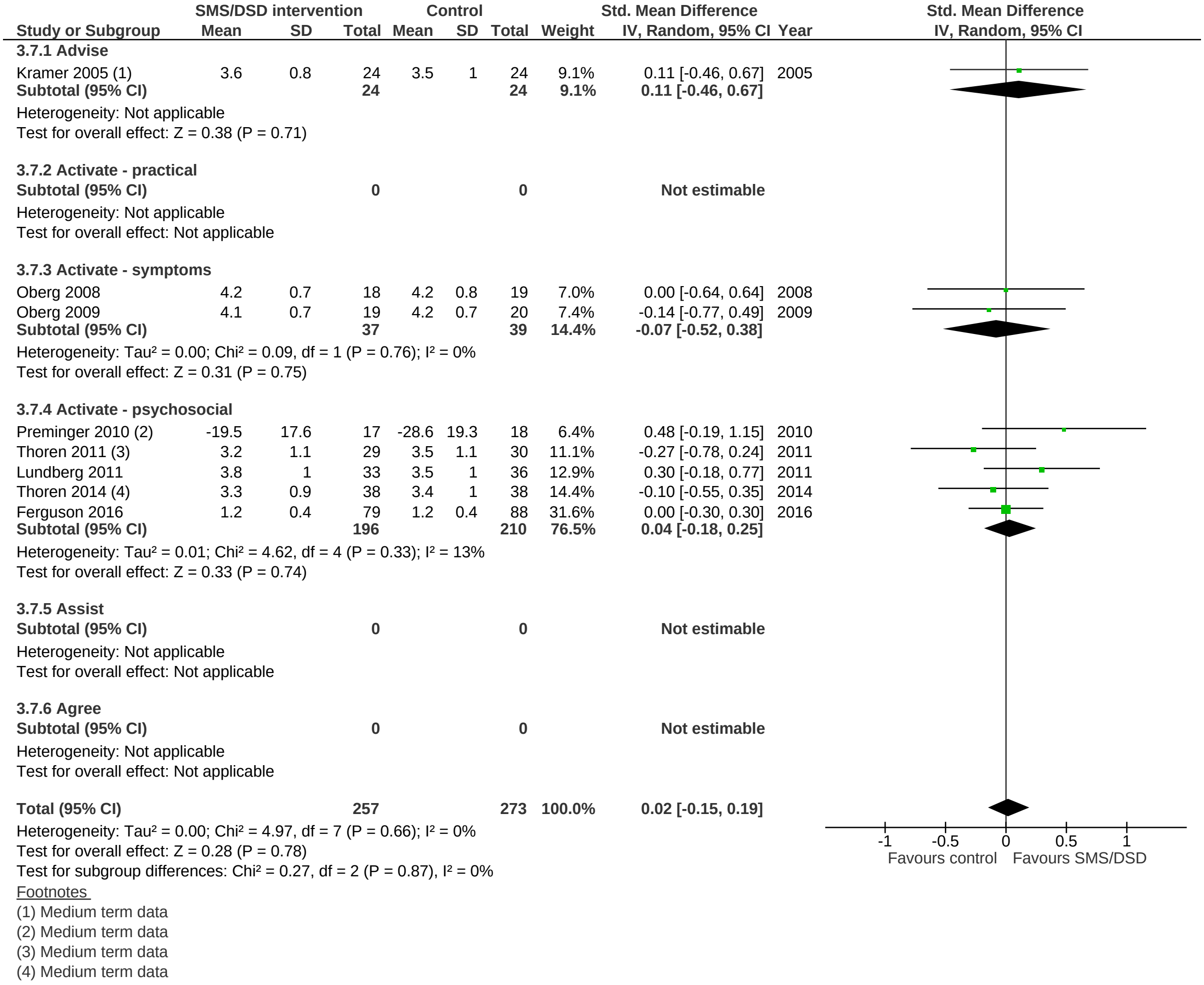
Figure 124: Combined SMS/DSD interventions versus control, outcome: quality of life – long term



	SMS/DSD intervention			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Oberg 2008	4.2	0.8	16	3.6	1	18	43.8%	0.60 [-0.01, 1.21]
Oberg 2009	4.2	0.7	17	4.1	0.8	18	56.2%	0.10 [-0.40, 0.60]
Total (95% CI)			**33**			**36**	**100.0%**	**0.32 [-0.17, 0.80]**

Heterogeneity: Tau² = 0.05; Chi² = 1.56, df = 1 (P = 0.21); I² = 36%
Test for overall effect: Z = 1.29 (P = 0.20)

Figure 125: Combined SMS/DSD interventions versus control, outcome: quality of life – short/medium term (SMS content)



	SMS/DSD intervention			Control				Std. Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
3.7.1 Advise									
Kramer 2005 (1)	3.6	0.8	24	3.5	1	24	9.1%	0.11 [-0.46, 0.67]	2005
Subtotal (95% CI)			**24**			**24**	**9.1%**	**0.11 [-0.46, 0.67]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 0.38 (P = 0.71)									
3.7.2 Activate - practical									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.7.3 Activate - symptoms									
Oberg 2008	4.2	0.7	18	4.2	0.8	19	7.0%	0.00 [-0.64, 0.64]	2008
Oberg 2009	4.1	0.7	19	4.2	0.7	20	7.4%	-0.14 [-0.77, 0.49]	2009
Subtotal (95% CI)			**37**			**39**	**14.4%**	**-0.07 [-0.52, 0.38]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.09, df = 1 (P = 0.76); I² = 0%									
Test for overall effect: Z = 0.31 (P = 0.75)									
3.7.4 Activate - psychosocial									
Preminger 2010 (2)	-19.5	17.6	17	-28.6	19.3	18	6.4%	0.48 [-0.19, 1.15]	2010
Thoren 2011 (3)	3.2	1.1	29	3.5	1.1	30	11.1%	-0.27 [-0.78, 0.24]	2011
Lundberg 2011	3.8	1	33	3.5	1	36	12.9%	0.30 [-0.18, 0.77]	2011
Thoren 2014 (4)	3.3	0.9	38	3.4	1	38	14.4%	-0.10 [-0.55, 0.35]	2014
Ferguson 2016	1.2	0.4	79	1.2	0.4	88	31.6%	0.00 [-0.30, 0.30]	2016
Subtotal (95% CI)			**196**			**210**	**76.5%**	**0.04 [-0.18, 0.25]**	
Heterogeneity: Tau² = 0.01; Chi² = 4.62, df = 4 (P = 0.33); I² = 13%									
Test for overall effect: Z = 0.33 (P = 0.74)									
3.7.5 Assist									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.7.6 Agree									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
Total (95% CI)			**257**			**273**	**100.0%**	**0.02 [-0.15, 0.19]**	
Heterogeneity: Tau² = 0.00; Chi² = 4.97, df = 7 (P = 0.66); I² = 0%									
Test for overall effect: Z = 0.28 (P = 0.78)									
Test for subgroup differences: Chi² = 0.27, df = 2 (P = 0.87), I² = 0%									

Footnotes
(1) Medium term data
(2) Medium term data
(3) Medium term data
(4) Medium term data

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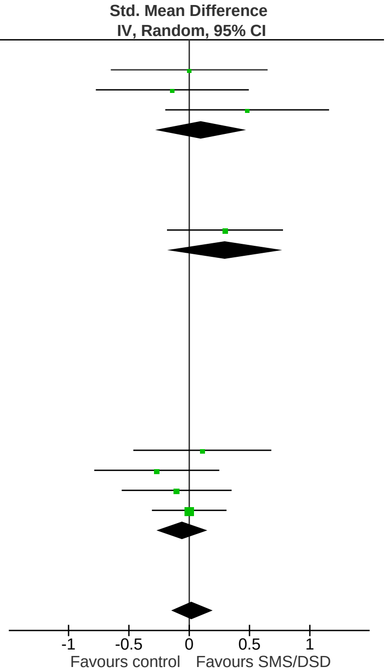
Figure 126: Combined SMS/DSD interventions versus control, outcome: quality of life – short/medium term (DSD format)

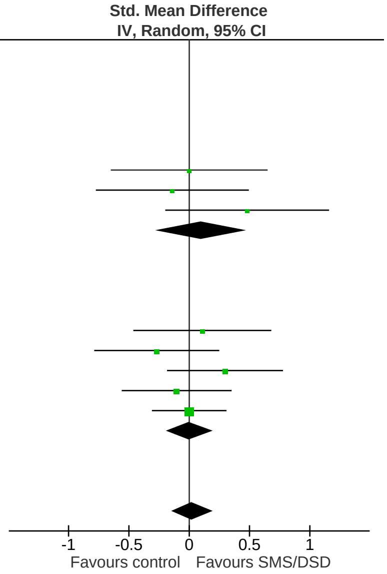
	SMS/DSD intervention			Control				Std. Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
3.8.1 Face-to-face									
Oberg 2008	4.2	0.7	18	4.2	0.8	19	7.0%	0.00 [-0.64, 0.64]	2008
Oberg 2009	4.1	0.7	19	4.2	0.7	20	7.4%	-0.14 [-0.77, 0.49]	2009
Preminger 2010	-19.5	17.6	17	-28.6	19.3	18	6.4%	0.48 [-0.19, 1.15]	2010
Subtotal (95% CI)			**54**			**57**	**20.8%**	**0.10 [-0.28, 0.47]**	
Heterogeneity: Tau² = 0.00; Chi² = 1.88, df = 2 (P = 0.39); I² = 0%									
Test for overall effect: Z = 0.52 (P = 0.60)									
3.8.2 Telephone									
Lundberg 2011	3.8	1	33	3.5	1	36	12.9%	0.30 [-0.18, 0.77]	2011
Subtotal (95% CI)			**33**			**36**	**12.9%**	**0.30 [-0.18, 0.77]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 1.22 (P = 0.22)									
3.8.3 Booklet									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.8.4 Remote									
Kramer 2005 (1)	3.6	0.8	24	3.5	1	24	9.1%	0.11 [-0.46, 0.67]	2005
Thoren 2011	3.2	1.1	29	3.5	1.1	30	11.1%	-0.27 [-0.78, 0.24]	2011
Thoren 2014 (2)	3.3	0.9	38	3.4	1	38	14.4%	-0.10 [-0.55, 0.35]	2014
Ferguson 2016	1.2	0.4	79	1.2	0.4	88	31.6%	0.00 [-0.30, 0.30]	2016
Subtotal (95% CI)			**170**			**180**	**66.2%**	**-0.05 [-0.26, 0.16]**	
Heterogeneity: Tau² = 0.00; Chi² = 1.16, df = 3 (P = 0.76); I² = 0%									
Test for overall effect: Z = 0.49 (P = 0.62)									
Total (95% CI)			**257**			**273**	**100.0%**	**0.02 [-0.15, 0.19]**	
Heterogeneity: Tau² = 0.00; Chi² = 4.97, df = 7 (P = 0.66); I² = 0%									
Test for overall effect: Z = 0.28 (P = 0.78)									
Test for subgroup differences: Chi² = 1.93, df = 2 (P = 0.38), I² = 0%									



Footnotes
(1) Medium term
(2) Medium term data

Figure 127: Combined SMS/DSD interventions versus control, outcome: quality of life – short/medium term (DSD intensity)

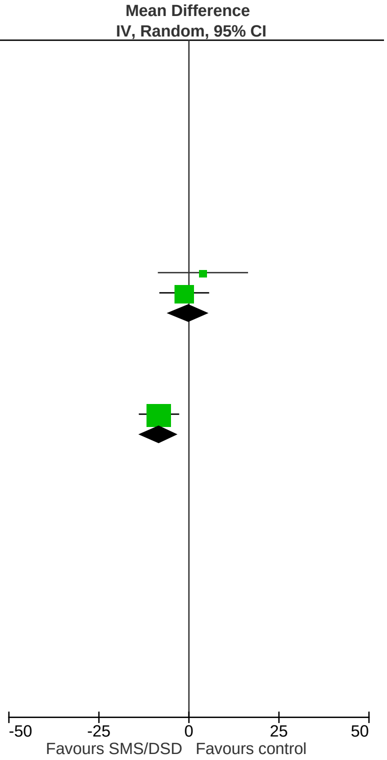
	SMS/DSD intervention			Control				Std. Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
3.9.1 Low-intensity									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.9.2 Medium-intensity									
Oberg 2008	4.2	0.7	18	4.2	0.8	19	7.0%	0.00 [-0.64, 0.64]	2008
Oberg 2009	4.1	0.7	19	4.2	0.7	20	7.4%	-0.14 [-0.77, 0.49]	2009
Preminger 2010	-19.5	17.6	17	-28.6	19.3	18	6.4%	0.48 [-0.19, 1.15]	2010
Subtotal (95% CI)			**54**			**57**	**20.8%**	**0.10 [-0.28, 0.47]**	
Heterogeneity: Tau² = 0.00; Chi² = 1.88, df = 2 (P = 0.39); I² = 0%									
Test for overall effect: Z = 0.52 (P = 0.60)									
3.9.3 High-intensity									
Kramer 2005 (1)	3.6	0.8	24	3.5	1	24	9.1%	0.11 [-0.46, 0.67]	2005
Thoren 2011 (2)	3.2	1.1	29	3.5	1.1	30	11.1%	-0.27 [-0.78, 0.24]	2011
Lundberg 2011	3.8	1	33	3.5	1	36	12.9%	0.30 [-0.18, 0.77]	2011
Thoren 2014 (3)	3.3	0.9	38	3.4	1	38	14.4%	-0.10 [-0.55, 0.35]	2014
Ferguson 2016	1.2	0.4	79	1.2	0.4	88	31.6%	0.00 [-0.30, 0.30]	2016
Subtotal (95% CI)			**203**			**216**	**79.2%**	**0.00 [-0.19, 0.20]**	
Heterogeneity: Tau² = 0.00; Chi² = 2.90, df = 4 (P = 0.57); I² = 0%									
Test for overall effect: Z = 0.04 (P = 0.97)									
Total (95% CI)			**257**			**273**	**100.0%**	**0.02 [-0.15, 0.19]**	
Heterogeneity: Tau² = 0.00; Chi² = 4.97, df = 7 (P = 0.66); I² = 0%									
Test for overall effect: Z = 0.28 (P = 0.78)									
Test for subgroup differences: Chi² = 0.19, df = 1 (P = 0.66), I² = 0%									



Footnotes
(1) Medium term
(2) Medium term data
(3) Medium term data

Figure 128: Combined SMS/DSD interventions versus control, outcome: self-reported hearing handicap – long term

	SMS/DSD intervention			Control				Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
3.10.1 Advise									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.10.2 Activate - practical									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.10.3 Activate - symptoms									
Oberg 2008	22.1	17.1	16	18.2	19.6	18	23.0%	3.90 [-8.44, 16.24]	2008
Oberg 2009	12.7	7.6	17	14	12.3	18	77.0%	-1.30 [-8.03, 5.43]	2009
Subtotal (95% CI)			**33**			**36**	**100.0%**	**-0.11 [-6.02, 5.80]**	
Heterogeneity: Tau² = 0.00; Chi² = 0.53, df = 1 (P = 0.47); I² = 0%									
Test for overall effect: Z = 0.04 (P = 0.97)									
3.10.4 Activate - psychosocial									
Andersson 1994	11.4	3.91	9	19.7	7.72	10	100.0%	-8.30 [-13.72, -2.88]	1994
Subtotal (95% CI)			**9**			**10**	**100.0%**	**-8.30 [-13.72, -2.88]**	
Heterogeneity: Not applicable									
Test for overall effect: Z = 3.00 (P = 0.003)									
3.10.5 Assist									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
3.10.6 Agree									
Subtotal (95% CI)			**0**			**0**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									



Test for subgroup differences: Chi² = 4.01, df = 1 (P = 0.05), I² = 75.0%

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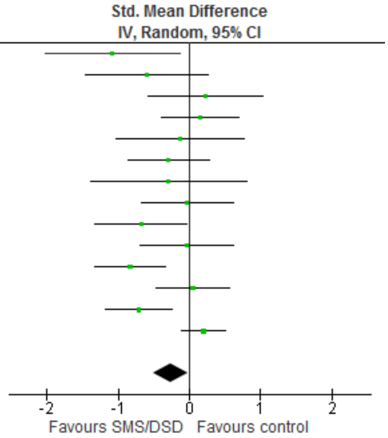
Figure 129: Combined SMS/DSD interventions versus control, outcome: self-reported hearing handicap – short/medium term

	SMS/DSD intervention			Control				Std. Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
Smaldino 1988 (1)	-104.9	59.6	10	-30.2	72.13	10	4.4%	-1.08 [-2.03, -0.13]	1988
Abrams 1992	22.7	19.7	11	37.6	27.5	11	5.1%	-0.60 [-1.46, 0.26]	1992
Andersson 1995	23.4	5.26	12	22.17	5.44	12	5.5%	0.22 [-0.58, 1.03]	1995
Kricos 1996 (2)	37.4	18.4	26	34.3	21.5	26	8.3%	0.15 [-0.39, 0.70]	1996
Andersson 1997	17.3	4.9	9	18.1	6.8	10	4.8%	-0.13 [-1.03, 0.77]	1997
Kramer 2005 (3)	-3.8	0.8	24	-3.5	1.2	24	8.0%	-0.29 [-0.86, 0.28]	2005
Miranda 2008	12.33	10.61	6	20.57	33.4	7	3.6%	-0.30 [-1.40, 0.80]	2008
Oberg 2008	9.9	7	18	10.1	8.3	19	7.1%	-0.03 [-0.67, 0.62]	2008
Oberg 2009	6.5	4.8	19	12.7	11.6	20	7.1%	-0.68 [-1.33, -0.03]	2009
Preminger 2010 (4)	43.9	18.9	18	44.6	15.8	18	7.0%	-0.04 [-0.69, 0.61]	2010
Lundberg 2011	26.6	11.5	33	37.6	14.3	36	9.0%	-0.83 [-1.33, -0.34]	2011
Thoren 2011 (5)	24.9	9	29	24.5	7	30	8.8%	0.05 [-0.46, 0.56]	2011
Thoren 2014	32.3	15.5	38	43	14.3	38	9.4%	-0.71 [-1.17, -0.25]	2014
Ferguson 2016	4	12	79	2	8	88	11.8%	0.20 [-0.11, 0.50]	2016
Total (95% CI)			**332**			**349**	**100.0%**	**-0.26 [-0.50, -0.02]**	
Heterogeneity: Tau² = 0.10; Chi² = 27.98, df = 13 (P = 0.009); I² = 54%									
Test for overall effect: Z = 2.13 (P = 0.03)									



Footnotes
(1) Change scores
(2) Active listening intervention versus standard care
(3) Medium term data
(4) Medium term data
(5) Medium term data

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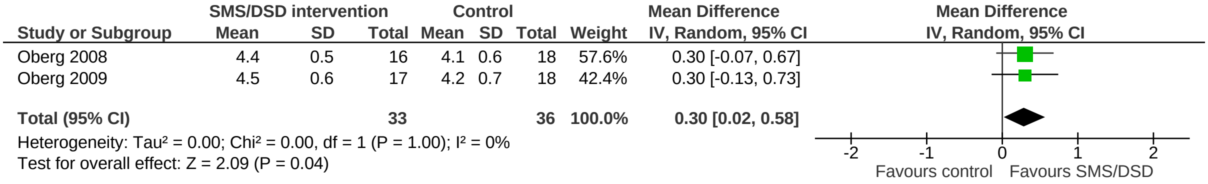
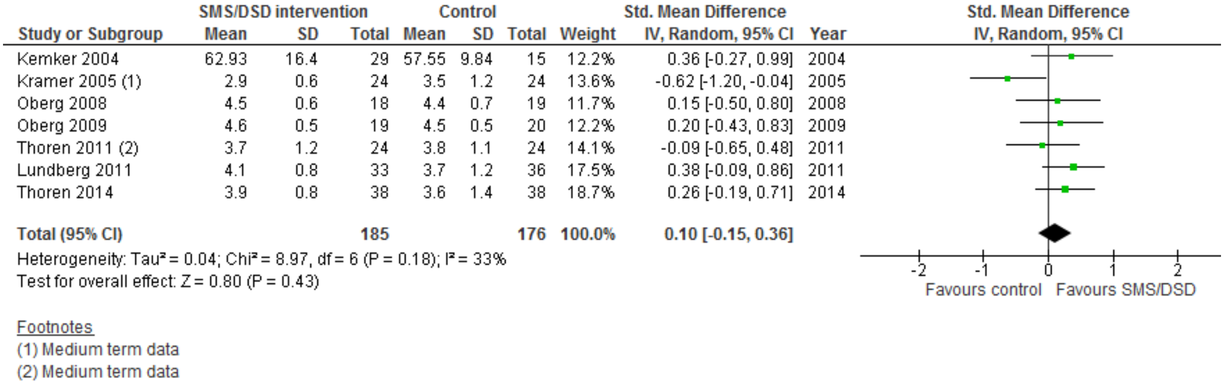
Figure 130: Combined SMS/DSD interventions versus control, outcome: hearing aid benefit – long term



	SMS/DSD intervention			Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Oberg 2008	4.4	0.5	16	4.1	0.6	18	57.6%	0.30 [-0.07, 0.67]	
Oberg 2009	4.5	0.6	17	4.2	0.7	18	42.4%	0.30 [-0.13, 0.73]	
Total (95% CI)			**33**			**36**	**100.0%**	**0.30 [0.02, 0.58]**	

Heterogeneity: Tau² = 0.00; Chi² = 0.00, df = 1 (P = 1.00); I² = 0%
Test for overall effect: Z = 2.09 (P = 0.04)

Figure 131: Combined SMS/DSD interventions versus control, outcome: hearing aid benefit – short/medium term

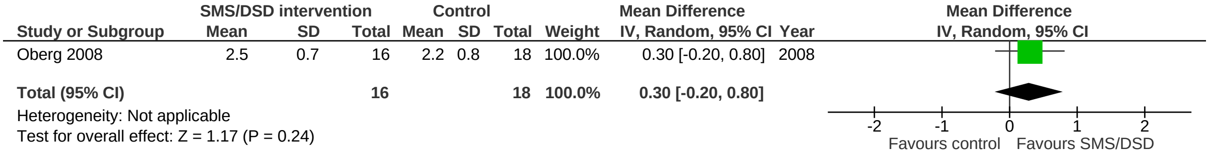


	SMS/DSD intervention			Control				Std. Mean Difference		Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year	IV, Random, 95% CI
Kemker 2004	62.93	16.4	29	57.55	9.84	15	12.2%	0.36 [-0.27, 0.99]	2004	
Kramer 2005 (1)	2.9	0.6	24	3.5	1.2	24	13.6%	-0.62 [-1.20, -0.04]	2005	
Oberg 2008	4.5	0.6	18	4.4	0.7	19	11.7%	0.15 [-0.50, 0.80]	2008	
Oberg 2009	4.6	0.5	19	4.5	0.5	20	12.2%	0.20 [-0.43, 0.83]	2009	
Thoren 2011 (2)	3.7	1.2	24	3.8	1.1	24	14.1%	-0.09 [-0.65, 0.48]	2011	
Lundberg 2011	4.1	0.8	33	3.7	1.2	36	17.5%	0.38 [-0.09, 0.86]	2011	
Thoren 2014	3.9	0.8	38	3.6	1.4	38	18.7%	0.26 [-0.19, 0.71]	2014	
Total (95% CI)			**185**			**176**	**100.0%**	**0.10 [-0.15, 0.36]**		

Heterogeneity: Tau² = 0.04; Chi² = 8.97, df = 6 (P = 0.18); I² = 33%
Test for overall effect: Z = 0.80 (P = 0.43)

Footnotes
(1) Medium term data
(2) Medium term data

Figure 132: Combined SMS/DSD interventions versus control, outcome: use of verbal communication strategy – long term



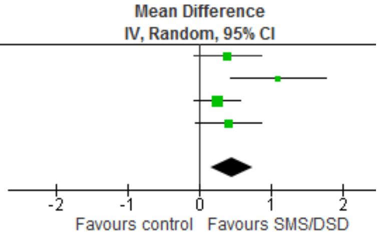
	SMS/DSD intervention			Control				Mean Difference		Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year	IV, Random, 95% CI
Oberg 2008	2.5	0.7	16	2.2	0.8	18	100.0%	0.30 [-0.20, 0.80]	2008	
Total (95% CI)			**16**			**18**	**100.0%**	**0.30 [-0.20, 0.80]**		

Heterogeneity: Not applicable
Test for overall effect: Z = 1.17 (P = 0.24)

Figure 133: Combined SMS/DSD interventions versus control, outcome: use of verbal communication strategy – short/medium term

	SMS/DSD intervention			Control				Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
Kricos 1996	3.61	1	26	3.22	0.7	26	24.3%	0.39 [-0.08, 0.86]	1996
Andersson 1997	3.9	0.62	9	2.8	0.86	10	14.9%	1.10 [0.43, 1.77]	1997
Turbin 2006	3.03	0.9	57	2.78	0.86	58	35.9%	0.25 [-0.07, 0.57]	2006
Oberg 2008	2.4	0.8	18	2	0.6	19	25.0%	0.40 [-0.06, 0.86]	2008
Total (95% CI)			**110**			**113**	**100.0%**	**0.45 [0.15, 0.74]**	

Heterogeneity: Tau² = 0.04; Chi² = 5.04, df = 3 (P = 0.17); I² = 40%
Test for overall effect: Z = 2.97 (P = 0.003)

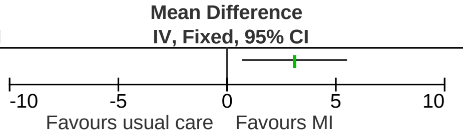


K.14.4 Motivational interviewing versus usual care

K.14.4.1 First time hearing aid users

Figure 134: International Outcome Inventory for Hearing Aids

	MI			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Zarenoe 2016	30.3	4.5	23	27.2	3.7	23	3.10 [0.72, 5.48]



K.14.4.2 Hearing aid users reporting ≤4h use per day

Figure 135: Change in hearing aid use (hours/day)

	Motivational interviewing			Standard care				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Aazh 2015	6	3.6101	19	2.8	3.0341	17		3.20 [1.03, 5.37]

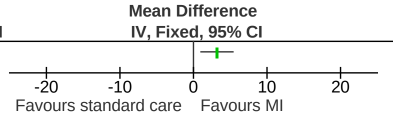


Figure 136: International Outcome Inventory for Hearing Aids (change score)

	Motivational interviewing			Standard care				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Aazh 2015	8.3	6.4317	19	7.5	7.0018	17		0.80 [-3.61, 5.21]

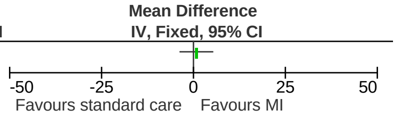


Figure 137: International Outcome Inventory for Hearing Aids – Significant Other (change score)

	Motivational interviewing			Standard care				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Aazh 2015	10.9	12.8635	19	8	10.6972	17		2.90 [-4.80, 10.60]

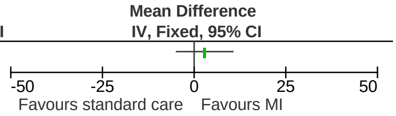


Figure 138: World Health Organization's Disability Assessment Schedule II (change score)

	Motivational interviewing			Standard care				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Aazh 2015	-1.3	3.7346	19	-0.4	2.9174	17		-0.90 [-3.08, 1.28]

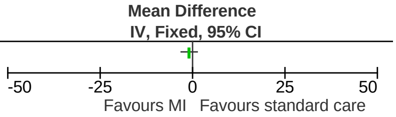
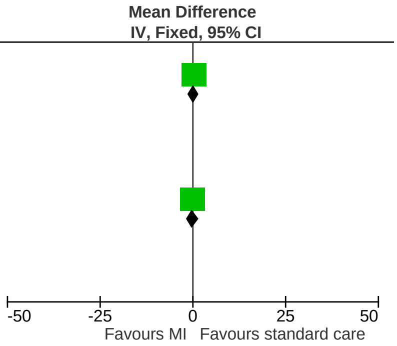


Figure 139: Hospital Anxiety and Depression Scale - Depression score (change score)

	Motivational interviewing			Standard care				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
4.5.1 Anxiety score								
Aazh 2015	-0.63	2.4275	19	-0.9	1.9449	17	100.0%	0.27 [-1.16, 1.70]
Subtotal (95% CI)			**19**			**17**	**100.0%**	**0.27 [-1.16, 1.70]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.37 (P = 0.71)								
4.5.2 Depression score								
Aazh 2015	-0.5	2.0748	19	-0.4	2.9174	17	100.0%	-0.10 [-1.77, 1.57]
Subtotal (95% CI)			**19**			**17**	**100.0%**	**-0.10 [-1.77, 1.57]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.12 (P = 0.91)								

Test for subgroup differences: Chi² = 0.11, df = 1 (P = 0.74), I² = 0%



K.14.5 Motivational engagement versus usual care

Figure 140: Hearing aid use (hours/day)

	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Ferguson 2016	10.01	5.1	28	8.73	5.35	25	1.28 [-1.54, 4.10]

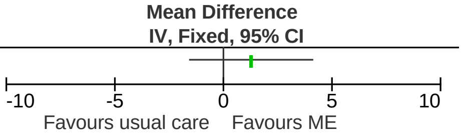
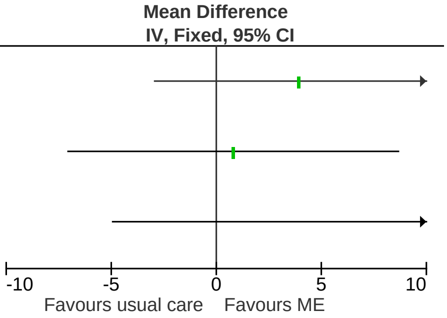


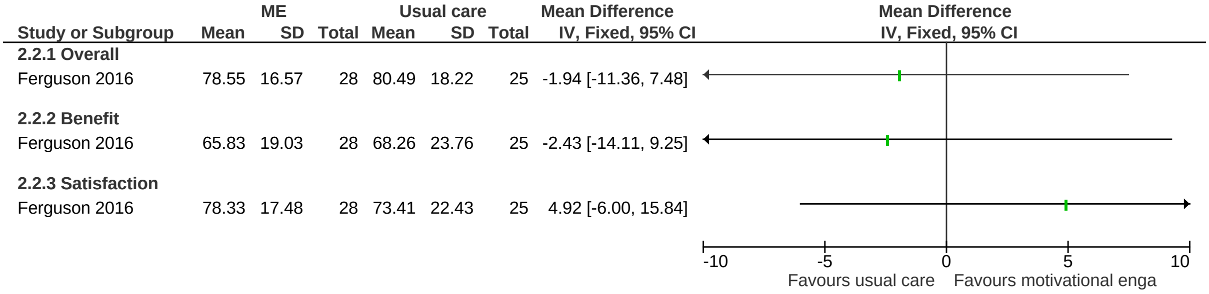
Figure 141: Measure of Audiologic Rehabilitation Self Efficacy for Hearing Aids

	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
2.1.1 Overall							
Ferguson 2016	85.25	12.16	28	81.32	13.2	25	3.93 [-2.93, 10.79]
2.1.4 Aided listening							
Ferguson 2016	86.35	16.29	28	85.54	12.86	25	0.81 [-7.05, 8.67]
2.1.5 Advanced handling							
Ferguson 2016	66.59	25.21	28	56.15	31.15	25	10.44 [-4.93, 25.81]



0–100; high is good outcome

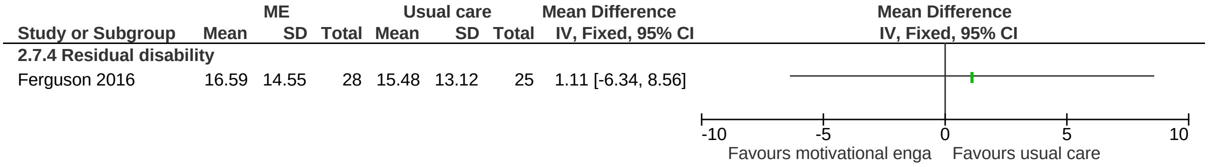
Figure 142: Glasgow Hearing Aid Benefit Profile



	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
2.2.1 Overall							
Ferguson 2016	78.55	16.57	28	80.49	18.22	25	-1.94 [-11.36, 7.48]
2.2.2 Benefit							
Ferguson 2016	65.83	19.03	28	68.26	23.76	25	-2.43 [-14.11, 9.25]
2.2.3 Satisfaction							
Ferguson 2016	78.33	17.48	28	73.41	22.43	25	4.92 [-6.00, 15.84]

0–100; high is good outcome

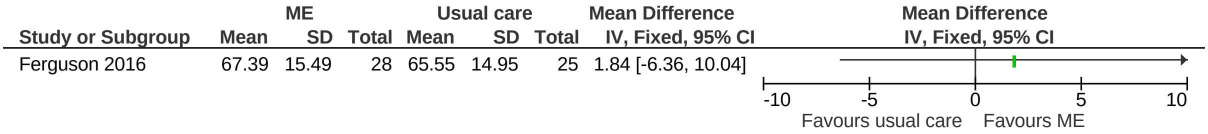
Figure 143: Glasgow Hearing Aid Benefit Profile – Residual Disability



	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
2.7.4 Residual disability							
Ferguson 2016	16.59	14.55	28	15.48	13.12	25	1.11 [-6.34, 8.56]

0–100; high is good outcome

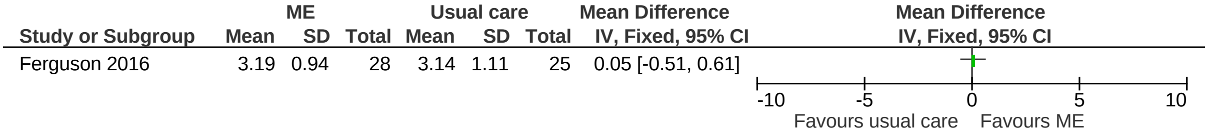
Figure 144: Short form Patient Activation Measure – activation score



	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Ferguson 2016	67.39	15.49	28	65.55	14.95	25	1.84 [-6.36, 10.04]

0–100; high is good outcome

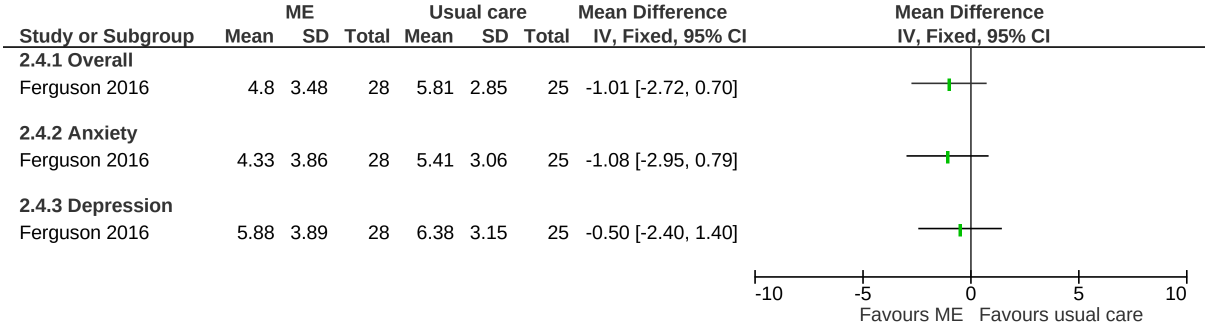
Figure 145: Short form Patient Activation Measure – level of activation



	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Ferguson 2016	3.19	0.94	28	3.14	1.11	25	0.05 [-0.51, 0.61]

1-4; high is good outcome

Figure 146: Hospital Anxiety and Depression scale

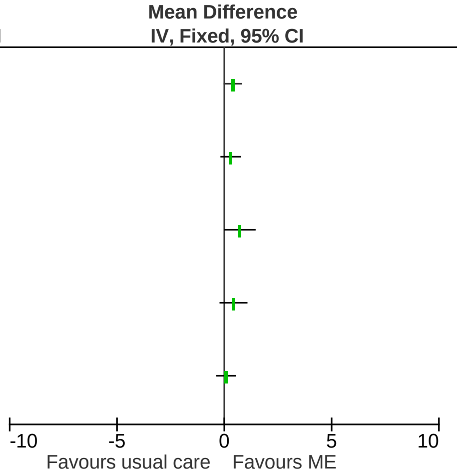


	ME			Usual care			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
2.4.1 Overall							
Ferguson 2016	4.8	3.48	28	5.81	2.85	25	-1.01 [-2.72, 0.70]
2.4.2 Anxiety							
Ferguson 2016	4.33	3.86	28	5.41	3.06	25	-1.08 [-2.95, 0.79]
2.4.3 Depression							
Ferguson 2016	5.88	3.89	28	6.38	3.15	25	-0.50 [-2.40, 1.40]

0–42; high is poor outcome

Figure 147: Satisfaction with Amplification in Daily Life

	ME			Usual care			Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**IV, Fixed, 95% CI**
2.6.1 Overall							
Ferguson 2016	5.71	0.86	28	5.31	0.57	25	0.40 [0.01, 0.79]
2.6.2 Positive effect							
Ferguson 2016	5.33	1.17	28	5.03	0.19	25	0.30 [-0.14, 0.74]
2.6.3 Negative features							
Ferguson 2016	5.56	1.31	28	4.84	1.3	25	0.72 [0.02, 1.42]
2.6.4 Personal image							
Ferguson 2016	6.3	1.19	28	5.87	1.09	25	0.43 [-0.18, 1.04]
2.6.5 Service and cost							
Ferguson 2016	6.26	0.91	28	6.17	0.66	25	0.09 [-0.33, 0.51]



1–7; high is good outcome

Appendix L: Excluded clinical studies

L.1 Urgent and routine referral

L.1.1 Urgent referral

Table 70: Studies excluded from the clinical review

Reference	Reason for exclusion
Aarnisalo 2004[1]	No multivariable analysis
Abuzeid 2008[6]	No multivariable analysis
Ahsan 2015[10]	Not relevant to review question (patients already undergoing MRI for asymmetric sensorineural hearing loss)
Aimoni 2010[11]	Not relevant to review question (cardiovascular risk factors as risk factors for ISSNHL)
Al-Mutairi 2011[12]	Not relevant to review question (association of audiological abnormalities with onset vitiligo) No multivariable analysis
Amiridavan 2006[22]	Not relevant to review question (otoacoustic emissions test for outcome of SSNHL) No multivariable analysis
Ashoor 1998[30]	Not relevant to review question (clinical presentation of patients with nasopharyngeal carcinoma) No multivariable analysis
Aslan 1997[31]	Not relevant to review question (initial symptoms in patients with vestibular schwannoma) No multivariable analysis
Baguley 2006[36]	Not relevant to review question (signs and symptoms of vestibular schwannoma) No multivariable analysis
Bakker 2012[39]	Not relevant to review question (systematic review with different protocol)
Bakthavachalam 2004[40]	No multivariable analysis
Ballester 2002[42]	Not relevant to review question (symptoms and treatment for Ménière's disease) No multivariable analysis
Ballesteros 2009[43]	No multivariable analysis
Barrett 1995[47]	No multivariable analysis
Bathla 2016[50]	No multivariable analysis
Berjis 2016[59]	Not relevant to review question (flow-mediated dilatation, as measure for endothelial function and total cholesterol as risk factors for SSNHL)
Bovo 2009[68]	Incorrect study design (narrative review)
Braun 2013[70]	No multivariable analysis
Braun 2013[69]	No multivariable analysis
Cadoni 2007[81]	Not relevant to review question (risk factors for SSNHL)
Cadoni 2010[82]	Not relevant to review question (risk factors for SSNHL)
Chaimoff 1999[85]	No multivariable analysis
Chang 2013[87]	Not relevant to review question (ISSNHL as risk factor for stroke; bilateral ISSNHL was not significant in the univariable analysis, and not included in the

Reference	Reason for exclusion
	multivariable analysis)
Chang 2015[88]	Not relevant to review question (systematic review on serum lipids as risk factors for SSNHL)
Chau 2010[92]	Not relevant to review question (systematic review on diagnostic methods for SSNHL)
Chung 2016[100]	Not relevant to review question (risk factors for chronic suppurative otitis media)
Ciccone 2012[101]	Not relevant to review question (endothelial function as risk factor for ISSNHL)
Ciorba 2015[103]	Not relevant to review question No multivariable analysis
Corona 2012[118]	Not relevant to review question (risk factors for vestibular schwannomas; different signs and symptoms, and confounding factors, from the protocol)
Del Pero 2013[134]	Not relevant to review question (assessment of disease activity and/or infection in the ear nose and throat in people with granulomatosis with polyangiitis, Wegener's)
Dubach 2010[146]	Not relevant to review question (systematic review on canal cholesteatoma: etiologic factors, clinical evaluation and therapy)
Durmus 2016[149]	Not relevant to review question (to investigate the effects of routine haematological parameters on the development and prognosis of ISSNHL) No multivariable analysis
Eleftheriadou 2009[154]	Not relevant to review question (to evaluate the presence of vestibular evoked myogenic potentials in patients with multiple sclerosis) No multivariable analysis
Emamifar 2016[156]	Incorrect study design (narrative review)
Ferrari 2016[167]	Not relevant to review question (incidence of asymptomatic sensorineural hearing loss in patients with systemic lupus erythematosus with no hearing complaints)
Friedland 2009[176]	Not relevant to review question presbycusis (gradual loss of hearing that occurs with aging) as risk factor for cardiovascular disease; development of a model for assessment of cardiovascular risk based on audiogram pattern and low-frequency hearing loss)
Fusconi 2012[178]	Not relevant to review question (to determine whether thrombophilic factors have a pathogenic role in SSNHL CRVO and SSVD)
Gates 2011[183]	Not relevant to review question (hazard ration for Alzheimer dementia in relation to hearing tests)
Gates 1993[184]	Not relevant to review question (hearing level as predictors of cardiovascular disease; patients received hearing test as part of screening, not because of sudden/recent onset)
Gerganov 2003[186]	No multivariable analysis
Gimsing 2010[187]	No multivariable analysis
Gluth 2006[188]	No multivariable analysis
Gomides 2007[192]	No multivariable analysis
Gopinath 2009[194]	Not relevant to review question (risk factors for stroke)
Harun 2012[218]	Not relevant to review question (age, gender and tumour size as risk factors for hearing loss)
Hasso 2000[219]	Unable to obtain paper
Hentschel 2016[221]	Not relevant to review question (systematic review on diagnostic accuracy of different non-imaging screening protocols that can be used to diagnose vestibular schwannoma in patients with asymmetrical sensorineural hearing loss and/or unilateral audiovestibular dysfunction, considered at risk of vestibular schwannoma)

Reference	Reason for exclusion
Hsiao 2015[235]	Not relevant to review question (tension type headaches as risk factor for SSNHL)
Hsu 2016[236]	Not relevant to review question (risk of developing vertebrobasilar insufficiency in patients with SSNHL)
Jeong 2016[249]	Not relevant to review question (risk factors for hearing impairment in patients with rheumatoid arthritis)
Kaminsky 2013[259]	Not relevant to review question (risk factors for cardiac disease, kidney involvement and brain complication in patients with Fabry's disease)
Keller 2013[262]	Not relevant to review question (risk factors for acute myocardial infarction)
Kentala 1996[264]	No multivariable analysis
Kentala 2000[265]	Not relevant to review question (diagnosis of otologic diseases in patients with vertigo. No multivariable analysis)
Kim 2016[271]	No multivariable analysis
Koo 2015[281]	Not relevant to review question (risk of SSNHL in patients with common sensorineural hearing impairment)
Koo 2016[280]	Not relevant to review question (risk factors for peripheral artery occlusive disease)
Kornblut 1982[284]	Incorrect study design (case report study for 4 patients)
Kuhn 2011[291]	Not relevant to review question (review on causes and treatment of SSNHL) No multivariable analysis
Kuo 2016[295]	Not relevant to review question (risk of SSNHL post-stroke)
Kwan 2004[296]	No multivariable analysis
Lee 2005[309]	Not relevant to review question (risk factors for sudden deafness in patients with vertebrobasilar ischemia) No multivariable analysis
Lee 2002[310]	No multivariable analysis
Lee 2015[316]	Not relevant to review question (lipid profiles as risk factor for SSNHL)
Lee 2017[313]	Not relevant to review question (prognostic factors on outcomes of various treatment modalities for ISSNHL)
Lee 2014[315]	No multivariable analysis
Lee 2015[312]	Not relevant to review question (risk factors for tinnitus in patients with ISSNHL and prognostic factors associated with full recovery) No multivariable analysis
Lee 2010[317]	Not relevant to review question (benign paroxysmal positional vertigo as prognostic factor for hearing outcome)
Lee 2015[318]	No multivariable analysis
Lin 2008[335]	Not relevant to review question (risk factors for stroke)
Lin 2012[336]	Not relevant to review question (systematic review on risk factors for SSNHL)
Lin 2012[337]	Not relevant to review question (diabetes as risk factor for SSNHL)
Lin 2013[330]	Not relevant to review question (risk factors for acute myocardial infarction)
Lionello 2015[339]	Not relevant to review question (prognostic factors to predict recovery in patients treated for ISSNHL)
Lionello 2014[340]	Not relevant to review question (prognostic factors to predict recovery in patients treated for ISSNHL)
Lorenzi 2003[345]	No multivariable analysis
Luntz 2013[347]	Not relevant to review question (to assess the severity of SNHL in patients with unilateral chronic otitis media) No multivariable analysis

Reference	Reason for exclusion
MacAndie 1999[350]	No multivariable analysis
Malucelli 2012[355]	Non-English language publication
Marcucci 2005[359]	Not relevant to review question (risk factors for ISSNHL)
Megighian 1986[368]	Not relevant to review question (frequency of sudden hearing loss by sex, age and presence of previous pathology at onset) No multivariable analysis
Mosnier 2011[386]	Not relevant to review question (cardiovascular events as risk factors for ISSNHL) No multivariable analysis
Mozaffari 2010[387]	Not relevant to review question (sensorineural hearing loss as risk factor for diabetes) No multivariable analysis
Nagaoka 2010[392]	Non-English language publication
Niu 2016[416]	No multivariable analysis
Nouraei 2007[418]	No multivariable analysis
Noury 1989[419]	Not relevant to review question (risk factors for unilateral sensorineural hearing loss and prognostic factors for recovery) No multivariable analysis
Peltomaa 2000[437]	Not relevant to review question (incidence of Lyme borreliosis in people with SNHL) No multivariable analysis
Penido 2009[439]	Not relevant to review question (clinical aspects, hearing evolution and efficacy of treatment for SSNHL) No multivariable analysis
Powell 2010[450]	Not relevant to review question (MRI scan to determine cause of hearing loss, tinnitus and vertigo) No multivariable analysis
Przewozny 2015[461]	No multivariable analysis
Raber 1997[465]	Not relevant to review question (diagnostic accuracy for asymmetric hearing loss) No multivariable analysis
Rajati 2016[468]	Unable to obtain paper
Ramos 2005[470]	Non-English language publication
Rassin 2005[471]	Not relevant to review question (characteristics of people with sudden hearing loss)
Rosito 2016[481]	Not relevant to review question (prevalence of cholesteatoma in patients with chronic otitis media) No multivariable analysis
Saunders 1995[490]	Not relevant to review question (prevalence of acoustic neuroma in sudden hearing loss) No multivariable analysis
Sauvaget 2005[491]	No multivariable analysis
Sheahan 2001[496]	No multivariable analysis
Sheu 2012[500]	Not relevant to review question (obstructive sleep apnoea as risk factor for SSNHL)
Soheilipour 2013[511]	Not relevant to review question (symptoms of people diagnosed with necrotising external otitis) No multivariable analysis
Stranden 2016[526]	Not relevant to review question (fibromyalgia as risk factor for hearing loss)
Suckfull 2002[528]	No multivariable analysis

Reference	Reason for exclusion
Tanaka 2016[540]	No multivariable analysis
Torre 2005[550]	Not relevant to review question (CVD variables as risk factors for cochlear function)
Tyrrell 2014[554]	Not relevant to review question (Meniere's disease as risk factor for hearing difficulty)
Vilayur 2010[565]	Not relevant to review question (chronic kidney disease as risk factor for hearing loss)
Vos 2017[567]	Not relevant to review question (risk factors for hearing impairment after subarachnoid haemorrhage)
Wallis 2015[569]	Incorrect study design (narrative review)
Webb 2008[573]	Incorrect study design (narrative review)
Wengrower 2016[578]	Not relevant to review question (inflammatory bowel disease as risk factor for hearing loss) No multivariable analysis
Wu 2013[591]	Not relevant to review question (chronic periodontitis as risk factor for SSNHL)
Xenellis 2006[593]	Not relevant to review question (prognostic factors linked to recovery from ISSNHL) No multivariable analysis
Yeh 2015[597]	Not relevant to review question (osteoporosis as risk factor for SSNHL)
Yen 2015[599]	Not relevant to review question (risk of sudden sensorineural hearing loss in patients with psoriasis and other comorbidities)
Yen 2015[598]	Not relevant to review question (chronic otitis media as risk factor for SSNHL)
Yew 2014[600]	Not relevant to review question (diagnostic test accuracy for evaluating tinnitus) No multivariable analysis
Zhang 2015[607]	No multivariable analysis

L.1.2 Routine referral

Table 71: Studies excluded from the clinical review

Reference	Reason for exclusion
Abdelkader 2004[4]	Not relevant to review question Direct referral by the GP to the audiology technician, without first having to be seen by an otolaryngologist. Results: % of people: • who received hearing aids • referred to ENT clinic • no treatment as hearing is normal or near normal
Becerril-Ramirez 2013[53]	Non-English language publication
Dobie 1981[143]	Not relevant to review question Assess a set of empirical chosen criteria (baseline and periodic audiograms) for otologic referral in an industrial hearing conservation program Results: % of people with a specific diagnosis and intervention (no data on sensitivity and specificity)
Dobie 1981[144]	Not relevant to review question Same data published in Dobie 1981[143]

Reference	Reason for exclusion
Dobie 1982[142]	Incorrect study design (narrative paper)
Fetterman 1996[168]	Not relevant to review question Results: "a multivariate regression analysis was used to examine the combined predictive value of clinical parameters on hearing outcomes (as measured by the change in PTA). The initial SDS contributed the most to prediction, followed by age at treatment, and number of treatment given, for an overall multiple correlation coefficient of 0.44. The initial discrimination score and age had a negative correlation, while the number of treatments had a positive correlation."
Koay 1996[277]	Not relevant to review question Direct referral by the GP for hearing aids. Results: % of people appropriately referred for hearing aid fitting
Lionello 2015[339]	Not relevant to review question Prognostic value of clinical signs and symptoms, comorbidities in relation to hearing recovery. All patients received steroids treatment.
Prince 2002[454]	Not relevant to review question Hearing loss due to occupational noise (occupational noise and hearing survey) Results: age-adjusted OR for hearing impairment associated with noise exposure, medical history and otological abnormalities
Simpson 1995[506]	Not relevant to review question Audiometric referral criteria for industrial conservation programs Results: % of people referred for different audiologic criteria (left >25 dB; right>25 dB; low-frequency shift >15 dB; high-frequency shift >30 dB)
Swan 1994[536]	Not relevant to review question Direct referral by the GP to the audiology department. Results: % of people who: • passed the audiometric, tympanometric and simple otoscopy screen and were prescribed hearing aids by technician • failed the three tier screen and were referred to an otologist. Re-analysis if data using other pass/fail criteria: • tone and otoscopic criteria without tympanometry • Revised Technicians, Therapists and Scientists in Audiology (TTSA) criteria
van den Berg 1999[560]	Not relevant to review question Effectiveness of first and repeated audiometric screen in terms of % of hearing-impaired subjects: • who had discussed their hearing loss withy GP, • who had been referred to an ENT specialist subsequently and • who had been prescribed a hearing aid
Yueh 2010[603]	Not relevant to review question Rating of hearing aid use in 4 screening strategies (no screening/control; otoscope-only; questionnaire-only; dual screening) Results: % of people for the following events: • patient screened positive for HL • patient contacted audiology • patient kept audiology appointment • audiogram show correctable HL • patient fit with hearing aid • hearing aid use at 1 year

L.2 MRI

Table 72: Studies excluded from the clinical review

Reference	Reason for exclusion
Aarnisalo 2004[1]	Incorrect study design: not diagnostic accuracy and no index tools
Ahsan 2015[10]	Incorrect study design: prognostic not diagnostic
Baker 2003[38]	Incorrect study design: not diagnostic accuracy
Carrier 1997[84]	Incorrect study design: not diagnostic accuracy and no index tools
Chatrath 2008[91]	Incorrect study design: case–control study
Gimsing 2010[187]	Incorrect study design: case–control study
Hentschel 2016[221]	Systematic review: references checked
Kwan, 2004[296]	Incorrect study design: not diagnostic accuracy and no index tools
Metselaar, 2015[372]	Results only presented graphically
Obholzer 2004[420]	Incorrect study design: case–control study
Raber 1997[465]	Flawed study design: not all had MRI (28% of referrals and criteria for MRI not stated); not all had index tests; and indirect population: not all had hearing loss
Saeed 1995[486]	Incorrect study design: not diagnostic accuracy
Sheppard 1996[498]	Incorrect study design: not diagnostic accuracy
Vandervelde[561]	Incorrect index tests

L.3 Subgroups

Table 73: Studies excluded from the clinical review

Reference	Reason for exclusion
Albers 2012[14]	Inappropriate study design
Allan 2006[20]	Inappropriate study design
Bade 1991[35]	Inappropriate study design
Bernabei 2014[61]	Inappropriate study design
Boi 2012[67]	Inappropriate indicators
Cooke 1988[113]	Survey of people with mental handicap in a long-stay hospital. Questionnaire used to diagnosis hearing loss.
Cooke 1989[114]	Survey of people with mental handicap in a long-stay hospital. Questionnaire used to diagnosis hearing loss.
Cooper 2007[115]	Inappropriate indicators. Logistic regression looking at association of intellectual disabilities with DC-LD depression. Hearing impairment is a covariate in the logistic regression, independently associated. Indicator is presence or no presence of depression, gives percentage of people with hearing impairment in either depression or no depression
Cruickshanks 2012[121]	Inappropriate study design (literature review). Scanned for relevant references.
De Silva 2008[131]	Inappropriate outcomes. Study looking at elderly people with a range of cognitive functions and hearing impairment and looked at the performance of a written MMSE rather than a verbal version.
Deal 2017[132]	Inappropriate outcomes. Logistic regression looking at the association of hearing loss and incident dementia.
Deal 2015[133]	Inappropriate outcomes. Logistic regression looking at the association of hearing

Reference	Reason for exclusion
	impairment and cognitive tests.
Evenhuis 1995[160]	Inappropriate presence or absence of indicators. No comparator group.
Gallacher 2004[179]	Inappropriate study design (review). Scanned for relevant references.
Gold 1996[190]	Inappropriate study design. Reports pass and fail rates for 2 different tests, No comparator
Golub 2017[191]	Inappropriate outcomes. Looked at hazard ratios, outcome dementia at follow-up in people with hearing loss, looked at association.
Granick 1976[200]	Inappropriate indicators. Two samples of elderly people, correlation between hearing loss and cognitive decline.
Gurgel 2014[207]	Inappropriate indicators. Cohort of elderly, dementia excluded, looked at incident dementia during follow-up compared in groups with and without hearing loss
Gussekloo 2005[208]	Inappropriate outcomes. Linear regression looking at the association of hearing impairment and cognitive function.
Heine 2014[220]	Inappropriate indicators. Studies included looked at dual loss of hearing and sight and effect on quality of life.
Heywood 2017[222]	Inappropriate presence or absence of indicators. Prevalence of MCI and dementia in a baseline cohort of people with and without hearing loss. Odds ratios for association, then incidence of dementia or MCI during follow-up in people with and without hearing loss.
Hong 2016[231]	Inappropriate outcomes. Logistic regression looking at the association of hearing loss and decline in MMSE.
Hook 1979[232]	Inappropriate study design
Hopper 2016[233]	Inappropriate indicators. Study looked at cohort of people with dementia and mild to moderate hearing loss, looked at the relationship between hearing loss diagnosis in people when using PTA and a different tool RAI-MDS.
Hung 2015[239]	Inappropriate study design (case–control).
Jupiter 2012[257]	Inappropriate presence or absence of indicators. Reports distribution of subjects as a function of categories of hearing loss and MMSE scores.
Kalayam 1995[258]	Inappropriate outcomes/inappropriate indicators. Logistic regression, association of depression and hearing loss.
Kiani 2010[268]	Inappropriate study design. Scanned for relevant references.
Koh 2015[278]	Inappropriate indicators. Study had population of elderly people attending a senior welfare centre, looked at correlation of MMSE with hearing loss.
Kropka 1980[290]	Inappropriate outcomes
Lin 2011[331]	Inappropriate outcomes. Logistic regression, looking at association of hearing loss with cognitive impairment.
Lin 2011[332]	Inappropriate indicators. Logistic regression, no presence of indicators population has no dementia or cognitive impairment.
Lin 2011[333]	Inappropriate outcomes. Cox proportional hazard looking at the association of hearing impairment and various covariates, gives number of people with hearing loss in incident dementia and no dementia group. All patients with dementia at baseline were excluded.
Lin 2013[334]	Inappropriate outcomes. Cox proportional hazard looking at the association of hearing impairment and cognitive impairment.
Lindenberger 2009[338]	Inappropriate indicators. Hearing loss as a predictor for dementia in elderly population.
Malloy 1991[354]	Unable to obtain paper
Matteson 1993[363]	Inappropriate indicators. Diagnosis rate, no comparator
Meister 2017[370]	Inappropriate study design

Reference	Reason for exclusion
Meusy 2016[374]	Inappropriate study design (conference abstract)
Meuwese-Jongejeugd 2008[375]	Inappropriate presence or absence of indicators Reports prevalence of combined sensorineural deficit in adults with intellectual disability, reports diagnosis rate prior to the study for combined, visual and hearing loss only, no comparator.
Meuwese-Jongejeugd 2006[376]	Inappropriate presence or absence of indicators. Prevalence of hearing loss in people with ID and a subgroup with Down's syndrome, no comparator, compares prevalences with population of people without ID but they are from separate published studies.
Mitoku 2016[381]	Inappropriate indicators/outcomes. Logistic regression looking at the association between sensory impairment and cognitive impairment, reports prevalence of cognitive impairment in people with hearing loss.
Naik 2011[393]	Inappropriate study design (conference abstract)
Nirmalasari 2017[415]	Inappropriate outcomes. Paper reports overall prevalence of hearing loss.
Panza 2015[429]	Inappropriate study design. Scanned for relevant references.
Panza 2015[430]	Inappropriate study design. Scanned for relevant references.
Peracino 2014[441]	Inappropriate study design
Peracino 2016[442]	Inappropriate study design. Scanned for relevant references
Peters 1988[444]	Inappropriate presence or absence of indicators. Cohort of dementia patients no comparator.
Pichora-Fuller 2015[445]	Inappropriate study design. Scanned for relevant references.
Piotrowicz 2016[446]	Inappropriate indicators. Cohort of elderly people, tested for hearing impairment and cognitive impairment, reports prevalence odds ratios, used to assess the strength of relation between 2 chosen deficits in the population.
Prasher 1995[451]	Inappropriate presence or absence of indicators. Population with downs syndrome, no comparator.
Prince 2011[453]	Inappropriate method of determining hearing loss. Hearing impairment in people with dementia versus no dementia. Hearing impairment was self reported
Reichman 1983[475]	Inappropriate study design. Scanned for relevant references.
Reynolds 1979[477]	Inappropriate outcomes/indicators. Study of mentally retarded adults in residential facilities, grouped by level of impairment (none to severe), prevalence of hearing impairment reported, unclear how hearing impairment has been evaluated, no comparator.
Schneider 2005[492]	Inappropriate indicators. A group of elderly and young patients tested with sentences at different speeds.
Schubert 2017[493]	Inappropriate outcomes (linear regression)
Sheft 2015[497]	Inappropriate indicators/outcomes (linear regression)
Smith 2000[510]	Inappropriate presence or absence of indicators. A group of people with learning difficulties, no comparator.
Stahl 2017[518]	Inappropriate study design. Scanned for relevant references.
Stein 1992[519]	Inappropriate study design. Scanned for relevant references.
Stewart 1978[524]	Inappropriate study design. Scanned for relevant references.
Su 2017[527]	Inappropriate outcomes. Logistic regression, has incidence rates of dementia in people with age-related hearing loss and control.
Sugawara 2011[529]	Inappropriate outcomes. Multiple linear regressions looking at the association of hearing loss and MMSE, reports overall prevalence of hearing loss for the study, population is people over 50 years.
Taljaard 2016[539]	Inappropriate indicators/outcomes. Scanned for relevant references. Meta-analysis comparing cognition in people with treated or untreated hearing loss and

Reference	Reason for exclusion
	normal hearing.
Uhlmann 1986[555]	Inappropriate presence or absence of indicators. People with Alzheimer's, no comparator group.
Uhlmann 1989[556]	Inappropriate study design (case–control)
Umeda-Kameyama 2014[557]	Inappropriate study design. Letter to the editor, all patients have some form of Alzheimer's, other dementia or cognitive impairment, then the number with or without hearing loss is reported.
Webb 1966[572]	Inappropriate study design. Scanned for relevant references.
Weinstein 1986[576]	Inappropriate study design
Woll 2013[588]	Inappropriate study design
Yamada 2014[595]	Inappropriate study design. Gives prevalence of hearing ability in people living in a care home, reported per country as multicentre
Yamada 2014[596]	Inappropriate outcomes
Zheng 2017[609]	Inappropriate outcomes

L.4 Early versus delayed management of hearing loss

Table 74: Studies excluded from the clinical review

Study	Exclusion reason
Ahn 2008[8]	Not review population
Alexander 2015[16]	Not review population
Aronzon 2003[28]	Inappropriate comparison
Atay 2016[32]	Not review population
Battista 2005[52]	Not review population
Bogaz 2014[66]	Not review population
Bogaz 2015[65]	Not review population
Chen 2015[94]	Not review population
Chou 2011[98]	Narrative review
Clary 2011[106]	Not review population
Dauman 1985[127]	Not English language
Davis 1992[130]	Non-comparative study
Dispenza 2011[141]	Inappropriate comparison. Not review population
Edizer 2015[150]	Not review population
Egli Gallo 2013[153]	Not review population
Enache 2008[157]	Not review population
Ferguson 2014[164]	Inappropriate comparison
Ferguson 2015[165]	Protocol only
Fitzgerald 2007[171]	Not review population
Gao 2016[181]	Systematic review: references checked
Gordin 2002[195]	Not review population
Gunel 2015[205]	Inappropriate comparison
Gupta 2016[206]	Not review population
Hixon 2016[227]	Inappropriate comparison

Ho 2004[228]	Not review population
Huy 2005[240]	Not review population
Ito 2002[244]	Not review population
Jung 2016[255]	Not review population
Jung Da 2016[256]	Inappropriate comparison. Not review population
Kim 2012[272]	Inappropriate comparison. Not review population
Lasak 2006[304]	Not guideline condition
Liebau 2016[327]	Not review population
Lionello 2015[339]	Not review population
Magnano 2015[351]	Not review population
Martin 2010[361]	Duration of deafness comparison uncontrolled
Michiels 2016[377]	Not guideline condition
Muhlmeier 2016[388]	Inappropriate comparison
Murphy-Lavoie 2012[390]	Narrative review
Mushi 2016[391]	Not guideline condition. Not review population
Nakagawa 2016[394]	Inappropriate comparison
Narozny 2004[396]	Incorrect interventions
Narozny 2006[395]	Incorrect treatments
Rafique 2013[467]	Unadjusted cohort data
Rassin 2005[471]	Not review population
Redleaf 1995[473]	Not review population
Salahaldin 2004[487]	Inappropriate comparison
Salihoglu 2015[489]	Inappropriate comparison
Sherlock 2016[499]	Incorrect treatments. Not review population
Smith 2005[509]	Systematic review: references checked
Summerfield 2000[530]	Not guideline condition
Suzuki 2006[533]	Incorrect interventions
Terzi 2016[543]	Not review population
Tiong 2007[547]	Not review population
Tsai 2011[551]	Not review population
Tschopp 1989[552]	Incorrect interventions
Vijayendra 2012[564]	Not review population
Vlastarakos 2012[566]	Systematic review: references checked
Yildirim 2015[601]	Not review population
Zhang 2004[606]	Incorrect interventions
Zhou 2013[611]	Incorrect interventions

L.5 Communication needs

Table 75: Studies excluded from the clinical review

Reference	Reason for exclusion
Ferguson 2016[163]	Not relevant to review question (Motivational engagement (ME) versus standard

Reference	Reason for exclusion
	care before and after (10 weeks) hearing aid fitting. Outcomes are not compared to PTA) [note: paper included in the decision tool review]
Ferguson 2016[166]	Not relevant to review question (predictor and outcome measures before and after hearing aid fitting. No intervention given; no comparison with PTA)
Fredriksson 2016[175]	Not relevant to review question (diagnostic performance of DPOAE (distortion product otoacoustic emission) and HINT (hearing in noise test) compared to audiometry, in people with and without hearing loss symptoms, exposed to occupational noise. No intervention for hearing loss is given)
Gopinath 2012[193]	Not relevant to review question (changes in SF-36 between baseline and 10 year follow-up in patients with/without hearing loss at baseline; with/without hearing handicap at baseline; with/without incident hearing loss at baseline; hearing aid users/non-hearing aid users at baseline)
Granberg 2014[198]	Not relevant to review question (systematic review to identify outcome measures used in research conducted in adults with HL as part of the developmental process of the ICF (International Classification of Functioning, Disability and Health)score sets for HL project)
Hickson 2003[224]	Not relevant to review question (HHIE (hearing handicap inventory for the elderly) before and after an ‘Keep on talking’ and ‘Active Communication Programme’ in elderly people; case-control study where control group does not receive the intervention; no PTA measured)
Hickson 2014[223]	Not relevant to review question (No intervention given; no comparison with PTA)
John 2012[251]	Not relevant to review question (calculation of binaural impairment (%BI) using six different arithmetic calculations of hearing impairment and their correlation with HHIA (hearing handicap inventory for adults) and HHIE (hearing handicap inventory for the elderly) in patients with sensorineural hearing loss. No intervention for hearing loss is given)
Knudsen 2010[276]	Not relevant to review question (Systematic review focusing on the crucial steps in the journey separately (help seeking, uptake, use, satisfaction). The “journey”=the sequence of (psychological) events experienced by the hearing impaired person in his or her process of seeking and obtaining help)
Leensen 2011[319]	Not relevant to review question (diagnostic accuracy and Speech in noise test versus PTA in people with noise induced hearing loss. Patients do not receive any intervention, test is applied to a normal hearing group and a hearing impaired group)
Leensen 2011[320]	Not relevant to review question (diagnostic accuracy and Speech in noise test versus PTA in people with noise induced hearing loss. Patients do not receive any intervention, test is applied to a normal hearing group and a hearing impaired group)
Leensen 2013[321]	Not relevant to review question (diagnostic accuracy and Speech in noise test versus PTA in people with noise induced hearing loss. Patients do not receive any intervention, test is applied to a normal hearing group and a hearing impaired group)
Mahmoud 2014[352]	Not relevant to review question (correlation between CNC (consonant nucleus consonant) and AzBio and age at implantation post-cochlear implant. CNC and AzBio were not performed before cochlear implantation)
Spyridakou 2015[515]	Incorrect study design: non-systematic review (how older adults perform in speech in noise tests and what are the key factors that affect such performance)
Tannahill 1979[541]	Not relevant to review question (measure of Speech reception threshold, Word identification and Hearing handicap scale before and after (4 weeks) hearing aid fitting)
Wiley 2000[583]	Not relevant to review question (correlation between HHIE (hearing handicap inventory for the elderly) and age. Logistic regression model based on data

Reference	Reason for exclusion
	collected at baseline examination of the population-based study of hearing loss in older adults; no intervention for hearing loss is considered)

L.6 Management of earwax

L.6.1 Treatment

Table 76: Studies excluded from the clinical review

Study	Exclusion reason
Amjad 1975[23]	Incorrect interventions. TPO (not available in UK) and carbamide peroxide (not available in UK) ear drops
Anonymous 2003[25]	Comment
Baker 1969[37]	Incorrect study design. Before and after design. TPO ear drops (not available in the UK)
Browning 2002[73]	Has been updated
Burgess 1966[75]	Incorrect interventions. Investigates Docusate-in-oil ear drops, which are not currently available in UK (Docusate in glycerine is available)
Burton 2009[77]	Systematic review: does not fit our protocol. All papers within the review have been considered
Burton 2016[76]	Protocol only
Caballero 2005[79]	Conference abstract
Chaput de Saintonge 1973[90]	Incorrect interventions. Investigated TPO ear drops (not available in the UK) against olive oil. Age group not stated
Clegg 2010[107]	Systematic review: all papers considered
Dummer 1992[148]	Incorrect interventions. Investigates Audax ear drops (not available in UK) against Cerumol (composition not stated)
Fahmy 1982[161]	Insufficient information on study designs. Four studies presented in one paper, and not enough information to determine if any were RCT
General practitioner research group 1967[185]	Incorrect interventions. Atypical ear drops for UK (Cerumol preparation has changed since 1967)
Hand 2004[215]	Systematic review: methods are not adequate/unclear
Harris 1968[217]	Comment paper
Iranian Registry of Clinical Trials 2007[243]	Protocol only
Jaffe 1978[245]	Incorrect interventions. Investigation of Otocerol ear drops (a mixture of oils, not available in UK) and Cerumol (composition not given)
Leong 2005[322]	Incorrect study design. Incorrect interventions
Loveman 2011[346]	Summary article
Lyndon 1992[349]	Incorrect interventions. Investigates Auduax ear drops (not available in UK) and Earex ear drops (Peroxide, available in UK)
Masterson 2000[362]	Comment paper
McCarter 2007[366]	Non-systematic review
NCT 2008[407]	Protocol only

Pothier 2006[449]	Incorrect interventions. Comparison of two specialist ENT procedures. Cannot be sure that our search was optimised to find similar studies, so may not be representative of this section of literature
Proudfoot 1968[457]	Incorrect study design. No comparison arm
Robinson 2001[479]	Comment paper
Silverstein 2011[504]	Long-term outcomes only. Uses isopropyl alcohol irrigations to prevent cerumen impaction. Not sure whether this is a treatment used in UK
Silverstein 2012[505]	Long-term outcomes only. Uses isopropyl alcohol irrigations to prevent cerumen impaction. Not sure whether this is a treatment used in UK
Singer 2000[507]	Incorrect interventions. Children . Investigates TPO ear drops (not available in UK) against Colace ear drops (Docusate sodium, available in UK under another brand name)
Somerville 2002[512]	Systematic review: all papers considered
Soy 2015[513]	Children
Spiro 1997[514]	No results could be extracted. Arms were merged and summary statistics were inadequate.
Williams 2005[584]	Systematic review: study designs inappropriate
Wright 2015[590]	Comment paper

L.6.2 Settings

Table 77: Studies excluded from the clinical review

Reference	Reason for exclusion
Almeyda 2007[21]	Inappropriate study design
Morgan 1991[383]	Inappropriate study design
Morgan 1992[384]	Inappropriate study design
Ballachanda 1992[41]	Inappropriate study design
Bunnag 2002[74]	Inappropriate intervention and comparator
Chen 2017[93]	Inappropriate population
Clegg 2010[107]	Inappropriate intervention and comparator
Hand 2004[215]	Inappropriate intervention and comparator
Loveman 2011[346]	Summary of HTA, of which full text was obtained
Martin 2000[360]	Inappropriate study design

L.7 Sudden sensorineural hearing loss

L.7.1 Treatment

Table 78: Studies excluded from the clinical review

Study	Exclusion reason
ACTRN 2013[33]	Study not yet recruiting, protocol only
Alimoglu 2011[19]	Incorrect study design

Al-shehri 2016[13]	Routes of administration [later question]
Anonymous 2013[246]	Unavailable: unable to locate as cited
Arastou 2013[27]	Inappropriate comparison. Route of administration [later question]
Arslan 2011[29]	Inappropriate study design: quasi-RCT
Awad 2012[34]	Systematic review: references checked
Barreto 2016[46]	Systematic review: study designs inappropriate
Berjis 2016[60]	Insufficient reporting: Unclear intervention frequency, no detail on doses of failed standard therapy, no time given for length of standard treatment just onset to start of 2nd line treatment
Chan 2009[86]	Abstract
Chang 2010[89]	Not in English language
Choi 2011[97]	Incorrect comparison
Choung 2005[99]	Not in English language
Cinamon 2001[102]	Inappropriate study design: quasi-RCT
Conlin 2007[111]	Systematic review: quality assessment is inadequate
Conlin 2007[112]	Systematic review: quality assessment is inadequate
Crane 2015[120]	Systematic review: references checked
Dispenza 2011[141]	Inappropriate comparison. Route of steroid administration [later question]
Drks 2016[139]	Trial, recruiting planned
Eftekharian 2016[152]	Inappropriate comparison. Route of steroid administration [later question]
Euctr 2005[159]	Trial still recruiting
Filipo 2014[169]	Incorrect study design
Fu 2011[177]	Incorrect study design
Gao 2016[181]	Systematic review: study designs inappropriate
Garavello 2012[182]	Systematic review: quality assessment is inadequate
Gundogan 2013[204]	Inappropriate comparison. Route of steroid administration [later question]
Gunel 2015 [205]	Incorrect study design
Halpin 2012[212]	Route of steroid administration [later question]. Inappropriate comparison
Han 2008[214]	Not in English language
Han 2009[213]	Incorrect study design
Ho 2004[228]	Incorrect intervention
Hong 2009[230]	Incorrect comparison
Hultcrantz 2015[237]	Not in English language
Iranian Registry of Clinical Trials 2012[242]	Clinical trial reference. No data
Kesornukhon 2011[266]	Unclear time points for outcomes. Unclear if randomisation broken for preference of treatment
Khorsandi Ashtiani 2012[267]	Inappropriate comparison. Route of steroid administration [later question]
Koltsidopoulos 2013[279]	Systematic review: study designs inappropriate
Kosyakov 2007[286]	Abstract
Kosyakov 2011	Inappropriate comparison. Route of steroid administration [later question]

Labus 2010[297]	Systematic review: quality assessment is inadequate
Lavigne 2016[307]	Systematic review
Lawrence 2015[308]	Systematic review: literature search not sufficiently rigorous
Lee 2008[311]	Incorrect study design
Li 2013[325]	Incorrect study design
Li 2015[324]	Systematic review: References checked
Lim 2013[329]	Inappropriate comparison. Route of steroid administration [later question]
Lim 2013[328]	Inappropriate comparison. Route of steroid administration [later question]
Liuh 2011[341]	Not in English language
Liyi 2007[342]	Not in English language
Meine Jansen 2005[369]	Incorrect age group
Min 2011[379]	Abstract
Moon 2011[382]	Incorrect study design
NCT 2003[405]	Letter to the Editor
NCT 2014[408]	Trial not open yet for participant recruitment
Ng 2015[409]	Systematic review: quality assessment is inadequate. Systematic review: methods are not adequate/unclear
Ocak 2014[421]	Incorrect study design
Ochi 1998[422]	Not in English language
Ovet 2015[427]	Incorrect study design
Oyoun 2014[428]	Incorrect study design
Park 2009[431]	Not in English language
Park 2011[433]	Systematic review: methods are not adequate/unclear
Park 2012[432]	Incorrect interventions
Peng 2009[438]	Not in English language
Plontke 2009[447]	Letter to the Editor
Qiang 2017[462]	Systematic review
Qu 2015[463]	Not in English language
Racic 2003[466]	Incorrect interventions
Rauch 2011[472]	Route of steroid administration [later question]. Inappropriate comparison
Seggas 2011[494]	Systematic review: study designs inappropriate
Shin 2002[503]	Not in English language
Stachler 2012[516]	Systematic review: references checked
Swachia 2016[534]	Inappropriate comparison. Route of steroid administration [later question]
Vlastarakos 2012[566]	Systematic review: study designs inappropriate
Wei 2013[574]	Systematic review: references checked
Wen 2005[577]	Not in English language
Westerlaken 2003[580]	Insufficient reporting
Wijck 2007[582]	Incorrect study design
Wilson 1980[585]	Unclear methodology, mixed treatment doses
Yoo 2017[602]	Incorrect intervention: simultaneous versus sequential administration

Zhao 2016[608]	Systematic review: quality assessment is inadequate
Zhou 2011[612]	Inappropriate comparison. Route of steroid administration [later question]
Zhou 2015[610]	Not in English language

L.7.2 Routes of administration

Table 79: Studies excluded from the clinical review

Study	Exclusion reason
ACTRN 2013[33]	Study not yet recruiting, protocol only
Alimoglu 2011[19]	Incorrect study design
JPRN 2013[246]	Unavailable: unable to locate as cited
Arslan 2011[29]	Inappropriate study design: quasi-RCT
Awad 2012[34]	Systematic review: references checked
Barreto 2016[46]	Systematic review: study designs inappropriate
Berjis 2016[60]	Insufficient reporting: Unclear intervention frequency, no detail on doses of failed standard therapy, no time given for length of standard treatment just onset to start of 2nd line treatment
Chan 2009[86]	Abstract
Chang 2010[89]	Not in English language
Choi 2011[97]	Incorrect comparison
Choung 2005[99]	Not in English language
Cinamon 2001[102]	Inappropriate study design: quasi-RCT
Conlin 2007[111]	Systematic review: quality assessment is inadequate
Conlin 2007[112]	Systematic review: quality assessment is inadequate
Crane 2015[120]	Systematic review: quality assessment is inadequate
Deutsches Register Klinischer Studien 2016[139]	Trial, recruiting planned
EU Clinical Trials Register 2005[159]	Trial still recruiting
Filipo 2014[169]	Incorrect study design
Fu 2011[177]	Incorrect study design
Gao 2016[181]	Systematic review: study designs inappropriate
Garavello 2012[182]	Systematic review: quality assessment is inadequate
Gunel 2015 [205]	Incorrect study design
Han 2008[214]	Not in English language
Han 2009[213]	Incorrect study design
Ho 2004[228]	Incorrect intervention
Hong 2009[230]	Incorrect comparison
Hultcrantz 2015[237]	Not in English language
Iranian Registry of	Unobtainable

Clinical Trials 2012[242]	
Kesornukhon 2011[266]	Unclear time points for outcomes. Unclear if randomisation broken for preference of treatment
Koltsidopoulos 2013[279]	Systematic review: study designs inappropriate
Kosyakov 2007[286]	Abstract
Kosyakov 2011 [285]	Incorrect interventions: dosing regimen not applicable to UK practice
Labus 2010[297]	Systematic review: quality assessment is inadequate
Lawrence 2015[308]	Systematic review: literature search not sufficiently rigorous
Lee 2008[311]	Incorrect study design
Li 2013[325]	Incorrect study design
Li 2015[324]	Systematic review: References checked
Liuh 2011[341]	Not in English language
Liyi 2007[342]	Not in English language
Meine Jansen 2005[369]	Incorrect age group
Min 2011[379]	Abstract
Moon 2011[382]	Incorrect study design
NCT 2003[405]	Letter to the Editor
NCT 2014[408]	Trial not open yet for participant recruitment
Ng 2015[409]	Systematic review: quality assessment is inadequate. Systematic review: methods are not adequate/unclear
Ocak 2014[421]	Incorrect study design
Ochi 1998[422]	Not in English language
Ovet 2015[427]	Incorrect study design
Oyoun 2014[428]	Incorrect study design
Park 2009[431]	Not in English language
Park 2011[433]	Systematic review: methods are not adequate/unclear
Park 2012[432]	Incorrect interventions
Peng 2009[438]	Not in English language
Plontke 2009[447]	Letter to the Editor
Qu 2015[463]	Not in English language
Racic 2003[466]	Incorrect interventions
Seggas 2011[494]	Systematic review: study designs inappropriate
Shin 2002[503]	Not in English language
Stachler 2012[516]	Systematic review: references checked
Vlastarakos 2012[566]	Systematic review: study designs inappropriate
Wei 2013[574]	Systematic review: references checked
Wen 2005[577]	Not in English language
Westerlaken 2003[580]	Insufficient reporting
Wijck 2007[582]	Incorrect study design
Wilson 1980[585]	Unclear methodology, mixed treatment doses
Zhao 2016[608]	Systematic review: quality assessment is inadequate

Zhou 2011[612]	Inappropriate study design: quasi-RCT
Zhou 2015[610]	Not in English language

L.8 Information and advice

Table 80: Studies excluded from the qualitative review

Reference	Reason for exclusion
Dahl 1998[126]	Incorrect study design: quantitative study
Cardoso 2006[83]	Non English language publication
Ferguson 2015[162]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Graham 2005[197]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Granberg 2014[199]	Includes data from a developing country
Grutters 2007[203]	Incorrect study design: quantitative study
Halberg 1993[211]	Does not meet protocol (no information/support/advice)
Hallam 2008[210]	Does not meet protocol (no information/support/advice)
Harkins 1988[216]	Incorrect study design: quantitative study
Holliday 2015[229]	Does not meet protocol criteria
Howe 1993[234]	Incorrect study design: review
Iezzoni 2004[241]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Jennings 2008[248]	Low quality study
Karras[260]	Non English language publication
Knudsen 2013[275]	Sub-analysis of Laplante 2012 study, no additional information
Kritzinger 2014[289]	Includes data from a developing country
Lane 2016[298]	Incorrect study design: quantitative intervention study
Laplante 2010[299]	Does not meet protocol criteria (compares interventions)
Laroche 2000[303]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Lockey 2010[343]	Does not meet protocol (no information/support/advice)
Manchaiah 2011[357]	Does not meet protocol (no information/support/advice)
Manchaiah 2012[356]	Does not meet protocol (no information/support/advice)
Pereira 2010[443]	Includes data from a developing country
Prior 2008[455]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Reeves 2005[474]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Jones 2005[252]	Does not meet protocol criteria (Health education priorities)
Rekkedal 2012[476]	Does not meet protocol criteria (population is children)
Sadler 2001[485]	Unclear methodology
Steinberg 1998[521]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Steinberg 2002[522]	Does not meet protocol criteria (includes people with childhood presentation of

Reference	Reason for exclusion
	deafness)
Steinberg 2006[520]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Topp 2013[549]	Incorrect study design: quantitative study and an abstract
Wanstrom 2014 [570]	Does not meet protocol (no information/support/advice)
Witte 2000[586]	Does not meet protocol criteria (includes people with childhood presentation of deafness)
Woll 2013[588]	Conference abstract
Wood 1983[589]	Incorrect study design: quantitative study

L.9 Decision tools

Table 81: Studies excluded from the clinical review

Study	Exclusion reason
Cobelli 2014[108]	Incorrect study design (non-randomised trial)
Ferguson 2016[163]	Incorrect intervention (included in chapter X)
Joore 2002[253]	Incorrect study design (uncontrolled prospective study)
Weineland 2015[575]	Protocol
Zarenoe 2016[605]	Incorrect intervention (included in chapter X)

L.10 Assistive listening devices

Table 82: Studies excluded from the clinical review

Study	Exclusion reason
Aldaz 2016[15]	Incorrect interventions
Alfakir 2015[17]	Incorrect study design
Ali 2008[18]	Incorrect study design. Abstract of a systematic review
Anttila 2012[26]	Not guideline condition. Systematic review is not relevant to review question or unclear PICO
Bertachini 2015[62]	Incorrect age group
Clark 2016[105]	Incorrect study design
Drennan 2005[145]	Incorrect interventions
Galvin 1999[180]	Incorrect study design
Gordon-Salant 2009[196]	Incorrect study design
Jerger 1996[250]	Incorrect study design
Kim 2014[270]	Incorrect study design
Kitterick 2015[274]	Systematic review. Inappropriate comparison
Kreisman 2010[287]	Incorrect interventions

Lewis 2005[323]	Incorrect study design
Maidment 2016[353]	Protocol
Yueh 2001[604]	Incorrect interventions

L.11 Hearing aids

L.11.1 Hearing aids versus no hearing aids

Table 83: Studies excluded from the clinical review

Reference	Reason for exclusion
Abrams 2002[5]	Inappropriate study design
Jerger 1992[250]	Inappropriate study design
Lavie 2015[306]	Inappropriate study design
Tolson 2002[548]	Inappropriate definition of hearing loss
Yueh 2001[604]	Inappropriate study design

L.11.2 1 hearing aid versus 2 hearing aids

Table 84: Studies excluded from the clinical review

Reference	Reason for exclusion
Formby 2015[173]	Intervention - 2×2 design comparing sound generators versus control and counselling versus no counselling
Kreisman 2010[287]	Intervention - All participants had binaural aids; compared different types of hearing aid designs
Metselaar 2009[373]	Intervention - Compared ‘comparative’ versus ‘prescriptive’ approach for fitting hearing aids
Lavie 2014[305]	Intervention - compared 3 strategies for fitting binaural aids (simultaneous versus sequential (starting with right ear) versus sequential (starting with right ear)
Yueh 2001[604]	Intervention - compared 3 different types of hearing aids against no amplification

L.12 Hearing aid microphones and noise reduction algorithms

L.12.1 Microphones

Table 85: Studies excluded from the clinical review

Study	Exclusion reason
Amlani 2001[24]	Systematic review: references checked
Bentler 2004[58]	Incorrect interventions
Bentler 2005[57]	Systematic review. Checked included papers
Brimijoin 2014[72]	Pre-crossover data unavailable

Desjardins 2016[137]	Incorrect study design
Gnewikow 2009[189]	Pre-crossover data unavailable
Korhonen 2015[283]	Incorrect interventions
Luts 2004[348]	Incorrect study design
Nielsen 1973[414]	Incorrect study design
Oeding 2013[423]	Inappropriate comparison. Incorrect study design
Peeters 2009[436]	Incorrect study design
Preves 1999[452]	Incorrect study design
Quintino 2010[464]	Incorrect study design
Ricketts 2003[478]	Incorrect study design
Shields 2001[502]	Incorrect interventions
Surr 2002[531]	Incorrect study design
Valente 2015[559]	Pre-crossover data unavailable
Wolframm 2012[587]	Incorrect study design
Yueh 2001[604]	Incorrect interventions

L.12.2 Noise reduction algorithms

Table 86: Studies excluded from the clinical review

Study	Exclusion reason
Bentler 2008[55]	Paper does not provide enough data for critical analysis. Contacted author for raw data but she was unable to provide it.
Bentler 1993[56]	Method of group allocation uncertain
Digiovanni 2011[140]	Incorrect study design
Kim 2014[269]	Incorrect study design
Korhonen 2013[282]	Incorrect study design
Kuk 2011[293]	Incorrect study design
Kuk 2015[292]	Incorrect study design
Miller 2017 [378]	Incorrect study design
NCT 2005[406]	Clinical trial reference. No data
Oeding 2013[423]	Incorrect study design
Peeters 2009[436]	Incorrect study design
Prosser 2009[456]	Not guideline condition

L.13 Monitoring and follow-up

Table 87: Studies excluded from the clinical review

Study	Exclusion reason
Chisolm 2013[96]	Incorrect study design

Study	Exclusion reason
Cullington 2016[123]	Protocol
Elkayam 2003[155]	Children
Ferguson 2016[163]	Incorrect interventions
Gussenhoven 2012[209]	Protocol
Hickson 2007[225]	Incorrect interventions
Laplante-Lévesque 2006[301]	Incorrect study design
Lonka 1995[344]	Protocol
Miranda 2008[380]	Incorrect interventions
Penteado 2014[440]	Incorrect interventions
Ramos 2009[469]	Cochlea implants
Selmi 1985[495]	Children
Swanepoel de 2010[537]	Systematic review checked for references
Swanepoel de 2010[538]	Not review population. Not guideline condition
Wasowski 2010[571]	Incorrect interventions
Whitton 2016[581]	Incorrect interventions

L.14 Interventions to support the use of hearing aids

Table 88: Studies excluded from the clinical review

Study	Exclusion reason
Colucci 2016[109]	Incorrect study design: article describing assistance to family caregivers
Hickson 2003[224]	Incorrect study design: non-RCT
Hickson 2007[225]	population: not all hearing aid users and cannot extract data for hearing aid users only
Hickson 2014[223]	Incorrect study design: logistic regression
Jennings 1994[247]	Incorrect study design: article describing a rehabilitation programme
Kricos 2011[288]	Incorrect study design: opinion piece
Ng 2015[410]	Systematic review
Pryce 2015[460]	Incorrect study design and method: qualitative review
Singh 2016[508]	Systematic review
Thoren 2011[544]	Already included in Barker 2016
Thoren 2014[546]	Already included in Barker 2016
Thoren 2015[545]	Incorrect study design: forum article summarising Thoren 2007 and Thoren 2011
Anonymous 1994[63]	Unobtainable

Appendix M: Excluded health economic studies

M.1 Urgent and routine referral

M.1.1 Urgent referral

None

M.1.2 Routine referral

None

M.2 MRI

None

M.3 Subgroups

None

M.4 Early versus delayed management of hearing loss

None

M.5 Communication needs

None

M.6 Management of earwax

M.6.1 Treatment

None

M.6.2 Settings

None

M.7 Sudden sensorineural hearing loss

M.7.1 Treatment

None

M.7.2 Routes of administration

None

M.8 Information and advice

None

M.9 Decision tools

None

M.10 Assistive listening devices

None

M.11 Hearing aids

M.11.1 Hearing aids versus no hearing aids

Table 89: Studies excluded from the health economic review

Reference	Reason for exclusion
Boas 2001[64]	This study was assessed as partially applicable with potentially serious limitations. However, given that a more recent analysis by the same authors set in the same country was available (Joore 2003[254]), this study was selectively excluded.

M.11.2 1 hearing aid versus 2 hearing aids

None

M.12 Hearing aid microphones and noise reduction algorithms

M.12.1 Microphones

None

M.12.2 Noise reduction algorithms

None

M.13 Monitoring and follow-up

None

M.14 Interventions to support the use of hearing aids

None

Appendix N: Cost-effectiveness analysis: early versus delayed management of hearing loss

N.1 Introduction

Hearing aids are the most commonly prescribed management option for people with hearing loss.

However, there is typically a gap of 10 years between when people first experience hearing loss and when they first report it[129,147] (see section N.2.4.1.1) Most people who could benefit from hearing aids have never used them,[129,147] while many people who have reported hearing difficulties to their GP have not had their hearing assessed.[129] Although hearing aids have been available on the NHS since its inception in 1948, the cost effectiveness of hearing aids for the management of hearing loss in the UK has not previously been investigated in a full economic evaluation, partly due to past difficulties in measuring the benefit of hearing aids in terms of health-related quality of life (HRQoL).

This economic analysis has been designed by the National Guideline Centre (NGC) to provide evidence for 2 review questions in the NICE guideline on hearing loss in adults:

- What is the clinical and cost effectiveness of early versus delayed management of hearing loss on patient outcomes?
- What is the clinical and cost effectiveness of hearing aids for mild to moderate hearing loss in adults who have been prescribed at least 1 hearing aid?

There are 11 million people with hearing loss in the UK. It is thought that around 2 million adults in the UK currently use hearing aids. It is likely that many more could benefit from them, but have not had their hearing assessed. Consequently, any intervention that would substantially increase the proportion of people using hearing aids would incur high overall costs for the NHS – whilst also resulting in health benefits for a very large number of people. Although hearing aids are currently recommended by NHS England for people who would benefit from them,[412] it is known that many people do not receive them, or receive them many years after they would have first been eligible. Identifying a greater proportion of those with hearing loss and offering them hearing aids could therefore give rise to a substantial increase in upfront costs for the NHS compared to current practice. For this reason, and because suitable data were identified that could be used to inform an economic analysis, this analysis was agreed by the guideline committee to be the highest priority for original economic analysis for this NICE guideline.

This health economic model compares the cost effectiveness of the early use of hearing aids soon after hearing loss is first recognised with not fitting hearing aids until later in life. By comparison to a no treatment arm, the model can also be used to compare the cost effectiveness of hearing aid use (either early or delayed) with no hearing aids.

There are many alternative or complementary interventions and strategies for managing hearing loss, such as counselling, support and advice sessions, assistive listening devices and lip-reading training. Although these are all within the scope of the review question on early versus delayed management, they have not been included in this model as we could not identify any clinical data on the efficacy of any interventions other than hearing aids to use as a basis for modelling. This model therefore looks only at hearing aid use, including the follow-up care and support provided to assist people in using their hearing aids.

N.2 Methods

N.2.1 Model overview

N.2.1.1 Comparators

There are 3 comparators (arms) in the health economic model:

- No treatment: hearing aids are never used.
- Delayed treatment: hearing aids are not offered for 10 years after hearing loss is first recognised, then everyone eligible is offered hearing aids.
- Early treatment: everyone eligible is offered hearing aids immediately after hearing loss is recognised.

N.2.1.2 Population

The population for this model is people reporting hearing difficulties.

The model is designed to represent the situation where an adult in England goes to see their GP reporting (for the first time) some kind of problem with their hearing.

People who experience no hearing problems are excluded from the population. People deaf from birth or with childhood-onset of hearing loss are excluded. People with a specific subtype of hearing loss dealt with in other review questions in this guideline, such as sudden hearing loss or hearing loss caused by earwax, are excluded from this model – when they report to their GP they should be referred on appropriately as recommended in the guideline, but will follow different pathways. The principal target population for hearing aids is people with acquired, gradual-onset sensorineural hearing loss (also known as presbyacusis or 'age-related' hearing loss). These people are described in this report as having 'aidable hearing loss' as this condition can usually be assisted by the use of hearing aids. However this model also includes people with other difficulties with their hearing who would also be referred for an initial audiological assessment, but at which it would be determined that their problem is not one that could be improved by using a hearing aid. They will receive advice regarding their hearing problem, but will not be offered hearing aids or receive any further treatment. These are described as having 'non-aidable hearing difficulties'.

In the base case people are aged 65 at the starting point of the model, but starting ages of 55 and 75 are explored in sensitivity analyses. This represents the age at which people first experience hearing difficulties. People who first experience hearing difficulties after the starting age do not join the model at a later stage – they can be considered instead by varying the starting age of the model.

The population is not divided into subgroups for different severities or magnitudes of hearing loss (see section **Error! Reference source not found.** below).

N.2.1.3 Time horizon, perspective, discount rates

The analysis follows the standard assumptions of the NICE reference case[398,404] including incremental analysis and discounting at 3.5% for both costs and health effects. A sensitivity analysis was conducted using a discount rate of 1.5% for costs and health benefits.

The base case takes a lifetime perspective (continuing to death, or when any people remaining in the model reach the age of 100 years), assuming that individuals continue to have hearing loss (hearing loss cannot be 'cured') and that hearing aids continue to be a management option throughout life. Results are also presented for the first 10 years as these have a lower uncertainty and will be of particular interest to funding bodies.

N.2.2 Approach to modelling

N.2.2.1 Model structure

The model is a cost–utility analysis, comparing costs incurred to quality-adjusted life years (QALYs) gained, and calculating incremental cost-effectiveness ratios (ICERs) to compare the alternative interventions.

A health state transition (Markov) model was developed. The model follows hypothetical groups of people (cohorts) who progress through the model in annual cycles, each year either staying in the same health state or moving to a new health state, until death or age 100 years.

The model is composed of 3 health states:

- Treated (that is, currently using hearing aids)
- Untreated (that is, currently not using hearing aids)
- Dead

The model starts at the point where people present to their GPs reporting hearing difficulties. All 3 arms (no treatment, early treatment, delayed treatment) therefore include the cost of 1 GP appointment. Following the first presentation, the cohort progresses in a different way for each of the 3 arms:

- In the **no treatment** arm everyone starts in the Untreated state, and stays there until they die.
- In the **delayed** treatment arm everyone starts in the Untreated state and stays there for the first 10 years (unless they die sooner). After 10 years all living participants receive a hearing assessment; those found eligible for hearing aids and who accept them then move to the Treated state, those whose hearing cannot be improved by hearing aids or who decline to receive hearing aids stay in the Untreated state.
- In the **early** treatment state the first hearing assessment occurs at the starting point of the model. Hence everyone who is eligible and accepts hearing aids starts in the Treated state, whilst those who are whose hearing cannot be improved by or who decline hearing aids start in the Untreated state.
- In both the **delayed** treatment and **early** treatment arms, those in the Treated state stay in that state until they either die or they decide to stop using hearing aids (drop out of treatment), at which point they move to the Untreated state. Those in the Untreated state remain in that state until they die.

Following every hearing assessment with an audiologist a person will either be found to have non-aidable hearing difficulties, in which case they would not benefit from hearing aids, or they are found to have aidable hearing loss and so will be offered hearing aids. If they accept the offer then they will be invited to a fitting appointment, again with an audiologist. They will receive 2 hearing aids (and either moulds made for them or thin tubes and domes depending on the appropriate type of hearing aid for them).

After 6 to 12 weeks all those receiving hearing aids will have a face-to-face follow-up appointment.

People who use hearing aids will self-refer to a clinic for brief aftercare (maintenance and repair) sessions periodically according to need, for example when a hearing aid needs to be mended or its settings adjusted.

People may continue to use hearing aids or cease to use hearing aids (drop out from treatment).

In both early and delayed arms, everyone still using hearing aids will be invited back every 3 years to repeat the assessment procedure (GP appointment, hearing assessment, fitting appointment, 2 hearing aids received, follow-up appointment).

Figure 148: Pathway of patients' journeys over time

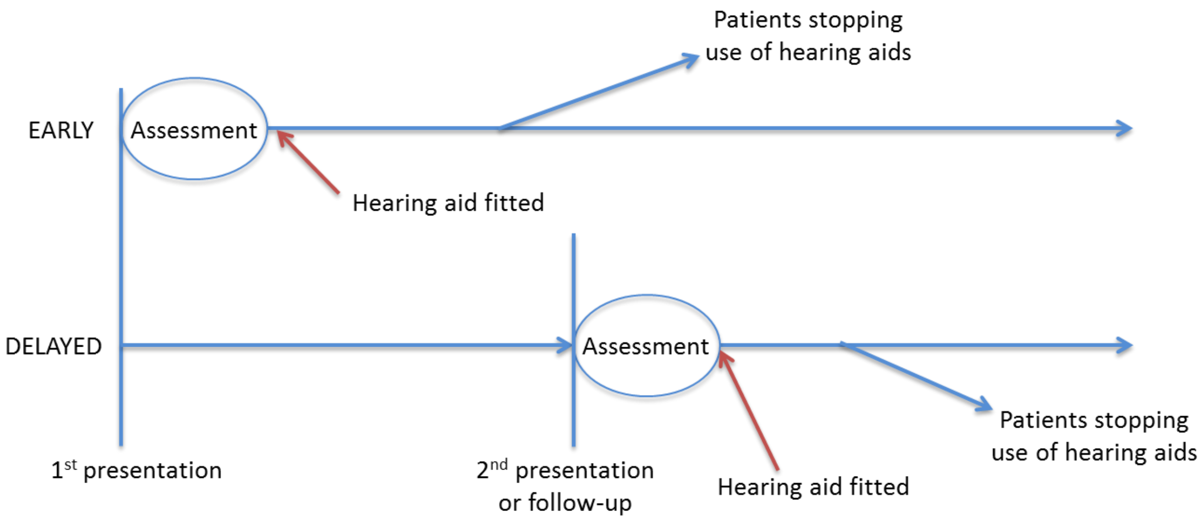
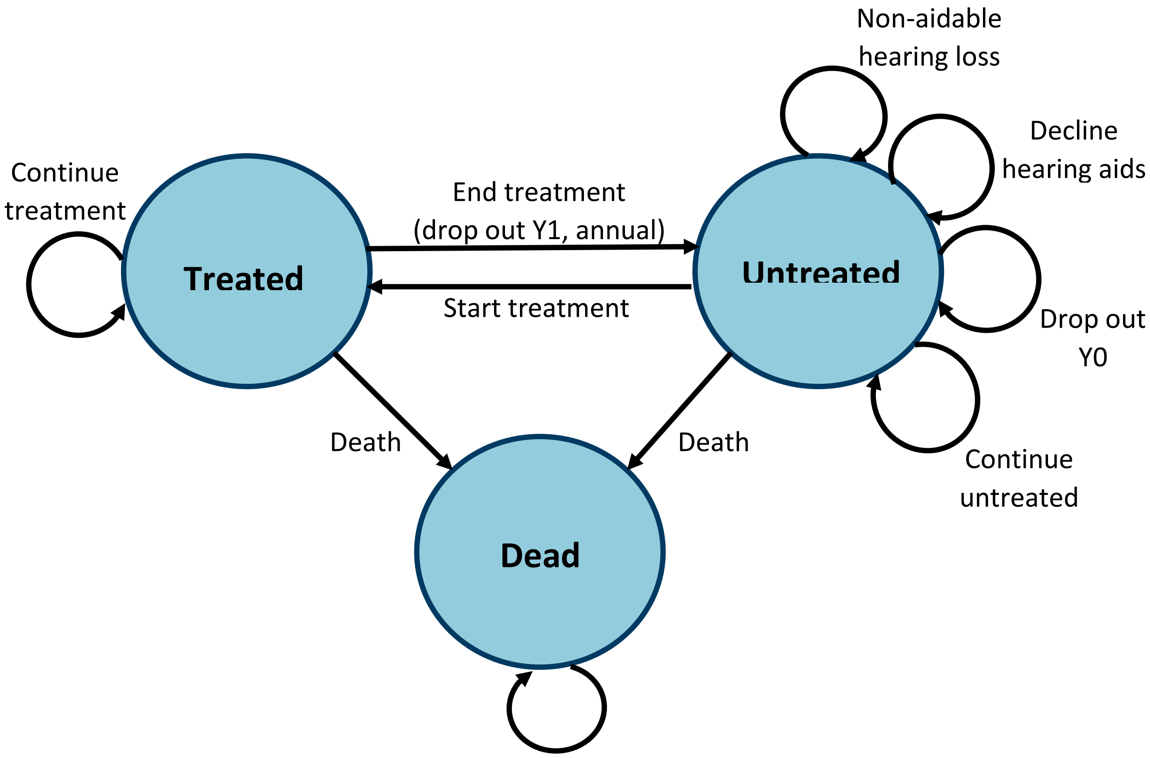


Figure 149: Markov model for early versus delayed use of hearing aids



The standard limitations of Markov models apply to this model: that is, each member of the cohort can undergo only 1 transition per cycle, at the end of the year. Thus, for example, someone cannot both stop using hearing aids and then die within the same year. This would, however, have no noticeable effect on the results of the model.

N.2.2.2 Assumptions regarding model structure

- We assume that people who stop using hearing aids (drop out from treatment) do not restart using hearing aids at any point in the future. Hence there are no transitions back from Untreated to Treated after a transition in the opposite direction. This is clearly a simplification of reality. However, the annual dropout rates were chosen to reflect as well as possible the proportion of people using hearing aids over time. It does not make a practical difference whether this includes some people restarting, balanced out by others stopping their use. There is also no evidence that rates of restarting would vary between the early and delayed groups.

- Similarly, we assume that those people who declined the offer of hearing aids when offered to them following a first hearing assessment never change their mind and receive hearing aids after all at a later point. Again, this is unrealistic, however there is no reason to believe that this would differ between groups. Those who wish to receive hearing aids at a later point are effectively starting the model again from the beginning but as part of an older age cohort.
- We assume that all participants have bilateral hearing loss (hearing loss in both ears) and will receive 2 hearing aids, 1 for each ear. Although this is true for the majority of patients it is not true for everyone, and so this will overestimate the number of hearing aids required and lead to higher costs being incurred in the model for the treatment arms, particularly early treatment. This simplification hence cautiously favours no treatment or delayed treatment over early treatment. See section N.2.4.5 below for further discussion of this point.
- We assume that wearing hearing aids has no effect on morbidity or mortality, and will have no effect on the rate of decline in hearing of people who use hearing aids. We assume that hearing aids give the same benefit to quality of life to all who use them, regardless of age, duration of hearing loss or level of hearing loss. See section N.2.4.5 below for further discussion of these points.

N.2.2.3 Uncertainty

The model was built probabilistically to take account of the uncertainty around input parameter point estimates. A probability distribution was defined for each model input parameter. When the model was run, a value for each input was randomly selected simultaneously from its respective probability distribution; mean costs and mean QALYs were calculated using these values. The model was run 1,000 times and results were summarised.

The way in which distributions are defined reflects the nature of the data, so for example probabilities were given a beta distribution, which is bounded by 0 and 1, reflecting that a probability must be within this range. Probability distributions in the analysis were parameterised using error estimates from data sources. Where this was not possible assumptions were made. Distribution methodology is given in Table 90 below, while the values used in each case can be found in section N.2.6.1.

Table 90: Description of the type and properties of distributions used in the probabilistic sensitivity analysis

Parameter	Distribution	Properties of distribution
Probabilities: proportion of patients dropping out, unsuitable or declining treatment, using aids successfully	Beta	Bounded between 0 and 1. Alpha and Beta values were calculated as follows: Alpha = $\text{mean}^2 \times [(1-\text{mean})/\text{SE}^2]-\text{mean}$ Beta = Alpha×[(1−mean)/mean] As these proportions were based on expert opinion not on experimental data, we adopted the assumption that: Standard error = mean/5
Costs: hearing aids and NHS appointments	Gamma	Bounded at 0, positively skewed. Derived from mean and its standard error. Standard errors were selected to make the calculated LQR and UQR as closely match the LQR and UQR in the data as possible. Alpha, Beta and Lambda values were calculated as follows:

Parameter	Distribution	Properties of distribution
		Alpha = $(\text{mean}/\text{SE})^2$ Beta = SE^2/mean Lambda = mean/SE^2
Utility: Increase in utility caused by use of hearing aids	Gamma	Calculated as for costs

The following variables were left deterministic (that is, they were not varied in the probabilistic analysis):

- the cost-effectiveness threshold (which was deemed to be fixed by NICE),
- starting age, sex
- length of delay, length of gap between hearing reassessment and hearing aid replacement, number of aftercare appointments
- costs of batteries, moulds, thin tubes and domes, and the cost of GP appointments
- baseline utility for people with hearing loss
- age-specific mortality rates.

Deterministic sensitivity analyses were also undertaken to test the robustness of model assumptions. In these, 1 or more inputs were changed and the analysis rerun to evaluate the impact on results and whether conclusions on which intervention should be recommended would change (see sections N.2.6.2–N.2.6.4).

N.2.3 Choice of appropriate instrument for measuring and valuing health-related quality of life

N.2.3.1.1 Measuring quality of life

Health-related quality of life (HRQoL) is assessed by measuring what health economists refer to as ‘utility’ on a scale of 0.0–1.0 representing death to perfect health (or converted into this scale). A number of instruments and a variety of techniques are used by researchers to gather information both from the general public on how they value certain states of health compared to other states of health; and from people with specific conditions on how their condition affects them.

These measurements of utility can then be combined with data on length of life to calculate the total number of QALYs for people with or without the intervention being studied.

N.2.3.1.2 EQ-5D

NICE’s preferred tool (NICE guideline manual, section 7.6[398]), and the most commonly used in the UK is called EQ-5D (EuroQol 5 dimensions). It is based on questions about 5 aspects of health:

- Mobility (ability to walk)
- Self-care (washing and dressing)
- Ability to perform ‘usual activities’ (work, study, housework, family or leisure activities)
- Pain or discomfort
- Anxiety and depression

Each of these aspects is graded on either a 3-point scale (EQ-5D-3L) – for example, “I have no pain or discomfort”, “I have moderate pain or discomfort”, “I have extreme pain or discomfort”, or on a newer 5-point scale (EQ-5D-5L). Each combination of responses maps to a valuation from 1.0–0.0 (technically some values slightly lower than 0 are allowed to represent a state worse than death, though these are rare). There is a standard UK valuation set for each of the 3 level and 5 level versions, which were created by questioning members of the UK public. If a person reports no problems with any of these 5 aspects they will score 1.0.

N.2.3.1.3 Challenges of measuring health-related quality of life in hearing loss

However, these 5 questions do not relate well to hearing loss, as hearing loss affects quality of life in ways that are largely not captured in these aspects of health (although there may be an effect on ‘ability to perform usual activities’ for some people).

It is widely accepted that EQ-5D does not capture changes in quality of life in people due to impaired or improved hearing. For example, 1 study[48] comparing the use of EQ-5D with another tool called HUI3 to measure the quality of life of people with hearing loss found that 41% of subjects scored a perfect 1.0 using EQ-5D despite reporting hearing loss and averaging 0.73 using HUI3.

A recent review (Payakachat 2015[435]) reviewed 145 studies to see how responsive EQ-5D is with regard to 56 health conditions. Hearing impairment was 1 of only 4 conditions to which EQ-5D was found not to be responsive.

It is clear however that hearing loss does impact, and hearing aids do improve, many aspects of quality of life. Shield 2006[501] reviewed studies that investigated the impact of hearing aids on a wide variety of aspects of quality of life and concluded that “there is overwhelming evidence that the use of hearing aids causes significant improvement to the quality of life of hearing impaired people […] having a positive effect upon their social, emotional, psychological and physical well being, and many of their day to day activities. In most areas the benefits occur early on in the wearing of aids, in some cases within a few weeks of fitting, and are then sustained throughout the period of wearing aids.”

N.2.3.1.4 NICE policy on choosing appropriate instruments

NICE’s policy is that EQ-5D is the preferred tool, but “[a]lternative methods [of] generating health state utility values will be considered by NICE in place of EQ-5D when EQ-5D data are either unavailable or inappropriate.” Alternative generic measures (those that seek to be applicable to all people) are preferred to condition-specific measures, such as any designed only for people with hearing loss but which cannot be used for people with other conditions, as these are difficult to validate to ensure comparability.

A report from NICE’s Decision Support Unit notes that “[e]vidence from recent reviews suggests the EQ-5D is probably not appropriate for assessing the impact [of] hearing loss”.[71]

N.2.3.1.5 Alternatives to EQ-5D

Several other generic tools have the same limitations as EQ-5D does in relation to hearing loss – either in full or to a lesser extent. For example the common SF-36 and SF-6D instruments also do not explicitly ask about hearing. Other tools may appear to work well for hearing loss, but have not been fully validated, either in relation to hearing loss or they lack a validated UK valuation set, so calibration may have been conducted in a different country.

Not using EQ-5D inevitably means that any results we look at with other tools will not be fully comparable to results using EQ-5D that NICE uses for its guidelines and technology appraisals for other conditions.

N.2.3.1.6 Health Utilities Index, Mark 3 (HUI3)

The tool that appears to be most commonly used in papers relating to hearing loss instead of EQ-5D is the Health Utilities Index, Mark 3: HUI3 (see, for example, Davis 2007,[129] Morris 2013,[385] Swan[535]).

The most substantial previous piece of guidance published by NICE relating to hearing is technology appraisal TA166, Cochlear implants for children and adults with severe to profound deafness (2009).[403] This relied upon evidence that used, or was mapped to, HUI3, and made no use of EQ-5D.

Another analogy is vision, which like hearing is captured directly by HUI3 but indirectly at best by EQ-5D. NICE also chose to use HUI3 in a technology appraisal on macular degeneration (TA155)[401].

HUI3 asks questions on 8 aspects of health:

- Vision (scored from 1 to 6)
- **Hearing** (1–6)
- Speech (1–5)
- Ambulation (1–6)
- Dexterity (1–6)
- Emotion (1–5)
- Cognition (1–6)
- Pain (1–5)

As for EQ-5D, each level for each aspect of health has a valuation; these are combined using a formula which will give a total between 1 and 0 (as for EQ-5D, theoretically it can be slightly below 0, but this is unlikely in practice). Unlike EQ-5D, there is only one valuation set, which was derived from the Canadian public, and so this has not been calibrated for a UK population.

Of particular note in HUI3, of course, is the inclusion of 'Hearing' as one of the aspects of health explicitly included. The 6 levels of response on the HUI3 questionnaire are:

- 1. Able to hear what is said in a group conversation with at least three other people, without a hearing aid.
- 2. Able to hear what is said in a conversation with one other person in a quiet room without a hearing aid, but requires a hearing aid to hear what is said in a group conversation with at least three other people.
- 3. Able to hear what is said in a conversation with one other person in a quiet room with a hearing aid, and able to hear what is said in a group conversation with at least three other people, with a hearing aid.
- 4. Able to hear what is said in a conversation with one other person in a quiet room, without a hearing aid, but unable to hear what is said in a group conversation with at least three other people even with a hearing aid.
- 5. Able to hear what is said in a conversation with one other person in a quiet room with a hearing aid, but unable to hear what is said in a group conversation with at least three other people even with a hearing aid.
- 6. Unable to hear at all.

N.2.3.1.7 Selection of the appropriate instrument to measure quality of life in hearing loss

The committee therefore agreed that HUI3 is the most appropriate instrument to use to measure quality of life in people with hearing loss. It is frequently used for this purpose.

The committee considered using quality of life measured using EQ-5D as an alternative in a sensitivity analysis to compare with the results of the model calculated using quality of life measured using HUI3. However, the committee agreed that this would not be appropriate. Since EQ-5D does not capture the effect of hearing loss on quality of life then this would not produce meaningful or useful results. In contrast to the improvement in utility caused by adopting hearing aids as measured by HUI3 (0.060, discussed in section N.2.4.5.2 below), the improvement measured using EQ-5D in the same population was found to be only 0.005,[49] which the committee believed to be too small a value to represent a true reflection of the difference in HRQoL caused by adopting hearing aids.

N.2.4 Model inputs

Model inputs were based on clinical evidence identified in the systematic reviews undertaken for the guideline, supplemented by additional data sources as required. Model inputs were validated by the guideline committee. Some data were supplied by members of the committee from their own clinical practice. Where no suitable data were available, the committee estimated parameters based on their experience of current UK practice. Where there was any uncertainty estimates were chosen conservatively, that is, costs were overestimated and the benefits of treatment were underestimated to favour no treatment compared with the other 2 arms, and to favour delayed treatment compared with early treatment. This was to ensure that the results produced by the model would on balance underestimate the cost effectiveness of the use of hearing aids, and so any finding favouring their use could be relied upon.

Details of calculations, sources, and the rationales for selection of individual parameters can be found in the following sections.

N.2.4.1 Structural parameters

N.2.4.1.1 Delay

This analysis examines the difference between someone with hearing difficulties having their hearing assessed when they first experience hearing problems, and the same assessment being conducted at a later point. This is based both on evidence that people typically do not take action to report their hearing problems until they have had them for a long period of time, and on evidence that people who do report hearing problems to their GP are often not referred for a hearing assessment the first time they report this.

Davis 2007[129] questioned people in the UK who reported hearing problems when asked in a screening questionnaire, and found that their retrospective self-perception was that they had had hearing problems for a mean of 10 years.

Of these people, none of whom had previously used a hearing aid, 45% had previously reported hearing problems to their GP, but none of these had been referred for any intervention.[129]

In a separate case–control study as part of the same report,[129] Davis identified a control group of people with hearing aids fitted recently at a hearing clinic following self-presentation, compared to a group fitted as part of a screening study which actively sought people with hearing loss. The self-presenting group was on average 10 years older when they first had hearing aids fitted.

A US prospective study (Dubno 2017[147]) has followed 1,530 people for up to 27 years. This found an average delay of 9.2 years between the point at which people who went on to adopt hearing aids were ‘candidates’ for hearing aids (that is, they had aidable hearing loss) and when they first adopted hearing aids. (It should be noted that most people eligible for hearing aids had still not (yet) adopted them at the most recent time of study, and so this is likely to be an underestimate).

The committee therefore agreed that 10 years would be an appropriate length for the gap between the time at which members of the early treatment cohort receive a hearing assessment and then are offered hearing aids (if eligible) and the time at which the delayed treatment cohort receive a hearing assessment and then are offered hearing aids (if eligible).

The delay in the model can be conceptualised as representing 2 alternative situations:

- A person delays for 10 years between first experiencing hearing difficulties and first reporting hearing difficulties to their GP or other healthcare professional, when they get referred for a hearing assessment.
- A person first reports hearing difficulties to their GP soon after first experiencing them, but the GP does not refer the patient for a hearing assessment; they do not re-report to their GP for another 10 years, at which point they do get referred for a hearing assessment.

Both of these interpretations of the model are equally valid, depending on the perspective of interest, or both causes of delay could of course be combined, adding up to a total delay of 10 years. There is evidence of both of these types of delay occurring. Considering both interpretations in relation to the results will allow us to draw a wider range of conclusions.

N.2.4.1.2 Age

Davis 2007[129] found that “The average age of individuals who consult their GP with concerns about their hearing is 75 years”. Given a delay of 10 years, the committee therefore chose a base case of 65 years for hearing assessment in the early group and 75 years for hearing assessment in the delayed group; that is, all participants will be 65 at the starting point of the model.

N.2.4.1.3 Sex

Women and men have different rates of prevalence and incidence of hearing loss.[128] However, in this analysis we are interested only in people who report hearing difficulties. Therefore the only parameters which will be varied by sex are the age-specific all-cause mortality rates. This leads to different life expectancy and so different durations of hearing aid use in men and women. Results will therefore be reported separately for men and women.

N.2.4.2 Eligibility for treatment

The committee noted that some people referred for an audiological assessment will be found as a result of the assessment not to have aidable hearing loss, but some other short- or long-term difficulty with their hearing that is not amenable to the use of hearing aids.

Such people receive advice from the audiologist, but will not receive any further treatment.

The committee obtained data from 1 audiology clinic (Betsi Cadwaladr University Health Board, unpublished data supplied directly on request). This recorded that 80% of people attending for a first assessment ended up being offered, accepting and receiving hearing aid(s). The remaining 20% include both those with non-aidable hearing difficulties and those who could benefit from hearing aids who are offered them but decline (see section N.2.4.3 below). In the committee’s experience these groups are of similar size, and so it was agreed that each group should be assumed to be 10% of those who are assessed.

It should be noted that, because they incur the same costs (the cost of a hearing assessment, but no hearing aids), these 2 groups in fact have exactly the same impact in the model, and so the choice of how the 20% is split into these 2 groups has no effect at all on the results of the model.

N.2.4.3 Treatment uptake

Some people eligible for hearing aids are offered them but do not wish to wear hearing aids and so decline. As discussed above in section N.2.4.2 this group was assumed to be 10% of those whose hearing was assessed.

Previous studies have shown that people who decline the offer of hearing aids have on average a lesser degree of hearing loss than those who accept, and give as the most common reason that they do not think that they need hearing aids.[129]

N.2.4.4 Treatment adherence

Of those people who are having aidable hearing loss and agree to have hearing aids, many will stop using them at some point. These people can be subdivided into those who stop using hearing aids ('drop out') in the first year, and those who drop out in later years. The committee agreed appropriate dropout rates having considered a variety of data regarding adherence rates at different length of time after initiation.[128,129,3,482,501]

These studies have complex results and are not all consistent. Some show decreases in usage with age or length of hearing aid use,[501] while others showed that people with more severe hearing loss are more likely to use their hearing aids regularly,[3] and hence people may increase their use over time if their hearing gradually deteriorates. One review of evidence on hearing aid usage concluded: "There is no consistent relationship between amount of use of a hearing aid and hearing loss or age".[501] Most studies were conducted many years ago with older models of hearing aids, such as analogue hearing aids, and fitted in varying positions, and so people using current day hearing aids may not respond in the same way. For example, digital hearing aids are preferred to analogue hearing aids, and the introduction of behind-the-ear hearing aids increased usage.[501]

Studies categorise hearing aid use in different. While some people may entirely stop using hearing aids, others may continue using them, but only for a small proportion of the time, whilst other people use them for moderate or high proportions of each day.

For the purposes of this analysis the committee agreed that it would be sufficient to use a binary categorisation of people as either using or not using their hearing aids. It was also agreed to adopt the assumption that once people have stopped using hearing aids they will not restart using them later. Hence the proportion of people in the model not using hearing aids will steadily increase over time.

Clearly this is a simplification of reality, however, the committee did not believe that a more complicated model would produce more useful results. A more complex model including the options of both starting and stopping using hearing aids at any time point would require more parameters, but given the lack of relevant and applicable data, this would inevitably rely upon estimates of expert opinion. It does not seem that such a model would give more helpful results than a simpler model relying on fewer estimated parameters. The simplification of not allowing people to restart hearing aid use will tend towards reducing the benefits of hearing aid use compared to the costs (for any hearing aid that has already been provided, additional years of use are at very low cost), and so will conservatively favour no treatment compared to treatment, although any effect is relatively short-term as new costs are incurred every 3 years for those continuing to use hearing aids.

There is no up-to-date study of dropout rates of hearing aid use in the UK. In 2000 a NICE technology appraisal (TA8,[399] since withdrawn) suggested the opinion that "In the UK it is generally accepted that around one third of hearing aids prescribed on the National Health Service are never used", however, no data were supplied to support this view. It may be considered that the improvement in hearing aid technologies, including digital hearing aids, since then may have improved this situation, but we include a sensitivity analysis that allows for a dropout rate within the first year of over a third to cover this possibility.

The committee noted that many reasons cited for non-use of hearing aids are related to poor fitting of hearing aids and poor or missing follow-up after fitting. This NICE guideline makes a number of recommendations in both of these areas, and the committee believes that if these recommendations are followed then the number of people not using or stopping using their hearing aids could be substantially reduced. However, the committee has agreed to be cautious in choosing a relatively high dropout rate for the base case analysis so as to avoid producing results that could be thought to be unduly optimistic.

Most sources agree that the dropout rate directly after hearing aids are first received is much higher than in later years. This includes people who may receive their hearing aids and take them home but never start to actually use them.

The committee agreed that the high initial dropout rate should be restricted to the first year of hearing aid use. As Markov models represent all changes as occurring between cycles, and this model uses annual cycles, for modelling purposes this has been divided into:

- Those who are expected to drop out in the first 6 months: these are modelled as if they dropped out immediately, and so do not benefit from hearing aids at all, though they incur the full costs of hearing aids.
- Those who are expected to drop out between 6 and 12 months: these are modelled as if they dropped out at the end of the first year, and so benefit from a full year of hearing aid use, and also incur the full costs of hearing aids.

The committee agreed a dropout rate of 10% of those who accept hearing aids in the first 6 months (modelled as immediate dropouts) and a further 10% of those still using hearing aids at the end of the first year of use dropping out then (after accounting for any deaths in the meantime).

After the first year, there is a dropout rate of 2% (of the remaining population using hearing aids) each year, continuing until death.

The effect of these dropout rates is that (leaving aside deaths), after 1 year 81% of those who accept hearing aids would still be using them, after 10 years 68% would and after 20 years 55% would.

Table 91 below summarises the parameters discussed in sections N.2.4.2 to N.2.4.4. These were all selected on the expert opinion of the committee after considering relevant evidence as outlined above.

Table 91: Summary of probabilities for hearing aid eligibility, acceptance and adherence

Category	Probability
Proportion of those assessed having non-aidable hearing difficulties	10%
Proportion of those assessed who decline hearing aids	10%
Proportion of those assessed who accept hearing aids	80%
Proportion of those who accept who stop using hearing aids after 0 years	10%
Proportion of hearing aid users who stop using hearing aids after 1 year	10%
Proportion of hearing aid users who stop using hearing aids each year, after the first year	2%

N.2.4.5 Treatment effect

In this study the benefit of using hearing aids is measured in terms of the change to the quality of life of the hearing aid user caused by the hearing aids.

We assume that wearing hearing aids has no effect on health (morbidity or mortality) including on hearing itself; it will neither improve or worsen a person’s current unaided level of hearing, nor affect the rate at which the person’s hearing changes over time. The impact of the hearing aids is only to improve the person’s quality of life due to a greater ability to communicate and hence participate in activities whilst the hearing aids are in use.

The committee considered studies by Barton 2004,[49] Grutters 2007,[202] and Swan 2012[535] which all used HUI3 to measure the utility of wearing hearing aids. Barton 2004 included 609 UK participants being fitted with hearing aid(s) for the first time, while Swan 2012 included 490 UK participants with sensorineural hearing loss or inactive middle ear disease, and Grutters 2007 was conducted in the Netherlands with 70 participants. Due to the larger population and generally applicable population and methods, Barton 2004 was selected as the most appropriate study for valuing quality of life, both for the decrease in utility caused by hearing loss, and the increase caused by using hearing aids.

The study implies, but does not explicitly state, that people with bilateral hearing loss were offered 2 hearing aids. However, it was undertaken as part of the Modernising NHS Hearing Aid Services programme which included the fitting of bilateral hearing aids as standard,[129] so it can be assumed that people with bilateral hearing loss would have been offered 2 hearing aids, although a minority of patients would only have had hearing loss in 1 ear and so only required 1 hearing aid. Thus the population seems highly applicable to the target population of this analysis.

In this analysis we are including the cost of 2 hearing aids for all hearing aid users, which is an overestimate of costs, whilst the benefit should be appropriate for a typical population of people with a mixture of severities of hearing loss in either one or both ears.

For more on the cost effectiveness of offering 2 hearing aids compared with 1 hearing aid to people with hearing loss in both ears, please see the threshold analysis appendix O.

N.2.4.5.1 *Baseline utility*

The baseline utility from Barton 2004[49] was 0.584 for people with hearing loss without use of a hearing aid.

We varied the baseline utility by age as adopted by Ward 2006[400] and NCGC 2014 (appendix L).[397] Ward analysed data from Kind 1998[273] and found a uniform linear regression. The utility for people in good health was 0.890 at 40 years and this declined with a regression of −0.00425 per year to 0.635 at 100 years.

The average pre-intervention utility of 0.584 in Barton 2004 (for a population with mean age 68) was compared to Ward’s standard health utility of 0.771 at 68. It was hence calculated that hearing loss causes a decline in quality of life by 0.187 compared with people without hearing loss. This decrease in quality of life (‘utility decrement’) was then applied to the age-related healthy utility from Ward 2006 at all ages to give the utility for someone with hearing loss at that age. It is noted that Ward used EQ-5D, and so these figures may not be directly comparable and this could overstate the decrease in utility caused by hearing loss. However, as this current analysis uses incremental analysis and the people in all 3 arms have the same baseline utility, the absolute value of the baseline utility does in fact have no influence on the results of this analysis. The difference in QALYs between the 3 arms is caused purely by the magnitude of the benefit to quality of life of those people successfully using hearing aids.

N.2.4.5.2 *Benefit of hearing aids to quality of life*

The increase in utility caused by successful adoption of hearing aids was 0.060 (95% CI 0.044 to 0.073, $p<0.001$), as found by Barton 2004.[49]

For comparison, Swan 2012 found a benefit of 0.084, and Grutters 2007 found a benefit of 0.12, both using HUI3, so the value selected by the committee was in fact the lowest of the comparable studies considered.

The same benefit was applied regardless of a person’s age or how long they had been in the model or using hearing aids. The same benefit was applied regardless of the degree of hearing loss. This is a simplification. The benefit caused by hearing aids will always vary based on the individual, and in particular both a person’s degree of hearing loss, and the extent to which the hearing aids ameliorate that hearing loss. For most people with age-related hearing loss, their hearing will continue to gradually decline over time. However, this does not mean that the benefit that hearing aids give will automatically increase over time, as hearing aids do not restore perfect hearing. In some cases people may gain more benefit as their hearing decreases as the hearing aids provide a greater improvement in hearing. But in other cases the capability of the hearing aids to provide benefit will be limited by the degree and nature of the remaining hearing ability. For example, someone who was able to function well in a crowded environment when using hearing aids when they had a low level of hearing loss, may only be able to understand well a one-to-one conversation even when using their hearing aids after their hearing has worsened.

Therefore, it is not clear in principle whether it should be expected that people will on average benefit more or less over time as their hearing deteriorates. Indeed, it may be the case that benefit follows a curve with a peak at moderate levels of hearing loss and less benefit at either lower or greater levels of loss. However, it has been noted that “[t]here is no evidence to support different estimates of utility gain for people with different degrees of hearing loss”[385] The committee therefore agreed to assume a constant rate of benefit to quality of life for everyone using hearing aids, regardless of age, duration of hearing aid use or level of hearing loss. Sensitivity analysis was however conducted on this parameter to investigate the impact if it was to be varied.

The study from which the measurement of benefit was taken (Barton 2004), measured utility in people who had just started using hearing aids for the first time, and so this is a measure of the effectiveness of hearing aids in people at the beginning of usage, at a relatively younger age (mean 68 years) and at a lower level of hearing loss than would be expected after further years of treatment. Therefore, if it is the case that there is a greater benefit of hearing aid use at an older age or greater level of hearing loss then the values used in this model would underestimate the effectiveness for those groups, rather than overestimating it in the early years of treatment.

N.2.4.5.3 Effectiveness of hearing aids in routine use

For the purposes of this model it is assumed that a hearing assessment with an audiologist has 100% specificity (0% false positives). That is to say that everyone identified as having aidable hearing loss does have aidable hearing loss. (The degree of hearing loss may be slightly over- or underestimated, but not the fact of whether there is some hearing loss or none.) Therefore everyone offered and accepting hearing aids should be able to benefit from them in terms of their quality of life.

However, the committee noted that not everyone who attempts to use hearing aids does in practice find them beneficial. This may be for a variety of reasons, including an unsuitable type of hearing aid being used, the hearing aid being set up wrongly, or the user not being able to fit or operate their hearing aids. The committee believe that following the recommendations in this guideline relating to fitting and follow-up appointments should reduce these problems, but it would be unrealistic to expect them all to be eliminated.

The committee also noted that the benefits measured in Barton 2004[49] were taken from a study of people receiving hearing aids for the first time at 4 UK audiology clinics, and who would be expected to be using their hearing aids with a variety of success, not all using them perfectly. Hence the average benefit measured would include that for those hearing aid users who had no benefit. This population should therefore be similar to the population being simulated in this model.

However, it may be the case that the fitting and follow-up procedures followed in Barton 2004 were better than those found on average in the UK, as the clinics were taking part in a programme being studied and so might be expected to represent best practice. Therefore, the committee agreed to use an assumption that 80% of people would achieve the expected benefit to quality of life found in Barton 2004 when using hearing aids. (Or, alternatively, that people would on average benefit 80% as much as found in Barton 2004.) Th assumption that hearing aid usage in this model would be less successful than was found by Barton is a cautious assumption that favours no treatment or delayed treatment over early treatment.

N.2.4.6 Life expectancy and mortality rates

Life tables for England and Wales, published by the Office of National Statistics (ONS)[424] based on 2014–16 mortality data were used to establish population mortality rates for men and women from age 50 to 100 years.

Mortality was assumed to be unaffected by hearing level or usage of hearing aids, and so was identical in all 3 arms of the model.

N.2.4.7 Resource use and costs

N.2.4.7.1 Resource use

The appointments and medical equipment required by people in the model are given in Table 92 below. Resources required as part of the assessment process differ depending on whether people decline, accept or do not require hearing aids (these are modelled as transitions in the Markov model). Ongoing costs differ depending on whether people are using hearing aids or not (this is modelled by the health states in the Markov model).

Table 92: Resource use

Cohort	Subgroup	Timing	Resources
Resources relating to assessments			
No treatment Delayed treatment	All	Consultation at start of model	GP appointment
Early treatment	People with non-aidable hearing difficulties People who decline hearing aids	Assessment at start of model	GP appointment Audiology assessment
Delayed treatment	People with non-aidable hearing difficulties People who decline hearing aids	Assessment after 10 years	
Early treatment Delayed treatment	People with non-aidable hearing difficulties People who decline hearing aids	Reassessment every 3 years	
Early treatment	People who accept hearing aids	Assessment at start of model	1 GP appointment 1 Audiology assessment 1 Fitting appointment 1 Follow-up appointment 2 hearing aids 2 ear moulds or 2 thin tubes and domes
Delayed treatment	People who accept hearing aids	Assessment after 10 years	
Early treatment Delayed treatment	People who accept hearing aids	Reassessment every 3 years	
Recurring costs			
Early treatment Delayed treatment	People using hearing aids (in 'Treated' state)	Annually	2×52 Batteries 3 Aftercare appointments
All cohorts	People not using hearing aids (in 'Untreated' state), or dead	Annually	None

All information in the table was agreed by the committee as constituting current standard practice or best practice, with the exception of the number of aftercare appointments required, for which there is no standard frequency.

- A GP appointment, followed by referral to a hearing assessment at an audiology clinic, followed by a fitting appointment at the audiology clinic are standard parts of the pathway someone being considered for hearing aids follows in current practice.

- A follow-up appointment is currently recommended by NHS England[412] and is good practice but not universal. NHS England has not restricted whether this should be a face-to-face or telephone appointment, but in this guideline the committee recommends that this needs to be a face-to-face appointment to be fully effective.
- There is currently no agreed frequency at which people are recalled for their hearing to be reassessed or their hearing aids to be replaced. In practice people are not usually routinely invited for an assessment, but are typically re-referred by their GP for a new hearing assessment if and when they report to the GP that their hearing aid is no longer adequate. However, the current funding system for hearing aids means that people can receive a new hearing aid up to once every 3 years. This is therefore the shortest interval at which reassessment and the provision of replacement hearing aids is likely. A UK pilot study of routinely recalling adult hearing aid users after 3 years (Goggins 2009) found that 62% attended, of whom 100% were found to need minor interventions and 39% needed major interventions (such as new hearing aids). The committee selected 3 years as the interval between reassessment and provision of new hearing aids. This is clearly not currently the case for all hearing aid users, but is an upper bound producing the maximum costs that could be incurred if reassessment was to become more routine. The committee is not making any recommendations in this guideline regarding at what frequency people should be reassessed.
- As discussed in N.2.4.5 above, the committee is assuming the cost of 2 hearing aids for every person, notwithstanding that not all people will have bilateral hearing loss, and so this will overestimate the costs
- People who use hearing aids can attend drop-in aftercare clinics whenever they wish for minor repairs and maintenance to their hearing aids, to collect new batteries, or for help with hearing aid settings and advice on how to use the hearing aid. The frequency with which people attend these sessions varies greatly, and some people never attend. There are no national data on the frequency of such appointments per hearing aid user, so we requested data from 1 audiology clinic (Betsi Cadwaladr University Health Board, unpublished data). As there is no count of active hearing aid users it is not possible to calculate the number of appointments per hearing aid user, but it is possible to calculate that there were 9 aftercare appointments for each hearing aid fitting appointment. If new hearing aids were fitted every 3 years this would give 3 aftercare appointments each year, and so this was chosen as the base case. The committee did however realise that in practice the average length between appointments is likely to be more than 3 years, and so it is likely that there are fewer than 3 aftercare appointments per person each year.
- It was assumed that each hearing aid would need its battery replacing once a week, in the experience of the committee. It is acknowledged that for people who are not using their hearing aids regularly, the batteries would not need replacing as frequently.

N.2.4.7.2 Costs

Costs are given in 2016 UK pounds.

Table 93: Costs

Resource use	Cost	Source
GP appointment	£36.00	PSSRU 2016[125]
Audiology assessment appointment	£71.31	Committee decision: assumed to be the same as for a fitting appointment as same duration, conducted by same staff
Audiology fitting appointment	£71.31	NHS Reference costs 2015/16[136]
Initial follow-up appointment	£53.34	NHS Reference costs 2015/16[136]
Aftercare appointment	£28.95	NHS Reference costs 2015/16[136]
Hearing aid, average	£70.96	NHS Supply Chain[413]

Batteries annual (52 each for 2 hearing aids)	£7.26[(a)]	NHS Supply Chain catalogue[413]
Mould	£8.00	Betsi Cadwaladr University Health Board (data supplied on request)
Thin tube and dome	£1.50	Betsi Cadwaladr University Health Board (data supplied on request)

(a) Based on 77.7% of hearing aids being standard power and 22.3% high power hearing aids (taken from the relative number of hearing aids of each variety supplied to the NHS). Standard power hearing aids using Rayovac size 312 or size 10 batteries (60 per pack). High power hearing aids using Rayovac size 675 (600 per pack). Other brands are available.

N.2.4.7.3 *Resource use for other health conditions*

There is insufficient evidence on the impact of hearing aids on the need for healthcare usage, particularly GP consultations.

The committee agreed that on average people using hearing aids are likely to have an increased risk of being affected by earwax blocking their ears, and an increased risk of otitis externa. This would probably lead to extra primary care appointments compared to people not using hearing aids.

However, the committee also noted that better hearing and communication, enabled by hearing aids also leads to benefits. In particular, people with hearing loss frequently require additional appointments (for any health issue) because of problems communicating with healthcare staff in their initial consultation.

The committee considered that on balance the decreased number of consultations due to better communication was likely to at least compensate, and probably outweigh any increase in usage due to earwax and otitis externa.

As a result, the base case analysis assumes no change in wider healthcare usage between people with or without hearing aids. A sensitivity analysis has however been conducted to investigate the possibility of benefit.

N.2.5 Computations

The model was constructed in TreeAge Pro 2017 and was evaluated by cohort simulation. Time dependency was built in by cross-referencing age as a respective risk factor for mortality. Baseline utility was also time dependent and was conditional on the age of the participants.

Patients begin at the start of the model in one of the living health states (Treated or Untreated). Patients moved to the Dead health state at the end of each cycle as defined by the age-related mortality transition probabilities.

Quality-adjusted life years for the cohort were computed for each annual cycle by multiplying the number of individuals in each health state at the start of the year by the utility multiplier for that health state. A half-cycle correction was applied. QALYs were then discounted to reflect time preference (discount rate 3.5%). QALYs during the first cycle were not discounted. The total discounted QALYs were the sum of the discounted QALYs per cycle.

Costs per cycle were summed in the same way as QALYs. A half-cycle correction was applied. Costs were discounted to reflect time preference (discount rate 3.5%) in the same way as QALYs using the following formula:

Discounting formula:

$$\text{Discounted total} = \frac{\text{Total}}{(1+r)^n}$$	Where: *r*=discount rate per annum *n*=time (years)

N.2.6 Sensitivity analyses

N.2.6.1 Probabilistic sensitivity analysis

Probabilistic sensitivity analysis was undertaken as laid out in section N.2.2.3 above. The parameters used and their distributions are given in Table 94.

Table 94: Distributions for probabilistic parameters

Parameter description	Point estimate	SE / range	Probability distribution	Distribution parameters
Probabilities				
Without aidable hearing loss	10%	SE: 0.02[(a)]	Beta	α=22.40, β=201.60
Declining hearing aids	10%	SE: 0.02[(a)]	Beta	α=22.40, β=201.60
Hearing aids used successfully	80%	SE: 0.16[(a)]	Beta	α=4.20, β=1.05
Dropout rate, year 0	10%	SE: 0.02[(a)]	Beta	α=22.40, β=201.60
Dropout rate, year 1	10%	SE: 0.02[(a)]	Beta	α=22.40, β=201.60
Annual dropout rate, after y1	2%	SE: 0.004[(a)]	Beta	α=24.48, β=1,199.52
Costs (£)				
Hearing assessment appointment	71.31	IQR: 42.55–81.95	Gamma	α=5.58, β=12.79, λ=0.078
Initial follow-up appointment	53.34	IQR: 30.75–65.17		α=3.98, β=13.42, λ=0.075
Aftercare appointment	28.95	IQR: 17.90–34.37	Gamma	α=5.24, β=5.53, λ=0.181
Hearing aid	70.96	IQR: 57.91–85.63	Gamma	α=11.53, β=6.16, λ=0.163
Utility				
Increase in utility caused by hearing aid use	0.060	95% CI: 0.044, 0.073	Gamma	α=65.74, β=0.000,9, λ=1,095.69

Abbreviations: 95% CI: 95% confidence interval; IQR: interquartile range; SE: standard error
(a) SE calculated as 20% of the point estimate

N.2.6.2 One-way deterministic sensitivity analyses

One-way sensitivity analyses were conducted by varying the parameters shown in Table 95.

Each analysis was conducted twice: for the comparison of early treatment versus delayed treatment and the comparison of early treatment versus no treatment, both at a lifetime horizon.

The variation of the discount rate was in line with NICE policy. The other ranges were chosen by the committee to reflect the widest range of variation that could be of interest. For the proportions this was ±100% of the base case value. For utility it was doubling and halving the base case.

Table 95: Parameters varied in one-way deterministic sensitivity analysis

Parameter	Base case	Min value	Max value
Starting age	65	55	75
Discount rate	3.5%	1.5%	-
Gap between assessments and length of time hearing aids kept before replacement	3 years	2 years	10 years
Number of aftercare appointments per year	3	1	5
Non-aidable hearing difficulties	10%	0%	20%
Decline hearing aids	10%	0%	20%
Drop out at year 0	10%	0%	20%

Parameter	Base case	Min value	Max value
Drop out at year 1	10%	0%	20%
Annual drop out, after year 1	2%	0%	4%
Hearing aids used successfully	80%	60%	100%
Increase in utility caused by hearing aid use	0.060 QALYs	0.030 QALYs	0.12 QALYs

The committee considered conducting sensitivity analyses that varied the effectiveness of hearing aid use over the course of the model (so that effectiveness of treatment either increased or decreased with time instead of staying constant). The committee agreed that such analyses would only be useful if the base case results were found to be close to the boundary of cost effectiveness. In the event these analyses were not required and so were not conducted.

Instead, the one-way sensitivity analysis of utility for early versus delayed treatment was repeated over a 10-year time horizon. This can be used to inform consideration of the cost effectiveness of early versus delayed treatment in the event that the benefit in the early years (first 10 years) of treatment was to be lower than expected, assuming that the benefit in both groups in further future years would be similar.

N.2.6.3 Multi-way deterministic sensitivity analyses

An additional analysis was conducted where the 3 dropout rates (year 0, year 1, subsequent years) were all varied upwards or downwards at the same time using the same limits as in Table 95 above.

N.2.6.4 Additional sensitivity analyses requested by the committee

After the committee had seen the initial results of the analysis, it requested 2 further analyses be conducted to answer additional questions:

- Number of GP appointments: an analysis was conducted where people not receiving treatment would require 1 additional GP appointment per year. This is to reflect the possibility that communication difficulties lead to more GP appointments (for non-hearing related causes) being required by people with untreated hearing problems. This analysis was run for men aged 65 years at both time horizons.
- High rate of people without aidable hearing loss: an additional analysis was conducted to inform the review question in the guideline “Which groups of people are more likely than the general population to miss having hearing loss identified?” (chapter 7). The committee was considering recommending regular hearing assessments for people with dementia or learning difficulties, and wished to know if this would be cost effective, even if most people tested each time would not have hearing loss. People in these groups have higher rates of hearing loss than the general population, and so an incidence rate of around 2–4% per year might be expected (or 4–8% every 2 years, which is the testing interval proposed). Consequently, we ran an analysis considering the effect if only 2% of people had aidable hearing loss and accepted hearing aids, and 98% did not have aidable hearing loss (or declined hearing aids). This was conducted in a population of men aged 75 years at the start of the model and at a 10-year horizon to better reflect a population with dementia.

N.2.7 Model validation

The model was developed in consultation with the guideline committee; model structure, inputs and results were presented to and discussed with the committee for clinical validation and interpretation.

The model was systematically checked by the health economist undertaking the analysis; this included inputting null and extreme values and checking that plausible results were generated for given inputs. The model was peer reviewed by a second experienced health economist from the NGC; this included systematic checking of all calculations and formulae used in the model.

N.2.8 Estimation of cost-effectiveness

The most widely used cost-effectiveness metric is the incremental cost-effectiveness ratio (ICER). This is calculated by dividing the difference in costs associated with 2 alternatives by the difference in QALYs. The decision rule then applied is that if the ICER falls below a given cost per QALY threshold the result is considered to be cost effective. If the costs of one intervention are lower than those of a second, and the QALYs gained from that intervention are also higher than from the other, then the first option is said to 'dominate' the second and an ICER is not calculated.

$$ICER = \frac{Costs(B) - Costs(A)}{QALYs(B) - QALYs(A)}$$

Where: Costs(A) = total costs for option A; QALYs(A) = total QALYs for option A

Cost-effective if:

- ICER < Threshold

When there are more than 2 comparators, as in this analysis, options must be ranked in order of increasing cost then options ruled out by dominance or extended dominance before calculating ICERs excluding these options. An option is said to be dominated, and ruled out, if another intervention is less costly and more effective. An option is said to be extendedly dominated if a combination of 2 other options would prove to be less costly and more effective.

Results are also presented graphically for the base case analyses. Comparisons not ruled out by dominance or extended dominance are joined by lines on the graph where the slope represents the ICER between 2 options.

N.2.9 Interpreting results

NICE's report 'Social value judgements: principles for the development of NICE guidance'[402] sets out the principles that guideline committees should consider when judging whether an intervention offers good value for money. In general, an intervention will be considered to be cost effective if either of the following criteria applied (given that the estimate was considered plausible):

- The intervention dominates other relevant strategies (that is, it is both less costly in terms of resource use and more clinically effective compared with all the other relevant alternative strategies), or
- The incremental benefit of the intervention costs less than £20,000 per QALY gained compared with the next most clinically effective strategy.

N.3 Results

N.3.1 Base case results

N.3.1.1 Base case, men, lifetime horizon

N.3.1.1.1 Deterministic results

Table 96: Base case, lifetime horizon, men, aged 65 at start, deterministic

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
No treatment	£36		7.59	-
Delayed treatment	£851	£815	7.75	0.16

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
Early treatment	£1,839	£988	7.96	0.21

ICERs:

Early versus delayed: £4,723 per QALY gained

Delayed versus NT: £5,183 per QALY gained

Early versus NT: £4,920 per QALY gained

N.3.1.1.2 Probabilistic results

Table 97: Base case, lifetime horizon, men, aged 65 at start, probabilistic

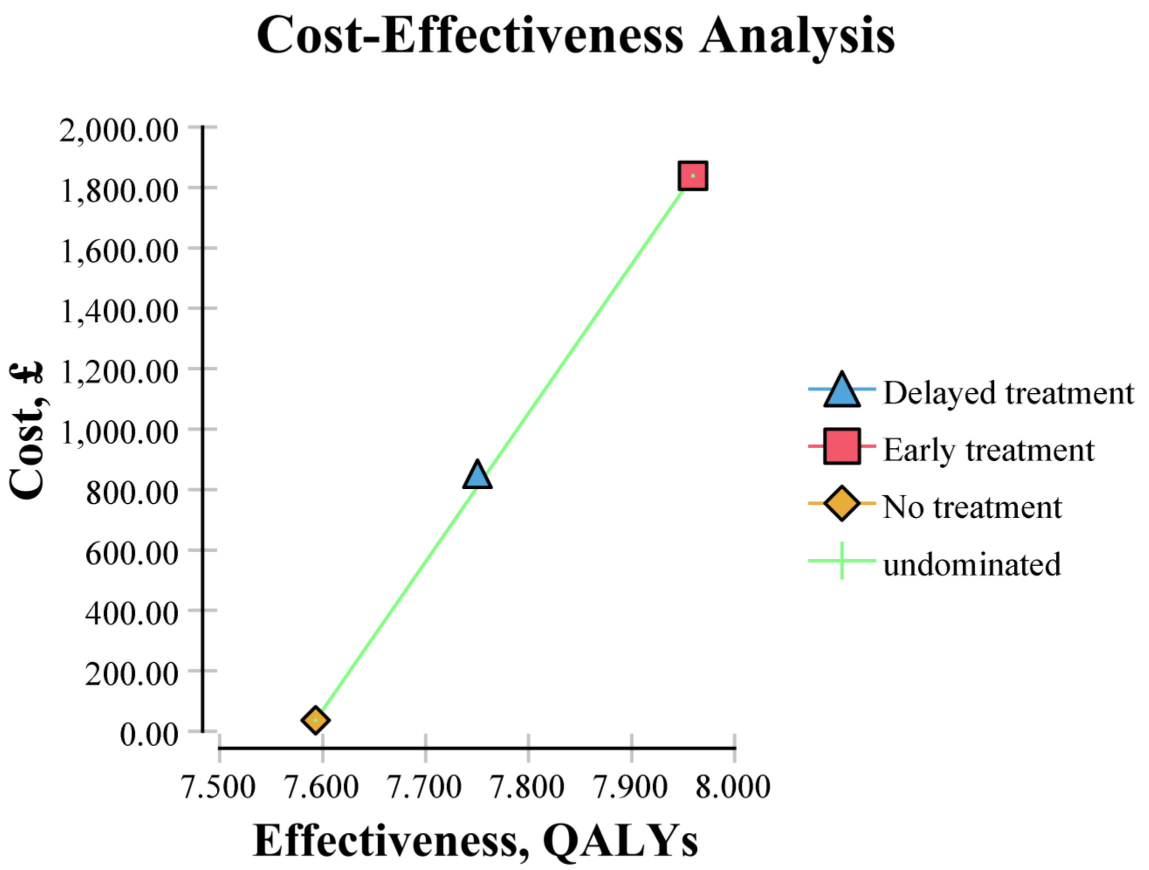
Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
No treatment	£36		7.59	-
Delayed treatment	£853	£817	7.75	0.16
Early treatment	£1,845	£992	7.96	0.21

ICERs:

Early versus delayed: £4,716 per QALY gained

Delayed versus NT: £5,172 per QALY gained

Early versus NT: £4,912 per QALY gained



For this model there is a very close agreement between the deterministic and probabilistic results. All the ICERs are well below the NICE cost-effectiveness threshold of £20,000 per QALY gained.

All 3 comparators are close to a straight line, and hence the ICERs are all similar. However the ICER for delayed versus no treatment is slightly greater than the ICER for early versus delayed (that is, delayed is above the line) and so we technically say that delayed is 'extendedly dominated' – that is to say that a combination of early and no treatment would be more effective than delayed. In a comparison between all 3 options delayed would not be preferred to early. However, for this model a comparison between all 3 options is not useful in practice, as it does not correspond to any real decision problem. Useful comparisons are the 2-way comparisons between early and delayed, early and no treatment, or delayed and no treatment. Early treatment is highly cost effective compared to either delayed treatment or no treatment, while delayed treatment is highly cost effective compared to no treatment. So, for example, if a patient is reporting their hearing difficulties to their GP for the first time, having had hearing difficulties for 10 years, then for this patient (given that early treatment is not an option in this case) delayed treatment is still very much preferable to not treating them. No treatment is not the best option in any comparison.

N.3.1.2 Base case, men, 10-year horizon

N.3.1.2.1 Deterministic results

Table 98: Base case, 10-year horizon, men, aged 65 at start, deterministic

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
No treatment OR Delayed treatment	£36	-	4.68	-
Early treatment	£1,295	£1,259	4.92	0.24

ICER: £5,263 per QALY gained

N.3.1.2.2 Probabilistic results

Table 99: Base case, 10-year horizon, men, aged 65 at start, probabilistic

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
No treatment OR Delayed treatment	£36	-	4.68	-
Early treatment	£1,300	£1,264	4.92	0.24

ICER: £5,190 per QALY gained

If the time horizon of the analysis is shortened to just 10 years (the period during which the delayed group are not receiving any treatment), then there are now effectively only 2 comparators, since neither no treatment nor delayed treatment receive any treatment during the first 10 years. Early treatment is still highly cost effective compared with no treatment at a cost-effectiveness threshold of £20,000 per QALY, with the ICER still close to £5,000 per QALY gained and only slightly higher than for a lifetime horizon.

This reflects the fact that patients both receive benefits (increased quality of life) and incur costs (hearing aids and appointments) steadily throughout the length of the model. It is not the case that there is either a large upfront cost with delayed benefit, or an early benefit with a long-lasting cost. Therefore the length of the analysis does not greatly affect the results.

N.3.1.3 Base case, women, lifetime horizon

Table 100: Base case, lifetime horizon, women, aged 65 at start, deterministic

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
No treatment	£36		8.24	-
Delayed treatment	£986	£950	8.43	0.19
Early treatment	£1966	£980	8.64	0.21

ICERs:

Early versus delayed:	£4,692 per QALY gained
Delayed versus NT:	£5,128 per QALY gained
Early versus NT:	£4,897 per QALY gained

N.3.1.4 Base case, women, 10-year horizon

Table 101: Base case, 10-year horizon, women, aged 65 at start, deterministic

Comparator	Cost	Incremental cost	QALYs	Incremental QALYs
No treatment OR Delayed treatment	£36	-	4.78	-
Early treatment	£1,320	£1,284	5.02	0.24

ICER: £5,259 per QALY gained

For women both costs and QALYs are slightly higher due to a higher average life expectancy. The ICERs are very similar to those for men, with the same distribution of results. (The sensitivity analyses below are shown just for the male cohorts as the results for women are all very similar.)

N.3.2 Sensitivity analyses

N.3.2.1 One-way deterministic sensitivity analyses

Table 102: ICERs for early versus delayed treatment (lifetime horizon, men, aged 65 at start) under one-way sensitivity analysis

Parameter	Base case	ICER	Min value	ICER	Max value	ICER (£/QALY)
Starting age	65	£4,723	55	£4,673	75	£4,873
Discount rate	3.5%	£4,723	1.5%	£4,628	-	
Gap between assessments (length of time hearing aids kept before replacement)	3 years	£4,723	2 years	£5,991	10 years	£2,957
Number aftercare appointments	3 per year	£4,723	1 per year	£3,516	5 per year	£5,929
Not suitable for HAs	10%	£4,723	0%	£4,719	20%	£4,727
Decline HAs (of total)	10%	£4,723	0%	£4,719	20%	£4,727
Drop out at year 0	10%	£4,723	0%	£4,679	20%	£4,778
Drop out at year 1	10%	£4,723	0%	£4,695	20%	£4,757
Annual drop out >yr1	2%	£4,723	0%	£4,702	4%	£4,745
Successful use	80%	£4,723	60%	£6,297	100%	£3,778
Improvement in QoL due to hearing aids	0.060 QALYs	£4,723	0.030 QALYs	£9,445	0.12 QALYs	£2,361

Parameter	Base case	ICER	Min value	ICER	Max value	ICER (£/QALY)
Additional annual GP appointments for people with untreated hearing loss	0	£4,723	-	-	1	£3,925

The one-way sensitivity analysis results vary from £2,361 to £9,445 per QALY gained – all well below a threshold of £20,000 per QALY gained.

The model is most responsive to the utility benefit given by using hearing aids. Because the difference in effectiveness in the model is calculated directly from this single parameter then there is a direct relationship between the parameter's value and the ICER: if the utility benefit is halved, the ICER exactly doubles, and vice versa. (Hence, if the utility benefit was decreased to only 25% of the base case value (0.015), then the ICER would quadruple to £18,891 per QALY gained, still below £20,000 per QALY gained.)

The next most responsive parameter is 'successful use of hearing aid' – which is in practice a different method of altering the magnitude of benefit given by hearing aids as it is multiplied by the utility benefit. This gives an ICER of £6,297 when it is decreased to 60%.

No other sensitivity analyses give an ICER larger than £6,000 per QALY.

The model is very unresponsive to the proportion of people who are unsuitable, decline or cease treatment. This is for a similar reason as the unresponsiveness to the length of the horizon. When someone is not receiving treatment they neither incur costs (after modest initial 'wasted' costs such a fitting appointment or a part-used pair of hearing aids) not receive benefits. Both costs and QALYs are reduced when fewer people are receiving treatment, but the cost effectiveness per person changes very little.

Table 103: ICERs for early versus no treatment (lifetime horizon, men, aged 65 at start) under one-way sensitivity analysis

Parameter	Base case	ICER	Min value	ICER	Max value	ICER (£/QALY)
Starting age	65	£4,920	55	£4,863	75	£5,042
Discount rate	3.5%	£4,920	1.5%	£4,869	-	
Gap between assessments (length of time hearing aids kept before replacement)	3 years	£4,920	2 years	£6,167	10 years	£3,195
Number aftercare appointments	3 per year	£4,920	1 per year	£3,714	5 per year	£6,126
Not suitable for HAs	10%	£4,920	0%	£4,899	20%	£4,948
Decline HAs (of total)	10%	£4,920	0%	£4,899	20%	£4,948
Drop out at year 0	10%	£4,920	0%	£4,841	20%	£5,019
Drop out at year 1	10%	£4,920	0%	£4,869	20%	£4,983
Annual drop out >yr1	2%	£4,920	0%	£4,876	4%	£4,966
Successful use	80%	£4,920	60%	£6,560	100%	£3,936
Improvement in QoL due to hearing aids	0.060 QALYs	£4,920	0.030 QALYs	£9,840	0.12 QALYs	£2,460
Additional annual GP appointments for	0	£4,920	-	-	1	£4,143

Parameter	Base case	ICER	Min value	ICER	Max value	ICER (£/QALY)
people with untreated hearing loss						

The pattern of results seen for the comparison of early treatment versus no treatment is entirely consistent with the early versus delayed treatment comparison above. Again, the highest ICER is for halving the utility benefit, in which case the ICER doubles to £9,840 per QALY gained.

Table 104: ICERs for early versus no/delayed treatment (10-year horizon, men, aged 65 at start) under one-way sensitivity analysis

Parameter	Base case	ICER	Min value	ICER	Max value	ICER
Improvement in QoL due to hearing aids	0.060 QALYs	£5,263	0.030 QALYs	£10,526	0.12 QALYs	£2,632

This additional analysis shows that if the benefit in the first 10 years is lower than expected by 50%, the ICER would be slightly higher than shown in any of the previous analyses, but still only £10,526 per QALY gained. If this analysis was expanded to add a second phase in which benefit was greater (in both early and delayed arms), for example due to a greater impact on people with more severe hearing loss, then the overall results would be unlikely to change greatly, as the costs and benefits after 10 years would be very similar in both arms, and so the only difference would be that incurred in the first 10 years. Taken with the rest of the sensitivity analysis results, this strongly suggests that no variation in benefit over time, related to age, duration of hearing loss, or severity of hearing loss, could alter the results sufficiently from the base case to prevent early treatment being cost effective at a threshold of £20,000 per QALY gained.

N.3.2.2 Multi-way deterministic sensitivity analysis

One multi-way analysis was conducted where all 3 dropout rates were varied at the same time. There was minimal impact on the ICER. This is due to the general unresponsiveness of the model to the dropout rates, for the reasons explained above.

Table 105: ICERs for early versus delayed treatment (lifetime horizon, men, aged 65 years at start) under multi-way sensitivity analysis

Parameter	Base case	Minimum value	Maximum value
Drop out at year 0	10%	0%	20%
Drop out at year 1	10%	0%	20%
Annual drop out >year 1	2%	0%	4%
ICER	£4,723	£4,645	£4,859

N.3.2.3 Additional sensitivity analyses

Number of GP appointments: the results of this analysis are shown in Table 102 and Table 103. If hearing aids are assumed to avoid 1 GP appointment each year, then this does, as expected, make treatment more cost effective, reducing the ICER by around £800 in both cases. However, given that the base case results are already highly cost effective this makes only a modest additional impact.

High rate of people without aidable hearing loss: the ICER for early treatment versus no treatment with 98% of people not with aidable hearing loss, for men aged 75 over a 10-year horizon is £18,214 per QALY gained. This shows that as long as 2% or more of people in this cohort have newly developed hearing loss then it would still be cost effective to conduct regular hearing reassessments for all of them. This is important as people with dementia (or learning difficulties) are not able to self-refer having noticed signs of hearing loss, and so need to rely on proactive referral for hearing assessments.

N.4 Discussion

N.4.1 Summary of results

The results of this study show that the provision of hearing aids to people with hearing loss at the earliest opportunity after they first recognise hearing difficulties is cost effective both compared to provision of hearing aids at a later point and compared to no provision of hearing aids. The results were robust to all the sensitivity analyses conducted, with all ICERs well below a cost-effectiveness threshold of £20,000 per QALY gained.

From these results it can be concluded both that the use of hearing aids is cost effective compared to no hearing aids; and that early provision of hearing aids is cost effective compared to delayed provision of hearing aids.

N.4.2 Limitations

The model used a very simple pathway of hearing aid use. It did not allow people to restart using hearing aids for a second time and it treated everyone as either using hearing aids or not using them, with no consideration of the proportion of time hearing aids were used for. However, this model produced clear results, which were very robust to sensitivity analysis. In this situation, it does not appear that there would have been any benefit from developing a more complicated model. Whilst a more complex model could have represented a patient pathway more accurately, it would have been unlikely to have produced more accurate results as the additional data it would have required would have been largely expert assumptions. And it does not seem credible that any plausible adaptations to the model could cause the more than quadrupling of the ICER required to make the cost effectiveness of the intervention uncertain. This model therefore seems to satisfy the maxim of being as complicated as necessary but no more so.

The model relied on expert assumptions where there was a lack of data. However, wherever an assumption had to be made, the committee erred conservatively on the side of caution by moderating benefits and maximising costs, hence favouring the no treatment arm. (For example, it was assumed that everyone would need 2 hearing aids, these would both be replaced every 3 years, and 3 maintenance appointments would be needed every year.) Therefore it is unlikely that the results overstate the cost effectiveness of hearing aid use.

The parameter of greatest importance for this analysis was the benefit to health-related quality of life that is obtained by using hearing aids. This value is subject to uncertainty, not least because the most appropriate instrument to measure health-related quality of life in people with hearing loss has been a matter of debate. However, the committee is confident that HUI3 is the best measure currently available for this purpose. The study used as the source of the utility benefit parameter in this model calculated the smallest benefit of hearing aids of any comparable study using HUI3, and so is less likely to have overstated this benefit. In sensitivity analysis it was found that if the benefit to quality of life was reduced to half, or even a quarter, of its baseline value, and the ICER consequently doubled or quadrupled as a result, early adoption of hearing aids would still be cost effective at a threshold of £20,000 per QALY gained.

N.4.3 Interpretation and generalisability

It was noted in section N.2.4.1.1 that the design of this model can be interpreted in 2 different ways.

In relation to GPs receiving a patient who reports that they are starting to experience hearing difficulties the interpretation is straightforward – all such people should be referred directly to an audiology service for a hearing assessment. Whilst the GP should be alert for issues such as sudden onset of hearing problems that require urgent or routine referral to specialist services, and should check if earwax is an issue; there is no reason not to refer on all remaining patients whose presentation is consistent with gradual, age- or noise-related hearing loss. Clinicians need not be concerned that some of the patients they refer may not have hearing loss severe enough to benefit from hearing aids, as sensitivity analysis has shown that even if a large proportion of patients are found not to require hearing aids, that does not prevent referral being cost effective for the group as a whole, and this will maximise the sensitivity of the process, minimising the number of people who could benefit from hearing aids who will be missed.

In relation to the person who is experiencing hearing difficulties for the first time, the clear implication of these results is that they should not delay seeking assistance but report their symptoms to their GP promptly. Of course they can do this already, and so the question raised is how to encourage people to do so? That question is largely beyond the scope of this analysis – educational and health promotion interventions would be required. Though individuals may not be overly concerned about the cost effectiveness of hearing aids, it would be helpful if there was wide awareness of the clinical benefits of hearing aids, including to those with only mild to moderate hearing loss. It may also help if people were aware that GPs would now treat all expressions of concern about hearing as a serious matter and refer people for a full hearing assessment as a matter of course.

In addition to people who actively seek out medical advice on realising that they are having difficulties in hearing, clinicians should also be aware that people can be unaware of their gradually deteriorating hearing for a substantial length of time. Others are aware that their hearing has deteriorated but have never reported this. As a result there are believed to be very large numbers of people who could benefit from hearing aids who have never had a hearing assessment or been offered hearing aids. Therefore, when a healthcare professional is talking with a patient – about any health matter – and has reason to think that they may be having problems in hearing, it would be very beneficial if the clinician took the opportunity to proactively ask the person if they are having problems with their hearing. This can then provide an opportunity to offer to refer the person for a hearing assessment. Such referrals would also be cost effective in line with these results.

It should be noted that age was not found to have a significant effect on cost effectiveness. Although hearing loss becomes increasingly common with age, some people can present at younger ages and these should be referred for a hearing assessment as readily as older people. At the same time, no-one should be considered too old to benefit from hearing aids.

N.4.4 Conclusions

- This cost–utility analysis found that early provision of hearing aids was cost effective compared to delayed provision of hearing aids for managing hearing loss (ICER: £4,716 per QALY gained). This analysis was assessed as directly applicable with minor limitations.
- This cost–utility analysis found that hearing aids were cost effective compared to no hearing aids for managing hearing loss (ICER: £4,912 per QALY gained). This analysis was assessed as directly applicable with minor limitations.

Appendix O: Threshold analysis: fitting 1 hearing aid compared with fitting 2 hearing aids

Given that this is an important question with a large economic impact for the NHS, but that no published health economic evidence was found, the guideline committee agreed to conduct a threshold analysis. This type of analysis takes into account the fact that the cost of a second hearing aid can be calculated, but the impact of a second hearing aid on quality of life is not known. It therefore calculates the magnitude of benefit to quality of life that would be required for the necessary expenditure to be cost effective.

This analysis uses the same costs as used in the cost–utility analysis conducted for this guideline – please see appendix N for sources and further details. The committee agreed that the resources required for a hearing aid for the second ear (above those that would be required for a first hearing aid for 1 ear only) would be the cost of the hearing aid itself, a mould or thin tube and dome and batteries. In addition, the committee cautiously assumed that people with 2 hearing aids would obtain 1 additional aftercare appointment each year for hearing aid repairs and maintenance. There will be no difference in costs for fitting or follow-up appointments, as an individual will have the same number of appointments whether they are having 1 or 2 hearing aids fitted. This analysis considers a period of 3 years, as that is expected to be the shortest length of time hearing aids would usually be kept before an individual's hearing is reassessed and they may receive new hearing aid(s). The costs are shown in Table 106.

Table 106: Additional costs of supplying a second hearing aid for an individual's second ear

Equipment	Cost each	Cost per 3 years
Hearing aid, average cost	£70.96	£70.96
Cost of mould or thin tube and dome, average	£2.93	£2.93
Batteries, per year	£3.63	£10.89
Aftercare appointment	£28.95	£86.85
TOTAL		**£171.63**

To calculate the threshold for the improvement in utility (quality of life) that would be necessary to make this expenditure cost effective at a cost-effectiveness threshold of £20,000 per QALY gained, we need to divide the total cost of £171.63 by £20,000.

This gives a utility increment of 0.0086 QALYs (or, alternatively, 3.1 quality-adjusted life days) over a period of 3 years, or **0.0029 QALYs per year**.

There are no published figures for the improvement in utility to be expected by adding a second hearing aid. However, there are figures for the improvement caused by the adoption of hearing aid(s) by people with hearing loss who previously did not have any hearing aids. As discussed in greater detail in appendix N, the committee has agreed that the most appropriate source for this measurement is the study by Barton 2004 using the HUI3 tool which gave this improvement in utility as 0.060 QALYs.[49] 0.0029 QALYs is 4.8% of 0.060 QALYs.

So if we compare the benefit gained by someone with hearing loss who previously had no hearing aids and adopts hearing aids (0.060 QALYs) with the benefit required by someone with hearing loss in both ears who currently has 1 hearing aid and is now adopting a second hearing aid (0.0029 QALYs) we find that the second person would need to benefit by at least 5% (a twentieth) as much from their second hearing aid as the first person benefits from their hearing aids for this to be cost effective at a cost-effectiveness threshold of £20,000 per QALY gained.

Appendix P: Unit costs

P.1 Urgent and routine referral

P.1.1 Urgent referral

None

P.1.2 Routine referral

None

P.2 MRI

None

P.3 Subgroups

None

P.4 Early versus delayed management of hearing loss

None

P.5 Communication needs

None

P.6 Management of earwax

P.6.1 Treatment

Table 107: Unit costs of relevant equipment

Equipment	Unit cost	Per patient	Cost per patient	Source
For irrigation				
Electric irrigator	£159			PCNFT
Cleansing tablet	£0.10	1	£0.10	Clegg 2010[107]
Disposable jet tip	£0.44	1	£0.44	Clegg 2010[107]
Total consumables per patient			**£0.54**	
For microsuction				
Suction machine	£550–760			BCUHB, PCNFT
Microscope	£7,000–13,500			PCNFT
Loupe [alternative to a microscope]	£799–2,600			BCUHB, PCNFT
Refill bag	£5.83	0.05	£0.29	BCUHB
Specula (5 mm or 6 mm)	£0.60	1	£0.60	BCUHB
Suction tube	£0.72	0.5	£0.36	BCUHB

Equipment	Unit cost	Per patient	Cost per patient	Source
Fenestrated Zoellner suction tube	£1.18	1	£1.18	BCUHB
Olive oil spray 10 ml	£3.56	0.05	£0.18	BCUHB
Kidney dish open moulded 700 ml	£0.03	1	£0.03	BCUHB
Total consumables per patient			**£2.64**	

Sources: Clegg 2010,[107] Betsi Cadwaladr University Health Board (supplied on request, 2017), Pennine Care NHS Foundation Trust (supplied on request, 2017)

Table 108: Unit costs of earwax softeners

Ear drops	Cost	Quantity	Source
Almond oil	£0.91	50 ml	BNF Nov 2017[110] NHS Drug Tariff Nov 2017[411]
Chlorobutanol	£2.05	11 ml	BNF Nov 2017[110]
Docusate sodium	£1.95	10 ml	BNF Nov 2017[110] NHS Drug Tariff Nov 2017[411]
Olive oil	£0.92	15 ml	BNF Nov 2017[110]
Sodium chloride [nasal drops]	£0.95	10 ml	BNF Nov 2017[110]
Urea hydrogen peroxide	£2.89	8 ml	BNF Nov 2017[110] NHS Drug Tariff Nov 2017[411]

P.6.2 Settings

Table 109: Unit costs for appointments

Appointment	Cost	Comment	Source
GP practice nurse	£11	15.5 min appointment	PSSRU 2016,[125] PSSRU 2015[124]
GP	£36	9.2 min appointment	PSSRU 2016[125]
Hospital outpatient procedure: minimal ear procedure, adult	£108	Currency code CA55A	NHS Reference costs 2015/16[136]

P.7 Sudden sensorineural hearing loss

Table 110: Unit costs for selected specimen regimens of steroids for management of SSNHL

Method	Drug	Regimen	Total quantity	Cost	Form of drug used
Oral	Prednisolone	60 mg for 3 days, tapering over 5 days	330 mg	£3.20(a)	30 mg tablets
Oral	Prednisolone	60 mg for 7 days, tapering over 5–7 days	610 mg	£6.11(a)	30 mg tablets
Oral	Prednisolone	60 mg for 14 days, followed by taper	990 mg	£9.61(a)	30 mg tablets
Intra-tympanic	Dexamethasone	0.3–0.4 ml of 5 mg/ml once a day × 3 days	5.25 mg	£3.60(a)(b)	3.3 mg/1 ml, 1 ampoule
Intra-tympanic	Dexamethasone	2 mg x 4 doses	8 mg	£4.80(a)(b)	3.3 mg/1 ml, 1 ampoule
Intra-tympanic	Dexamethasone	0.5–0.7 ml of 12 mg/ml once a day x 3 days	19.8 mg	£6.60(a)(b)	6.6 mg/2 ml, 1 ampoule

Method	Drug	Regimen	Total quantity	Cost	Form of drug used
Intra-tympanic	Methylprednisolone	25 mg × 4 doses	100 mg	£6.32[(a)]	40 mg powder and solvent for injection
Intra-tympanic	Methylprednisolone	40 mg × 4 doses	160 mg	£6.32[(a)]	40 mg powder and solvent for injection
Intra-tympanic	Methylprednisolone	80 mg (1.5–2 ml of 40 mg/ml) × 4 doses	320 mg	£12.64[(a)]	40 mg powder and solvent for injection

Source: (a) BNF,[110] July 2017; (b) NHS Drug Tariff,[411] July 2017

Table 111: Unit costs for appointments

Appointment	Cost	Comment	Source
GP	£36	9.2 min appointment	PSSRU 2016[125]
Hospital outpatient procedure: minor ear procedure, adult	£110	Currency code CA54A	NHS Reference costs 2015/16[136]

P.8 Information and advice

None

P.9 Decision tools

None

P.10 Assistive listening devices

None

P.11 Hearing aids

P.11.1 Hearing aids versus no hearing aids

None

P.11.2 1 hearing aid versus 2 hearing aids

None

P.12 Hearing aid microphones and noise reduction algorithms

P.12.1 Microphones

None

P.12.2 Noise reduction algorithms

None

P.13 Monitoring and follow-up

None

P.14 Interventions to support the use of hearing aids

Table 112: Unit costs for appointments

Appointment	Cost	Comment	Source
Audiology face-to-face follow-up, adult	£53	Currency code AS08	NHS Reference costs 2015/16[136]

Appendix Q: Research recommendations

Q.1 Hearing loss prevalence in people who under-present for hearing loss

Research question: What is the prevalence of hearing loss amongst populations who under-present for possible hearing loss?

Why this is important:

The research question aims to identify the prevalence of hearing loss among populations who may be unaware of their own hearing loss or lack motivation and capability to seek help for this.

A full population prevalence study matched to audiology service usage will help identify populations who under-present for possible hearing loss. The research will also identify factors that can act as red flags to prompt health and social care professionals to proactively consider the possibility of hearing loss.

The evidence review for the NICE guideline on adult hearing loss highlighted significant health benefits for people whose hearing loss is identified and addressed at an early stage, yet people often delay seeking treatment for up to 10 years (national commissioning framework for hearing loss services). There are certain groups who are particularly disadvantaged because their health issues lead to a lack of awareness of their deteriorating or suboptimal hearing, or a failure to report their difficulties. These include those with learning (intellectual) disabilities , dementia and mild cognitive impairment.

Given the importance of early detection, this research is urgently needed to identify populations who are under-represented and any factors that would lead healthcare and social care professionals to consider the possibility of hearing loss.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults aged ≥18 years Intervention(s): To identify the prevalence of modifiable hearing loss in different populations particularly within populations who are unable to report their hearing difficulties namely: cognitive impairment; dementia; learning difficulties; Comparison: Usage of audiology services Outcome(s): Generate intelligence that would lead healthcare and social care professionals to proactively consider the possibility of hearing loss in those populations.
Importance to patients or the population	Improved quality of life and health outcomes in all domains. Reduce health inequalities between populations.
Relevance to NICE guidance	The intention of this research recommendation is to generate robust evidence that would enable NICE to make recommendations to healthcare and social care professionals regarding the possibility of hearing loss in populations who may be unaware of this loss or who are unable to present their hearing difficulties.

Relevance to the NHS	Population benefit: Increased health gain, quality of life Reduced health inequalities Financial incentives: Increased independence, reduction in care requirements
National priorities	Action Plan on hearing loss Commissioning services for people with hearing loss 5 Year Forward View https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf DH Annual report on inequalities in health – 2017
Current evidence base	The evidence review for the NICE guideline on hearing loss was unable to identify any studies that identify populations at greater risk of having undetected hearing loss.
Equality	Yes. Directly redresses the growing disparity in health status between different populations
Study design	Prevalence study: identification of undetected hearing loss assessment in different populations and current levels of service usage.
Feasibility	Realistic timescale? Yes Acceptable Cost? yes Ethical or technical issues? Methodologies for assessment of hearing loss in populations with cognitive impairment of learning difficulties
Other comments	None
Importance	• High – Given the evidence about the benefits of early detection, research is urgently needed to identify populations who might be unaware of hearing difficulties in order to minimise the risk of further increasing the health inequality divide.

Q.2 Use of hearing aids and incidence of dementia

Research question: In adults with hearing loss, does the use of hearing aids reduce the incidence of dementia?

Why this is important: In the ageing UK population, the incidence of dementia is increasing. Dementia has considerable long-term costs for people with dementia, their families and the NHS and there is no effective treatment to prevent its progression.

Hearing loss is associated with an increased incidence of dementia. It is estimated that among people with mild to moderate hearing loss the incidence of dementia is double that of people with normal hearing, and that the ratio increases to 5 times that of people with normal hearing in those with severe hearing loss. The cause of this association is unknown; there may be common factors causing both dementia and hearing loss, such as lifestyle, genetic susceptibility, environmental factors or age-related factors such as inflammation and cardiovascular disease. Hearing loss may cause dementia either directly (for example, neuroplastic changes caused by deprivation or increased listening demands) or indirectly via social isolation and depression (which are known be associated with cognitive decline and dementia). Conversely, it is possible that cognitive decline has an impact on sensory function (for example, affecting attention and listening skills). Currently, there is no good evidence to show that hearing loss causes dementia or that hearing aids delay the onset or reduce the incidence of dementia. Hearing aids do, however, have the potential to improve functioning and quality of life, and this could delay the progress of dementia or improve its management.

1 **Criteria for selecting high-priority research recommendations:**

PICO question	Population: Adult patients Comorbidities and risk factors: Any Sex: Any Ethnic group: All Specific inclusion criteria: New adult referrals with age-related hearing loss Specific exclusion criteria: Pre-existing cognitive impairment or dementia Intervention: Provision of hearing aids Comparison: New adult referrals with age-related hearing loss who do not receive hearing devices Outcome: Incidence of dementia
Importance to patients or the population	Dementia is a distressing disabling condition for patient and carers. It has no specific treatment and can lead to premature death. Conversely, management of hearing loss with hearing aids and good communication strategies are acceptable to many patients. This management has significant benefits to the patient and their associates from the point of view of reducing isolation and depression.
Relevance to NICE guidance	If using hearing aids was to improve functioning and delay the onset or progression of dementia it would be unhesitatingly recommended in future guidelines for hearing loss and dementia as well as becoming widely used in practice. As a result, further investigation would be encouraged into the nature of the relationship between hearing loss and dementia, leading to new approaches to the prevention and management of both conditions.
Relevance to the NHS	Hearing loss itself is associated with greater morbidity and use of healthcare and social care resources, issues that can be alleviated by good management of the hearing loss using hearing aids and other strategies. As the population ages, dementia is one of the most common problems the NHS has to deal with leading to significant costs for residential care. Any approach which can reduce the onset of progression of dependence in patients with dementia and thus lead to a reduction in morbidity and use of NHS resources would be of great importance. Analysis for the NICE hearing loss guideline shows the early provision of hearing aids is cost-effective at £ 4,704 per QALY gained for treating the hearing loss itself. Delaying the onset of dementia by 1 year would have a potential benefit of reducing the disease prevalence by 10% (Lin et al. 2011). The average cost of a care home placement for dementia was £32,000 p.a. in 2012 (Dementia 2012: a national challenge - Alzheimer's Society). The use of donepezil to treat dementia has an ICER of £7,093 per QALY gained (NICE technology appraisal 217, 2011, updated 2016. “The Committee noted that the key driver of cost effectiveness in the Assessment Group's model was treatment leading to delay to institutionalisation. This assumption led to less

	time spent in institutional care and subsequent savings to the NHS/personal social services" (para 4.3.29). The delay to institutionalisation was <2 months.
National priorities	**NHS 5-Year Forward View** (October 2014) "reduce the risk of dementia […] committed new funding to promote dementia research and treatment." https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf **National Service Framework for Older People** (2001) key aims include: • prevent unnecessary hospital admission • promote independence **NHS Action Plan on Hearing Loss** (2015)https://www.england.nhs.uk/2015/03/hearing-loss/ **CMO's Report** (March 2014) highlighted need for more research into hearing loss and dementia link. http://www.actiononhearingloss.org.uk/news-and-events/all-regions/news/cmos-report-highlights-need-for-more-research-into-hearing-loss-and-dementia-link.aspx **NICE guideline: Dementia, disability and frailty in later life** (2015) mid-life approaches to delay or prevent onset: Research recommendation 5.4: How strong are the associations between hearing and visual loss, and sleep patterns and positive and negative health outcomes, in particular the development of dementia, disability and frailty? What are the most effective and cost-effective interventions to protect hearing and vision and improve sleep and what is their effect on the development of dementia, disability and frailty? (Source: Evidence reviews 2 and 3; Expert paper 10)
Current evidence base	Throughout the development of the NICE guideline on hearing loss the committee has had difficulty identifying relevant economic research evidence. The costs of caring for and treating people with dementia are so significant that if it is shown that the condition can be prevented or delayed by hearing aid use, the economic benefits will become obvious. Summary of trials and reviews: a. Hearing Loss and Incident Dementia. Frank R. Lin, E. Jeffrey Metter, Richard J. O'Brien, Susan M. Resnick, Alan B. Zonderman, Luigi Ferrucci (Baltimore) Arch Neurol. 2011;68(2):214-220. doi:10.1001/archneurol.2010.362. http://archneur.jamanetwork.com/article.aspx?articleid=802291 b. Self-Reported Hearing Loss, Hearing Aids, and Cognitive Decline in Elderly Adults: A 25-Year Study. Amieva et al., J Am Geriatr Soc 63:2099–2104, 2015. https://doi.org/10.1111/jgs.13649 c. Lin F, et al. (2013) Hearing Loss and Cognitive Decline in Older Adults. JAMA Intern. Med. 173: 293-99. http://archinte.jamanetwork.com/article.aspx?articleid=1558452 d. Hearing Impairment and Incident Dementia and Cognitive Decline in Older Adults: The Health ABC Study. Deal et al., J Gerontol A Biol Sci Med Sci (2016) glw069. DOI: https://doi.org/10.1093/gerona/glw069 e. Dementia 2012: a national challenge. Alzheimer's Society. https://www.alzheimers.org.uk/downloads/file/1389/alzheimers_society_dementia_2012-_full_report f. Dementia prevention, intervention, and care. The Lancet Commissions. Livingston G, Sommerlad A, Orgeta V, et al. (2017) http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(17)31363-6.pdf
Equality	The **NHS Action Plan on Hearing Loss** focuses on a range of groups

	disadvantaged by hearing loss that would benefit from assessment and treatment. These include people with learning disability, veterans, older people, and those at the end of life.
Study design	A significant difficulty arises from the presumed long timescale for the development of dementia in a given population. Although the ideal would be a prospective study (Deal et al. 2016's duration was 9 years), the use of population based databases over recent years, particularly in general practice and in audiology departments, has led to more readily achievable research scenarios. These might include detailed analysis of very large databases; carefully controlled retrospective studies of populations who have been given hearing aids, observational studies using propensity scores, and matched pair studies. It is important not to be too prescriptive in this respect. The potential for research extends over a wide range of interests, for example • Cognitive science • Neuroscience • Deafness • Dementia • Speech and language Cross-faculty research should be particularly welcomed.
Feasibility	Can the proposed research be carried out within a realistic timescale? Yes Using alternative study designs, for example, observational, modelling or recruiting high risk groups. A full RCT would be unrealistic in view of the long timescale to see any benefit of treatment and the relatively low incidence of dementia. Would the sample size required to resolve the question be feasible? Yes Recent trials on which to base a power calculation suggest a total of 2,000–3,000 patients may be sufficient. Would the expense needed to resolve the question be warranted? Yes. See NHS benefits, above. Are there any ethical or technical issues? Yes. Care must be taken to avoid withholding hearing aids from people who wish to use them. This important issue would need to be addressed in the design of the research protocol. Considerable publicity has been given recently to the link between hearing loss and dementia. The mixed evidence is already being used commercially in the UK and overseas to drive sale of hearing aids, as if it were a fact. It seems likely that soon not only will it be considered unethical not to offer hearing aids to control groups, but also the number of people choosing not to use aids and thus provide a control group will reduce significantly.
Other comments	Other potential funders: Action on Hearing Loss, Alzheimer's Society, NIHR.
Importance	High: the research is essential to inform future updates of key recommendations in the hearing loss guideline and other NICE guidance.

Q.3 Earwax

Research question: What is the clinical and cost effectiveness of microsuction compared with irrigation to remove earwax?

Why this is important: A build-up of earwax in the ear canal can cause hearing loss and discomfort, contributes to infections and can lead to stress, social isolation and depression. Moreover, earwax can prevent adequate clinical examination of the ear, delaying investigations and management; GPs cannot check for infection and audiologists cannot test hearing and fit hearing aids if the ear canal is blocked with wax. Excessive earwax is common, especially in older adults and those who use hearing aids and earbud-type earphones. In the UK, it is estimated that 2.3 million people each year have problems with earwax sufficient to need intervention.

Earwax is usually treated initially with ear drops. However, if this is unsuccessful, the wax can be removed using irrigation (flushing the wax out using water) or microsuction (using a vacuum to suck the wax out under a microscope). There are few studies comparing these different techniques in terms of effectiveness, efficiency and adverse events.

Criteria for selecting high-priority research recommendations:

PICO question	Population: adults of 18 years or older with occluding earwax Intervention(s): microsuction or irrigation Comparison: with each other Outcome(s): health related quality of life; adverse effects, wax-related measures, hearing, time to recurrence.
Importance to patients or the population	Newly informed guidance will help identify whether ear irrigation or microsuction is the more clinically or cost-effective treatment for wax removal. This will help provide the best care for patients with earwax. It will help develop patient pathways that will work toward providing equitable and efficient care for patients with earwax.
Relevance to NICE guidance	This research would enable NICE to recommend whether patients with earwax, unresponsive to drops, should be treated using irrigation or microsuction.
Relevance to the NHS	The research would help improve financial efficiency, identifying the most cost-effective strategy for the treatment of a common ENT problem. It would also provide primary care and ENT clinicians with clear information on the most clinically effective treatment option, in an area where uncertainty exists. Robust information on clinical and cost-effectiveness would help develop evidence base guidance and policy, that could help develop an effective, fair and efficient patient pathway.
National priorities	Yes - Action Plan on Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf; Commissioning Services for People with Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2016/07/HLCF.pdf
Current evidence base	Existing evidence on earwax management strategies are mostly with small sample sizes and inconclusive. There is a lack of evidence on mechanical earwax removal methods including microsuction. There is no trial comparing ear irrigation and microsuction for earwax.
Equality	No equality issues
Study design	Randomised controlled trial, with an associated economic evaluation.
Feasibility	Can the proposed research be carried out in a realistic timescale - Yes Acceptable cost - Yes.
Other comments	None
Importance	High: the research is essential to inform future updates of key recommendations in the hearing loss guideline.

Q.4 Idiopathic sudden sensorineural hearing loss

Research question: What is the most effective first-line treatment for idiopathic sudden sensorineural hearing loss?

Why this is important: Idiopathic sudden sensorineural hearing loss (SSNHL) affects approximately 5 to 20 people per 100,000 per year [78,172,364,517] and accounts for up to 90% of cases of SSNHL. The hearing loss is usually unilateral, can range from mild to total and can be temporary or permanent. Idiopathic SSNHL has a significant impact on people's lives, causing considerable concern and disability, particularly if there is already a hearing deficit in the other ear.

First-line treatment options for idiopathic SSNHL can include oral steroids, intra tympanic steroid injections or a combination of both. There is a paucity of evidence assessing the effectiveness of these different treatment options. There is heterogeneity in doses and types of steroids and this makes the findings unreliable. Therefore, it is difficult to establish the most clinically and cost effective first-line treatment for idiopathic SSNHL. This has a direct impact on the care provided to people with SSNHL and on our ability to develop robust guidelines and policy.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults ≥18 years with idiopathic SSNHL - Exclusion criteria: bilateral SSNHL, underlying cause identified, Previous unsuccessful steroid therapy for this episode of SSNHL - Setting: primary or secondary care - - At first presentation (not salvage or second line therapy) Interventions: oral steroids; IT steroid injections; oral + IT steroids Comparisons: - Placebo - The time from onset of sudden hearing loss to first steroid dose should be recorded and results analysed with this as a variable Outcomes: pure tone audiometry, speech discrimination, quality of life measures, adverse events, for example: gastrointestinal bleeding, mood alteration or psychosis, persistent perforation of tympanum, middle ear infections, ear pain, increased appetite, sleep changes
Importance to patients or the population	Sudden sensorineural hearing loss (SSNHL) is a rapid loss of hearing that can occur over a few hours or up to 3 days. The cause of SSNHL can be found in only 10–15% of patients. The estimated yearly incidence of SSNHL is 5 to 20 cases per 100,000 people. It mostly affects adults in their 40s and 50s and has equal gender distribution. It is an alarming symptom and can have a major impact upon a person's quality of life. It is important that the best treatment is given to patients with SSNHL as quickly as possible, to ensure the best outcome. The use of steroids as a treatment for idiopathic SSNHL (ISSNHL) is widely debated. About half the people with SSNHL will recover some or all of their hearing spontaneously, usually within 1 to 2 weeks from onset. Whilst there is some published research on the most effective initial treatment for SSNHL the evidence review for the NICE guideline on hearing loss found no robust evidence (numbers too small, inconsistency, risk of bias) to be able to offer confident recommendations about best practice. Several current guidelines suggest the use of oral steroids as initial treatment and increasingly the use of IT steroid injections as a salvage therapy if first-line treatment is not successful. IT therapy is considerably more costly than oral steroids. Patients and doctors are

	often motivated to 'do something' for patients with SSNHL but it is not possible from the evidence to be confident that current practice is effective and that benefits outweigh any potential risks. Patients would benefit from more evidence-based treatment by being offered the initial treatment which offers the best chance of improvement in SSNHL and therefore quality of life. In addition, there would be less chance of patients receiving initial treatments which carry some risks and costs but may have no beneficial effect. Newly informed guidance would help provide fair and equitable care to patients with idiopathic SSNHL. Importantly, it would also help ensure that patients receive the most effective care for a potentially reversible condition that is associated with considerable concern and disability.
Relevance to NICE guidance	This research would enable NICE to recommend the most clinically and cost-effective first-line treatment for idiopathic SSNHL.
Relevance to the NHS	The research would deliver a financial advantage, identifying the most cost-effective strategy for treatment of a common ENT emergency. It would also provide primary care and ENT clinicians with clear information on the most clinically effective treatment option, in an area where considerable uncertainty exists. Robust information on clinical and cost effectiveness would help develop evidence based guidance and policy that could help develop an effective and efficient patient pathway.
National priorities	Action Plan on Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf Commissioning Services for People with Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2016/07/HLCF.pdf
Current evidence base	The current evidence base consists of very few studies with small populations sizes. Moreover, there is considerable disparity amongst the existing research on the doses and types of steroid used as well as definitions of idiopathic SSNHL.
Equality	No equality issues.
Study design	Randomised, placebo-controlled trial, with an associated economic evaluation.
Feasibility	Can the proposed research be carried out in a realistic timescale? - Yes Acceptable cost? - Yes. Are there any ethical or technical issues? – IT steroids need to be administered by ENT registrars or more senior clinicians.
Other comments	None
Importance	High: the research is essential to inform future updates of key recommendations in the guideline.

Q.5 Decision tools

Research question: What is the clinical and cost effectiveness of person-centred, decision-making tools when agreeing the preferred management strategy for hearing loss in adults.

Why this is important: Hearing aids are effective in managing hearing loss in adults, and are routinely offered as the first-line clinical management for hearing difficulties. However, hearing aids are not always used. This impacts on healthcare resources, and for the individual, the consequences of untreated hearing loss remain, impacting on quality of life. There are a wide range of interventions to address hearing loss (for example, communication strategies, assistive listening devices, personal sound amplification products and auditory training), each with their advantages and limitations.

The systematic review for the NICE guideline on hearing loss found a lack of studies that addressed the benefits of patient-centred decision-making tools. Robust research is needed to establish the clinical and cost effectiveness of patient-centred tools, and to understand how they might best be used in clinical practice. This will inform future guidelines and policy.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults aged ≥18 years with hearing loss Interventions: Patient-centred tools to support decision-making for strategies to manage hearing loss (for example, motivational tools, motivational interviewing, option grids), including new innovations (eHealth, pre-appointment). Comparison: Usual care or other decision-making tools. Outcomes: Hearing-specific health-related quality of life, health-related quality of life, participation, self-efficacy, management strategy adherence and satisfaction.
Importance to patients or the population	Newly informed guidance would help identify whether patient-centred tools, as part of shared decision-making, are effective in facilitating patients' readiness and motivation to use their chosen management strategies. If effective, this would ultimately improve quality of life for people with hearing loss as well their family members and friends.
Relevance to NICE guidance	This research would provide evidence that would enable NICE to recommend which patient-centred tools were the most clinically and cost effective in promoting shared decision-making.
Relevance to the NHS	This research, if shown to be effective, would improve financial efficiency if management strategies were adhered to. It would provide audiologists with clear information on the most clinically and cost-effective tool to use, as currently there is limited use of such tools. This research would help develop a robust evidence base where currently none exists, and help inform future policy to deliver a more effective and efficient pathway.
National priorities	Action Plan on Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf Commissioning Services for People with Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2016/07/HLCF.pdf British Society of Audiology Practice Guidance (2016) Common principles of Rehabilitation for Adult in Audiology Services http://www.thebsa.org.uk/wp-content/uploads/2016/10/Practice-Guidance-Common-Principles-of-Rehabilitation-for-Adults-in-Audiology-Services-2016-3.pdf Kings Fund (2011) Making shared decision-making a reality: No decision about me, without me https://www.kingsfund.org.uk/sites/default/files/Making-shared-decision-making-a-reality-paper-Angela-Coulter-Alf-Collins-July-2011_0.pdf NICE CG138 (2012) Patient experience in adult NHS service https://www.nice.org.uk/guidance/cg138/chapter/1-guidance
Current evidence base	The systematic review undertaken for the NICE guideline on hearing loss did not identify any studies to provide evidence on the effectiveness of patient-centred tools to help with deciding on what management strategies to choose. The current evidence base is therefore almost non-existent.
Equality	No equalities issues.
Study design	Randomised controlled trial, with associated economic evaluation. Qualitative research would highlight the relevance and impact of patient-centred

	tools for patients, their communication partners and hearing healthcare professionals, and how and when the tools should be used.
Feasibility	Can the proposed research be carried out in a realistic timescale? Yes At an acceptable cost? Yes. Are there any ethical or technical issues? No, other than the control group not having access to the tools. Yes.
Other comments	Hearing healthcare professionals, such as audiologists, would need training in how to use the tools effectively. Use of eHealth technologies may be used to pre-empt the decision-making process for patients and their communication partners prior to attending clinic, and throughout the patient pathway.
Importance	High: the research is essential to inform future updates of key recommendations in the guideline Shared decision-making is core to NHS policy (see Kings Fund report 'Making shared decision-making a reality: No decision about me, without me' (2011) and NICE guideline CG138 (2012).

Q.6 Assistive listening devices

Research question: What is the clinical and cost effectiveness of assistive listening devices (ALDs) in supporting adults with hearing loss, compared to other devices, combination of devices or no intervention to support adults with hearing loss.

Why this is important: Hearing loss is highly prevalent. Not all people with hearing loss choose or would benefit from hearing aids, as their individual needs, such as personal safety, may be situation-specific. Assistive listening devices, like hearing aids, make sounds more audible. They cover a range of functions, which can be broadly classified into improving communication (for example, remote microphones, personal sound amplification products (PSAPs), improving listening (for example, television loops), and increasing awareness of environmental sounds (for example, amplification, vibration or flashing lights for doorbell, telephone ring, fire alarm). The systematic review undertaken for the NICE guideline on hearing loss identified a paucity of robust evidence for the clinical or cost effectiveness of ALDs, compared to other devices, combination of devices or no intervention. Evidence that ALDs are clinically effective could enable the design of new patient pathways and service delivery models. This could improve financial efficiency and improve outcomes for patients.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults aged ≥18 years with hearing loss Interventions: Assistive listening devices such as FM devices, telephone/television amplifiers, loop systems (personal or in-built), telecoils, hearing aid apps, bluetooth devices, personal sound amplification products (PSAPs). Comparison: hearing aids or no intervention (such as waiting list control) Outcomes: Hearing-specific health-related quality of life, health-related quality of life, participation, listening ability, speech intelligibility, listening effort, device use and satisfaction.
Importance to patients or the population	Newly informed guidance would help identify which ALDs would improve communication with others and increase awareness of important environmental sounds. This would improve quality of life for people with hearing loss and their family members, and increase connectivity to their environment (for example by alerting them to fire alarms and visitors ringing the doorbell).
Relevance to NICE	This research would provide evidence that would enable NICE to recommend

guidance	which ALDs are clinically and cost effective in improving communication and quality of life. This could then inform new and innovative models of service delivery.
Relevance to the NHS	This research could enable the design of new patient pathways and service delivery models. This could improve financial efficiency and patient outcomes. The findings would provide audiologists with clear information on the most clinically and cost-effective ALD to use, as currently there is limited use of such technologies. This research would provide a robust evidence base where currently none exists, and help inform future policy to deliver effective and efficient pathways.
National priorities	Action Plan on Hearing Loss (2016)- https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf Commissioning Services for People with Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2016/07/HLCF.pdf Audiology: Framework of action for Wales, 2017–2020: Integrated framework of care and support for people who are D/deaf or living with hearing loss http://gov.wales/topics/health/publications/health/reports/audiology/?lang=en Quality Standards for Adult Hearing Rehabilitation Services (2016) http://gov.wales/topics/health/professionals/committees/scientific/reports/audiology-services/?lang=en Quality Standards for Adult Hearing Rehabilitation Services (2009) http://www.gov.scot/Publications/2009/04/27115807/2
Current evidence base	The systematic review undertaken for the NICE guideline on hearing loss only identified 1 low-quality study on the clinical effectiveness of ALDs. The current evidence base is therefore almost non-existent.
Equality	No equality issues.
Study design	Randomised controlled trial, with associated economic evaluation. Qualitative research would highlight the relevance and impact of ALDs for patients, their communication partners and hearing healthcare professionals, patient preference, how and when the devices should be used, and possible models of service delivery.
Feasibility	Can the proposed research be carried out in a realistic timescale? Yes At an acceptable cost? Yes. Are there any ethical or technical issues? No.
Other comments	There are different types of ALDs for different purposes, which may require a number of research studies to answer the question.
Importance	High: the research is essential to inform future updates of key recommendations in the guideline as current research is non-existent.

Q.7 Outcome measures for effectiveness of hearing aid features

Research question: What is the correct outcome measure to use when investigating the clinical and cost effectiveness of directional microphones and digital (adaptive) noise reduction?

Why this is important: The most common complaint of adults with hearing loss is difficulty understanding speech in the presence of background noise or competing speech. Because hearing aids cannot improve deficits in frequency, temporal and spatial resolution, an adult with hearing loss may continue to experience some difficulties, even when wearing hearing aids. The perception, and acceptance, of hearing aids is likely to be improved if they can be shown to improve listening to speech in the presence of background noise.

One hearing aid option that has been developed to distinguish speech from noise, and improve the speech-to-noise ratio (SNR), is the directional microphone. In contrast to omnidirectional microphones, which respond equally well to sounds arriving from all directions, a directional microphone is more sensitive to sounds from one direction (for example, speech coming from directly in front of the hearing aid user), and less sensitive to other directions (for example, background noise from the side or behind the hearing aid user). Directional microphones have the potential to benefit all hearing aid users. A potential disadvantage is that the signal of interest to the hearing aid user may come from a location where the microphone is least sensitive (such as from behind). Modern hearing aids generally have microphones that can be enabled as omnidirectional or directional, usually involving the user selecting a different setting or programme on the hearing aid. Directional microphones have been shown to be efficacious in the research laboratory although their effectiveness in the real world is less clear.

Amplification of background noise can be reduced using digital (or adaptive) noise reduction. The aim of a hearing aid that has adaptive noise reduction is to provide less amplification to noise than to speech. This is achieved by identifying the frequencies (or time) where noise is particularly intense, relative to speech, and applying less amplification. Again, users often have the option of enabling/disabling the noise reduction setting on the hearing aid.

There is a lack of good quality evidence on what is an appropriate primary outcome measure when assessing the real-life effectiveness of directional microphones and adaptive noise reductions. Studies have generally reported benefits in terms of improvements in speech recognition (or SNR) but it is not always clear that this results in real-life benefit. In addition, the SNR remains unchanged with adaptive noise reduction, but there is the potential to improve listener comfort and reduce listening effort, which may prevent decrements in performance over the course of the day.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults ≥18 years with hearing loss who use hearing aids. Interventions: Directional microphones and adaptive noise reduction. Comparison: No (or disabled) directional microphone or adaptive noise reduction.
Importance to patients or the population	The most common complaint of adults with hearing loss is difficulty understanding speech in the presence of background noise or competing speech. Because hearing aids cannot improve deficits in frequency, temporal and spatial resolution, an adult with hearing loss may continue to experience some difficulties, even when wearing hearing aids. The perception, and acceptance, of hearing aids is likely to be improved if outcome measures can be developed for use when investigating the listening benefits from features such as directional microphones and digital (adaptive) noise reduction.
Relevance to NICE guidance	This research would enable NICE to recommend how the real-world effectiveness of hearing aid features designed to assist in background noise should be assessed and quantified.
Relevance to the NHS	The NHS spends tens of millions of pounds each year buying hearing aids. For this investment it would be useful to optimise benefit.
National priorities	Action Plan on Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf Commissioning Services for People with Hearing Loss - https://www.england.nhs.uk/wp-content/uploads/2016/07/HLCF.pdf
Current evidence base	The most common complaint of adults with hearing loss is difficulty understanding speech in the presence of background noise or competing

	speech. The benefits of hearing aid features designed to improve hearing in background noise are based largely on theoretical advantages and studies of efficacy. Outcome measures need to be identified, or developed, for use when investigating real-work listening benefits of hearing aid features design to provide benefit in background noise.
Equality	No equality issues
Study design	RCTs or blinded within-subject design
Feasibility	No obvious limitation in terms of recruitment or blinding
Other comments	None
Importance	High: the research is essential to inform future updates of key recommendations in the guideline.

Q.8 Monitoring and follow-up for adults with hearing loss

Research question: What is the clinical and cost effectiveness of monitoring and follow-up for adults with hearing loss post-intervention compared with no follow-up?

Why this is important: The systematic review for the NICE guideline on hearing loss found a lack of evidence to establish the benefits of monitoring and follow-up, how they should be delivered and across what time periods. Robust evidence is needed to establish the clinical and cost effectiveness of monitoring and follow-up, and to understand how and when they might best be used in clinical practice. This will inform future guidelines and policy.

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults aged ≥18 years with hearing loss Intervention: Monitoring and follow-up post-intervention or when no intervention is taken up. Comparison: (i) no follow-up (ii) individual follow-up (iii) group follow-up Outcome: Hearing health hearing-specific quality of life, health-related quality of life, participation, intervention adherence (or uptake if no intervention taken up initially) and satisfaction.
Importance to patients or the population	Newly informed guidance would help identify whether monitoring and follow-up are effective in improving outcomes for patients, and at what time periods they should be undertaken, in either individual or group settings.
Relevance to NICE guidance	This research would provide evidence that would enable NICE to make recommendation regarding whether monitoring and follow-up should be undertaken, in what format and across which time periods in the patient pathway.
Relevance to the NHS	This research, if shown to be effective, would provide ongoing support for patients.
National priorities	Action Plan on Hearing Loss https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf Framework of action for Wales, 2017–2020: Integrated framework of care and support for people who are D/deaf of living with hearing loss http://gov.wales/topics/health/publications/health/reports/audiology/?lang=en Quality Standards for Adult Hearing Rehabilitation Services (2016) http://gov.wales/topics/health/professionals/committees/scientific/reports/audiology-services/?lang=en

	Quality Standards for Adult Hearing Rehabilitation Services (2009) http://www.gov.scot/Publications/2009/04/27115807/2
Current evidence base	The systematic review undertaken for the NICE guideline on hearing loss did not identify any studies on how or when to monitor or follow-up patients.
Equality	No equality issues.
Study design	Randomised controlled trial, with associated economic evaluation. Qualitative research would highlight which aspects of monitoring and how and when it is carried out that are beneficial.
Feasibility	Can the proposed research be carried out in a realistic timescale? Yes At an acceptable cost? Yes Are there any ethical or technical issues? None (although withholding all monitoring and follow-up may be unethical as the clinical opinion is that this is beneficial)
Other comments	None
Importance	High: the research is essential to inform future updates of key recommendations in the guideline.

Appendix R: Additional information

R.1 Sudden sensorineural hearing loss (SSNHL)

R.1.1 First-line treatment for idiopathic sudden sensorineural hearing loss

Table 113: Additional narrative information

Study	Intervention and comparison	Population	Outcomes	Risk of bias
Filipo 2013[170]	Prednisolone (IT, 0.3ml at a dose of 62.5mg/ml/day for 3 days) versus placebo (IT) 3 days of intervention, follow-up at 1 month.	n=50 For the IT prednisolone group 49.9 (12.6) and IT saline group 50.8 (14.7) years old	Minor adverse effects in each group which were pain in the injection site (n=4) and short duration vertigo (n=6). No persistent tympanic membrane perforation occurred	Unclear method of randomisation/ allocation concealment Risk of bias: High Serious indirectness: Unclear how many children were included (inclusion age 15-85 years)

Table 114: Additional narrative information

Study	Intervention and comparison	Population	Outcomes	Risk of bias
Westerlaken 2007[579]	Prednisolone (oral, 70mg/day for 3 days, 40mg for 1 day, 30mg for 3 days) versus dexamethasone (oral, 300mg for 3 days followed by placebo 4 days) 12 month follow-up.	n=91 Prednisolone group: 49 (16), Dexamethasone group 46 (15)	Limited mild side effects. Mild headache, palpitations, euphoria and mild nausea. All patients transient increase on day 3 blood glucose and leukocyte count. All returned to normal and no differences between treatment groups.	Unclear method of randomisation and allocation concealment Risk of bias: High

Table 115: Additional narrative information

Study	Intervention and comparison	Population	Outcomes	Risk of bias
Ahn 2008[9]	Methylprednisolone (oral, 48mg for 9 days, 5 day	n=120 No age restriction given	No significant complications during or after ITD (tympanic	Unclear method of randomisation and allocation concealment

Study	Intervention and comparison	Population	Outcomes	Risk of bias
	tapering) versus Methylprednisolone (oral, as above) plus dexamethasone (IT, 0.3-0.4ml of 5mg/ml 1st, 3rd and 5th day) 14 days of treatment, 3 months follow-up	in inclusion criteria. ITD group 48.6 (15.4) years, Control 45.9 (14.7) years.	membrane perforation, otitis media, vertigo and tinnitus)	No blinding Risk of bias: Very high Indirectness: Risk that children were included as it wasn't stated that they were excluded.

Table 116: Additional narrative information

Study	Intervention and comparison	Population	Outcomes	Risk of bias
Stokroos 1998[525] (HL range 0-112 days)	IV prednisolone 1mg/kg day 1, to be diminished in equal increments over 7 days to 0mg. One group received 10mg/kg acyclovir 3 times a day for 7 days, other group a placebo	n=44 11-71 years Mean age 42.5 years acyclovir group, 45.7 years placebo	15/22 (68%) in the acyclovir and 9/21 (43%) of patients noticing an improvement in their hearing loss after 1 week of treatment (p>0.05). Subjective recovery was only given overall and not by treatment group. PTA measurements for hearing improvement were not found to be significantly different (data not published, only graphical representation). The average hearing loss at different time points was given, but there were no standard deviations. For the acyclovir and placebo groups respectively; Initial hearing loss average 67 dB, 91 dB, at 1 week 55 dB, 74 dB, 2 weeks 48 dB, 67 dB, after 3 months, 43 dB, 57 dB, after 6 months 42 dB, 54dB, after 12 months 44 dB, 49 dB. AEs: headache n=3 placebo, n=1	Unclear how pathologies for SSNHL were excluded There were differences in baseline severity of hearing loss between the two groups and the method of randomisation was unclear. Improvement was a subjective, self-assessed measure Patients with causes for HL later identified were then excluded Risk of bias: Very high Serious indirectness: includes children, unclear how many

Study	Intervention and comparison	Population	Outcomes	Risk of bias
			acyclovir Slight to moderate nausea n=1 in both groups Stomach pain n=1, placebo group Reversible high blood glucose n=1 placebo group Latter two AEs thought to be due to prednisolone. No specific acyclovir side effects observed.	
Tucci 2002[553]	Prednisolone (oral, Day 1-4: 80mg (40,20,20mg) three times a day, day 5-6; 60mg (20,20,20mg) three times a day, Days 7-9 40mg (20,20mg) twice daily, day 10-12; 20mg per day) plus valacyclovir (oral, 1g/day for 10 days) versus prednisolone (oral, dose as other treatment group) plus placebo (oral) 12 days of systemic steroids, 10 days antiviral or placebo, total duration of study 6 weeks.	n=105 55.8 years (range 18-82 years)	Withdrawal due to AEs attributable to steroids (PO): n=1 diabetes in the Prednisolone plus valacyclovir group was hospitalised for hyperglycaemia, dehydration and renal insufficiency on the 6th day of treatment n=1 Prednisolone plus placebo group withdrew on day 2 due to gastrointestinal irritability and sleep disturbance no differences between the treatment groups for the number or type of side effects (numbers not published). No significant differences in SF-12 between those completing this survey and a large US control population	Unclear method of randomisation/ allocation concealment High missing data (unclear which groups they are from). Unable to calculate randomised n values Risk of bias: Very high
Uri 2003[558]	Hydrocortisone (IV, 100mg three times a day for 7 days followed by prednisolone	n=60 45.8 years, range 18-60	No side effects of acyclovir (central nervous system, renal or	Unclear method of randomisation/ allocation concealment

Study	Intervention and comparison	Population	Outcomes	Risk of bias
	tapering for 7 days) versus Hydrocortisone (IV, dose as above) plus acyclovir (IV, 15mg/kg/day) 14 days of intervention, 1 year follow-up	years, median 48 years.	hepatic) were observed.	No blinding Risk of bias: Very high

R.1.2 Second-line treatment for idiopathic sudden sensorineural hearing loss

Table 117: Additional narrative information

Study	Intervention and comparison	Population	Outcomes	Risk of bias
Li 2011[326]	Previous treatment: IV steroids 1mg/kg for 5 days, division into 4 doses and tapered over the course of 9 days Prednisolone (IT, 1ml of 40mg/ml methylprednisolone in 1ml sodium bicarbonate, once every 3 days for 15 days) versus prednisolone (ear drops, 1ml of methylprednisolone, one every 3 days over 15 days) versus no treatment 15 days intervention, 2 month follow-up	n=65 IT methylprednisolone 53.5 years (18-72), ear drop methylprednisolone 50 years (21-69), blank control group 55.1 years (22-73)	AEs: Vertigo/ increase in tinnitus during the injections which resolved within minutes (n=3), persistent tympanic membrane perforation without hearing loss in the affected ear (treated with a paper patch). No SAEs such as chronic otitis media, disequilibrium or dysgeusia	Unclear method of randomisation and allocation concealment No blinding No outcomes pre-specified in the paper Risk of bias: Very High
Plontke 2009[448]	Previous treatment High dose prednisolone (IV, 250mg/day) for 3 days followed by a dose	n=23 IT dexamethasone 53 (21) years, Placebo 56	"Possibly, probably or very likely" related to the study were; ear pain (n=2), headache (n=1), ear	Unclear method of randomisation and allocation concealment

Study	Intervention and comparison	Population	Outcomes	Risk of bias
	reduction of 50% every 2 days together with systemic rheological medication (pentoxifylline, 3 x 400mg/day) and an antioxidant drug (alphasliponic acid, 1 x 600mg/day). Dexamethasone (IT, 4mg/ml, daily dose 0.58mg, rate 6µL/h) versus placebo (IT, sodium chloride 0.9%, rate 6µL/h) Intervention time: 2 weeks	(15 years)	canal skin defect (n=1), increase in vertigo (n=1), major catheter dislocation with perforation of ear drum (n=1). The ear drum perforation was closed with a myringoplasty. All adverse events were reported to have resolved and there were no serious adverse events.	Risk of bias: High
Wu 2011[592]	Previous treatment: IV steroid 5 days, tapered with oral prednisolone for 5 days. Dexamethasone (IT, 0.5ml of 8mg/2ml every 4 days for 2 weeks) versus placebo (0.5mls normal saline every 4 days for 2 weeks) 2 week intervention plus 1 month follow-up (post treatment), total 6 week study	n=60 IT steroid: 49.1 (14.2), IT saline 47.4 (15.7)	Adverse events: No gastrointestinal adverse events (severe nausea and vomiting) in either treatment group	Risk of bias: Low
Xenellis 2006[594]	Previous treatment: prednisolone IV, 1mg/kg per day for 10 days divided in 3 doses, gradually tapered for 5 days and acyclovir 4mg/day for 5 days divided in 5 doses, buflomedil hydrochloride	n=37 Intratympanic treatment group 50.9 years, control group 50.3 years (no SD reported)	"No perforation or infection was noticed in any of the patients at their last visit".	Unclear method of randomisation and allocation concealment Not blinded 1 child aged 15 included. Unclear if any patients had infections/perforations prior to last visit Risk of bias: Very high

Study	Intervention and comparison	Population	Outcomes	Risk of bias
	300mg, divided in 3 doses for 10 days and ranitidine during steroid treatment Methylprednisolone (IT, 1.5-2mls, 80mg/2ml, done 4 times in 15 days) versus no treatment Intervention 15 days, follow-up 1.5 months (total time 2 months)			

1 # R.2 Interventions to support the use of hearing aids

2 ## R.2.1 Audit trail of difference from Cochrane review

Analysis reference	Detail of differences	Reason for amendment
Self-management support interventions versus control, outcome: hearing aid use (>8 h/day) – short/medium term	Not analysed in Cochrane review because daily use categorised in a different way from the Cochrane review	Alternative definition of daily usage still informative for recommendations
Self-management support interventions versus control, outcomes: quality of life - short/medium-term; self-reported hearing handicap - short/medium-term; use of verbal communication strategy - short-term	Not downgraded for indirectness based on the majority of evidence being from studies sampling populations from the USA VA system, which provides health care support to male and female military veterans and their dependents.	Population samples appear generalisable to adult male and female populations in different health care settings, including the NHS
Self-management support interventions versus control, outcomes: quality of life, self-reported hearing handicap and communication – short/medium term	Not downgraded for indirectness based on only short- to medium-term outcomes being available	Short- to medium-term outcomes still informative for recommendations
Self-management support interventions versus control, outcomes: self-reported hearing handicap - short/medium-term; use of verbal communication strategy - short-term	Only downgraded once for risk of bias	Lack of blinding not considered important for this intervention
Delivery system design interventions versus control, outcomes: adherence, hearing aid use, self-reported hearing handicap, hearing aid benefit	Not downgraded for indirectness based on only short- to medium-term outcomes being available	Short- to medium-term outcomes still informative for recommendations
Delivery system design interventions versus control, outcome: hearing aid use	Not downgraded for risk of bias	Majority of data from studies at low risk of bias
Delivery system design interventions versus control, outcomes: hearing aid use, adverse effects, self-reported hearing handicap, hearing aid benefit, use of verbal communication strategy	Not downgraded for imprecision based on standard deviations being imputed	Imputing standard deviations is not considered a source of imprecision and sufficient data were presented that the standard deviations could be calculated accurately, so no outcome reporting bias was present either
Delivery system design interventions versus control, outcomes: quality of life - short/medium-term; self-reported hearing handicap - short/medium-term; use of verbal communication strategy - short-term	Not downgraded for indirectness based on the majority of evidence being from studies sampling populations from the USA VA system, which provides health care support to male and female military veterans and their dependents.	Population samples appear generalisable to adult male and female populations in different health care settings, including the NHS
Delivery system design interventions versus control,	Text changed from 0.10 higher to 0.10 lower	Text in Cochrane GRADE tables not consistent with the data files

Analysis reference	Detail of differences	Reason for amendment
outcomes: Use of verbal communication strategy - short/medium-term;		
Combined DSD/SMS versus control	Short/medium term outcomes added to GRADE and summary of findings tables	Short- to medium-term outcomes still informative for recommendations
Combined DSD/SMS versus control, outcome: adherence	Not downgraded for risk of bias and inconsistency	Lack of blinding not considered important for this outcome (data-logged HA use). Single study does not equate to inconsistency
Combined DSD/SMS versus control, outcome: long term quality of life	Only downgraded once for imprecision	95% CI of point estimate only crosses one MID
Combined DSD/SMS versus control, outcome: self-reported hearing handicap (long term)	SMS subgroup data presented separately	These predefined subgroups explain the heterogeneity
Combined DSD/SMS versus control, outcome: hearing aid benefit	Only downgraded once for imprecision	95% CI of point estimate only crosses one MID
Combined DSD/SMS versus control, outcome: use of verbal communication strategy (long term)	Only downgraded once for imprecision and once for indirectness	95% CI of point estimate only crosses one MID First-time hearing aid users not an indirect population
Combined DSD/SMS versus control, outcome: use of verbal communication strategy (short term)	DSD intensity subgroup data presented separately	These predefined subgroups explain the heterogeneity
Motivational interviewing and engagement interventions	Not included in Cochrane review	Interventions meet our review protocol

Appendix S: NICE technical team

Name	Role
Kay Nolan	Guideline Lead
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Ross Maconachie	Health Economist
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