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Guidelines for Best Practice in the Audiological Management of Adults with Severe and Profound Hearing Loss

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Abstract

Individuals with severe to profound hearing loss are likely to present with complex listening needs that require evidence-based solutions. This document is intended to inform the practice of hearing care professionals who are involved in the audiological management of adults with a severe to profound degree of hearing loss and will highlight the special considerations and practices required to optimize outcomes for these individuals.

Keywords: severe to profound hearing loss, hearing aids, cochlear implants, guideline

Definitions

For the purposes of these guidelines the World Health Organization definitions will apply:

- Severe hearing loss is an average hearing loss of 61-80 dB HL (ISO) in the better ear.
- Profound hearing loss is an average hearing loss of 81 dB HL (ISO) or above in the better ear.
- An adult is a person older than 19 years of age
- In these guidelines, best practice refers to a two-stage approach: (1) evidence-based, using evidence where available, and elsewhere (2) provide consensus advice of expert panel.

The guidelines are focused on adults with severe and profound hearing loss in the better ear. Conductive hearing loss is largely excluded. Precipitous and asymmetrical hearing loss with at least a severe degree of hearing loss in the better ear, are included. Characteristics associated with severe and profound sensorineural hearing loss such as severe recruitment and tinnitus are also considered. In each section, the guidelines will first address acquired hearing loss and then indicate if a different practice is required for congenital hearing loss.

Purpose

These guidelines are intended to inform the practice of hearing care professionals who are directly involved in the audiological management of adults with a severe and profound degree of hearing loss. These guidelines recognize that audiological management of mild-to-moderate hearing loss is widely understood. These management practices are sometimes insufficient to address the special needs of adults with severe and profound hearing loss.

The current guidelines will highlight the special considerations and practices required to optimize the outcomes for adults with severe and profound hearing loss and their communication partners. Full details of evidence is given in Appendix 1. The guidelines will include practical information in the form of recommendations for hearing care professionals.

The specific goal of these guidelines is to provide a set of statements, recommendations, and strategies for best practices specific to the audiologic management of adults with severe and profound hearing loss.

Content

I. Introduction

Individuals with severe to profound hearing loss (an estimated 87 million people worldwide) may experience challenges related to social participation, health comorbidities, work or school limitations, and overall reduced quality of life. These individuals often have specific, complex listening

needs that may not be adequately addressed by routine audiologic care. The authors of these guidelines have compiled, reviewed, and evaluated relevant evidence in order to provide clear, evidence-based direction for providers managing the audiologic care of this population.

"In many ways patients with severe hearing loss are the most interesting we see, calling upon our skills as clinicians to develop assistive strategies, provide counseling, and think more creatively than the "typical" hearing aid fitting. As clinicians, we understand that the end result of a hearing aid fitting is limited by the processing capability of the peripheral and central auditory system, and that few patients with severe sensorineural hearing loss will achieve high levels of speech recognition in complex listening situations". [1]

I.i. Consequences of Severe and Profound Hearing Loss

The consequences of this degree of hearing loss changes life experience and opportunities including those of the people closest to those with the hearing loss. [2] [3] [4] Several studies have identified higher levels of social isolation, anxiety and depression among adults with severe and profound hearing loss, compared to their better hearing peers. [5] [6]

Young people with severe and profound hearing loss are less likely to go to university or work full time compared to their hearing peers. [7] Severe and profound hearing loss has been found to negatively affect quality of life, regardless of age or suddenness of onset [8] and to negatively impact activities of daily living. [9] [10] Many adults with severe and profound loss will also have tinnitus, [8] which has been shown to negatively impact quality of life for some individuals. As these adults age, they may struggle with other attributes of ageing, such as declining vision, mobility, dexterity, cognition and general health. In addition to a social support network of friends and family, [10] to avoid poor health and social isolation, hearing healthcare has an important role in the life of the person with hearing loss, to support them and provide effective tools for communication. [11]

I.ii. Prevalence

The World Health Organization (WHO) estimates the prevalence of disabling hearing loss (where the average hearing loss is greater than 40 dB HL in adults and greater than 30 dB HL in children) at 460 million people worldwide. [12] This number includes an estimated 87 million with a severe and profound degree of hearing loss. [13]

If the WHO definition of severe hearing loss (of greater than 60 dB HL) is applied then the prevalence stands around 2.2% of the general population. [14] [15] (If severe hearing loss was considered more conservatively (of greater than 70 dB HL) then the prevalence estimation lowers to 0.7% of the general population). [8] [10] Regardless of the definition, the number of adults affected peaks around the 8th decade of life, regardless of gender. It is expected that up to 2 out of 10 adults with hearing loss presenting to a typical hearing aid service will have a severe and profound hearing loss. [8]

I.iii. Causes

Factors which can lead to severe and profound sensorineural hearing loss include age, noise exposure, congenital and genetic conditions, ototoxic drugs and injuries such as head trauma. Diseases include meningitis, viral and autoimmune diseases, advanced otosclerosis and Meniere's disease. The hearing loss onset can be sudden or progressive. [16]

I.iv. Unique Amplification and Rehabilitation Needs

Such clients do not easily fit into our regular routines for hearing care: “patients with severe loss are also the best illustration of the complexities of the auditory system and remind us (yet again) that adding gain is not a simple solution to communication problems”. [1] Even as technologies improve “hearing aids may never be fully sufficient for those with severe cochlear damage”. [17]

People with severe and profound hearing loss are often long-term, full-time users of amplification who, because of their degree of loss, are highly reliant on their devices. Their amplification needs are unique: individuals in this population require that a wide range of input levels be made audible, comfortable, and safe within a narrow range of residual hearing. [18] [19] Assistive technologies and hearing dogs may be relevant considerations for this population. The benefits of wireless microphone technology have been well established for severe and profound hearing loss [20] and can be considered as a standard component of a rehabilitation program. [21] People with severe and profound hearing loss pose unique hearing, psychosocial and communication rehabilitation challenges. The authors have tried to address these challenges within the recommendations throughout this Practice Guidance.

Equally, bimodal fittings present another unique set of circumstances for amplification, which is addressed in further guidelines by Gifford (ed) et al in Guidelines for best practice in the audiological management of adults with severe and profound hearing loss. Part 2: Bimodal fitting (2020, unpublished data).

In a recent study of adults presenting for cochlear implant assessment by Holder et al, only 30% of candidates were found to have sufficient hearing aid gain to achieve the prescription target. [22] It is little surprise that when hearing aids are not optimally fitted. 177 of 287 patients presented with no hearing aid, reporting lack of perceived benefit. This finding highlights the need to revisit best practice in the support offered by the hearing care professional. Best practice in the audiological management of severe and profound hearing loss will rely on much more than hearing aids alone.

II. Methods

II.i. How the Guidelines were Developed

These guidelines outline best practice in the audiological management of adults with severe and profound hearing loss. Best practice will be defined using a two-stage approach: (1) use evidence where available, and elsewhere (2) provide consensus advice of expert panel. Where evidence is available it will provide the evidence for best evidence-based practice and where the scientific evi-

dence is insufficient, the guide provides specific recommendations based on expert advice. The authors hope that sharing this information will inform best practice in hearing care and improve outcomes for adults with severe and profound hearing loss.

Specific statements, recommendations and strategies were made by initially reviewing the existing scientific evidence published in peer-reviewed and non-peer-reviewed journals. When direct evidence was not available, both indirect evidence (often evidence from mild-to-moderate hearing loss, pediatrics or cochlear implants) was used, and consensuses on practice were considered in making recommendations. This document presents practice guidance by recognized experts in the field of audiology with specialized knowledge in the management of severe and profound hearing loss. It encompasses the evidence-base and consensus on good practice, given the stated methodology and scope of the document and at the time of publication.

The process of developing the recommendations is evidence-based when possible. Where evidence is ambiguous or conflicting, or where scientific data are lacking, the clinical expertise of the authors was used to guide the development of consensus-based recommendations.

The methodology used in developing the guidelines is drawn from the 2018 revision of the 2016 NHMRC Standards for Guidelines, National Health and Medical Research Council of Australia. [23]

In addition, useful information was provided by Rosenfeld et al (2013) Clinical Practice Guideline Development Manual, Third Edition: A Quality-Driven Approach for Translating Evidence into Action Otolaryngology–Head and Neck Surgery 148(1S) S1–S55 [24] and the American Academy of Audiology Clinical Practice Guideline: Pediatric Amplification. [25]

II.ii. Research Evidence for Adults with Bilateral Severe and Profound Hearing Loss

Although often highlighted in the literature, it is important to emphasize the limited research which has focused on this population over the last 10-15 years. In the coming years, the authors would strongly encourage research that focuses on the gaps in the published evidence.

II.iii. Evidence

Appendix 1 outlines the evidence from which the recommendations are based. These guidelines are not intended to be a systematic review. Instead the authors searched the literature to identify the best available evidence to provide support for the development of key recommendations. In searching the literature, the authors first sought to identify studies at the top of the hierarchy of study types (II.iii.i. Levels of evidence). The authors then graded the evidence using the rating scheme described below (II.iii.ii. Grades of recommendation). In addition, the authors determined “effective” (EV) or “efficacious” (EF). “EV” is evidence measured in the real world while “EF” is evidence measured under laboratory or ideal conditions (II.iii.iii. Types of Evidence#x0029; Finally, if the authors have had to extend their literature search to beyond adults with severe and profound hearing loss this is identified by evidence from elsewhere (II.iv. Supporting evidence). All authors reviewed the recommendations and evidence grading for the Practice Guidance and agreed on the

levels of quality assigned. This assessment of the literature is based on the recommendations for evidence-based practice in the provision of amplification [27] as implemented in the AAA Pediatric Amplification. [26] The results of the assessment are collated in an evidence table as follows:

II.iii.i. Levels of Evidence

1. Systematic reviews and meta-analyses of randomized controlled trials
2. Randomized controlled trials
3. Non-randomized intervention studies
4. Descriptive studies (cross-sectional surveys, cohort studies, case-control designs)
5. Case studies
6. Expert opinion

II.iii.ii. Grades of Recommendation

A. Consistent level 1 or 2 studies
B. Consistent level 3 or 4 studies or extrapolations from level 1 or 2 studies
C. Level 5 studies or extrapolations from level 3 and 4 studies
D. Level 6 evidence or troubling inconsistencies or inconclusive studies at any level

II.iii.iii. Types of Evidence

In addition to grading the evidence and assigning it a level, it was determined if the evidence was Efficacy (EF) or Effectiveness (EV). EF is evidence measured under “laboratory or ideal” conditions and EV is evidence measured in the “real” world.

II.iv. Supporting Evidence from Elsewhere

In the absence of direct evidence, indirect evidence including evidence given for mild-to-moderate hearing loss (MM), pediatrics (P) or cochlear implants (CI) was considered for inclusion.

This paper presents best practice guidance by experts in the field of audiology with specialized knowledge in the management of severe and profound hearing loss. It encompasses the evidence base and consensus on good practice, given the stated methodology and scope of the document and at the time of publication. No previous outlines for the audiological management of severe and profound hearing loss are known to the authors, who are unanimous in recognizing the need for such an outline. The following data bases were searched:

Internationally, there are many general guidelines for the assessment and audiological management for all adults with hearing loss (See Appendix 2 for the list of international guidelines and Appendix 3 for a table which summarizes the relevance of each general guidelines to topics in the

current guidelines.) Rarely, if ever are people with a severe and profound hearing loss referred to specifically in any of these guidelines. The following recommendations focus on severe and profound hearing loss which may differ from the general guidelines listed in Appendix 2.

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Guidelines and Recommendations

1. Assessment

Key Concepts

1.1. Obtaining Diagnostic Information

Objective

People with severe and profound hearing loss should receive an individually tailored audiological assessment which should include a comprehensive audiological examination including case history, otoscopy, and behavioral and physiological auditory measures. The elements of the auditory assessment include, but are not limited to, the following:

- A comprehensive relevant medical history.
- Otoscopic examination.
- Measurement of hearing impairment (type and extent of hearing loss).
- Assessment of the need for additional evaluation and/or medical referral.
- Assessment of candidacy for amplification, referral for implantable hearing devices and for other treatments.

Recommendations (See Appendix 1: Section 1.1.)

1. People with severe and profound hearing loss may need extended clinical time and additional support throughout their pathway.
2. Prior to the hearing assessment, enquire if communication support (e.g., palantypists for captioning, note takers, interpreters) is required.
3. It is beneficial to take an extensive, chronological otological history, taking the client back to the start of their hearing problems to fully understand their journey so far and enable problem solving to take place when developing a treatment plan later in the assessment.
4. Often the client will be returning for a reassessment of their hearing, rather than attending for a first assessment and, in such cases, the medical history should focus on any changes since their last assessment.
5. In the case of sudden onset of severe and profound hearing loss or acute tinnitus, the hearing care professional must refer the client for ENT investigation. This should be treated as a medical emergency and the client should be seen urgently. **See sections 3.3 and 4.1** .

6. The measurement of the degree and type of hearing loss should include both threshold and uncomfortable loudness levels to ascertain the dynamic range for both ears.
7. Speech recognition testing is beneficial in considering amplification strategies, setting expectations, and onward referral for cochlear implants. **See section 2.3** . See Table 1

    A. The hearing care professional and the client should consider what they want to measure (e.g., evaluating amplification or considering a cochlear implant assessment). Speech testing can be a useful qualitative measure of both communication abilities and hearing aid benefit.
    B. Speech testing may be dictated by local/national protocols for cochlear implant referrals, but ideally, it should be flexible enough to assess auditory speech perception, auditory-visual speech perception, and conversational fluency either through one test or through a battery of tests available to the hearing care professional.

8. Cochlear dead region testing might be undertaken to consider the success of amplification or candidacy for cochlear implants. **See sections 2.1.3 and 2.3** .
9. Tinnitus management should be investigated and implemented if required. **See section 4.0** . and Table 1 .

1.2. Non-Auditory Needs Assessment

Objective

Alongside the auditory assessment, it is essential to examine factors (outside of the hearing loss) which also influence the client and the possible treatment options. These non-auditory issues may influence the need for modification in testing, additional counseling, and referrals to other professionals and may change the treatment options to be offered.

Recommendations (See Appendix 1: Section 1.2.)

1. Information should be gathered on the following comorbidities and other relevant factors: See Table 2 .

    A. Cognitive ability.
    B. Mental health status.
    C. Physical status (mobility and craniofacial status).
    D. General health.
    E. Dexterity.
    F. Visual status.

2. Clients presenting with significant neurological disorders/cognitive impairment may require an assessment test battery that is adapted appropriately. Tests which are assessed verbally must be administered carefully to avoid confusing hearing and cognitive aspects.

3. Hearing care professionals with training may perform these additional tests outside the scope of audiology (e.g., tests of dexterity, vision, cognition, and depression) or make recommendations for an onward referral for completion of these tests if required. See Table 2 .
4. Hearing care professionals should make appropriate referrals for onward management where significant non-auditory needs are discovered requiring further support.
5. The communication impairment and association of other long-term health conditions with severe and profound hearing loss will render referrals in and outside of the health system. **See section 3.0** .

1.3. Understanding the Client's Self-Perception, Motivation, Communication Needs, and Treatment Goals

Objective

To complement the case history taken so far, it is important to examine the self-reported communication difficulties experienced by the client (considering the assessment of activity limitations and participation restrictions). This assessment will intricately link to the non-auditory and auditory assessment. It should cover the client's hearing and communication needs at home, at work or in education, and in social situations; any psychosocial difficulties related to hearing; the client's expectations and motivations with respect to their hearing loss; and any restrictions on everyday life, because of their severe and profound hearing loss and the degree and type of support that can be expected from family and other significant communication partners. [75]

All this information can be used by the hearing care professional and the client to set goals to structure their treatment plan.

Recommendations (See Appendix 1: Section 1.3.)

A full social history of the client's circumstances should be taken, which should include living arrangements, employment, social interactions, and hobbies and give the professional an overview of what their life looks like on daily basis, particularly around levels of social isolation/interactions.

1. Hearing care professionals should interview the client to get a thorough assessment of their current hearing needs. This will help determine any factors that could impact on the client's motivation, unrealistic expectations, appropriate amplification, and other treatment options. In particular, the client's current communication strategies should be assessed for their effectiveness.
2. The needs analysis could be completed using a self-report instrument (with open-ended questions) such as the Client-Orientated Scale of Improvement (COSI), the Glasgow Hearing Aid Benefit/Difference Profile (GHABP and GHADP), or the Speech, Spatial and Qualities of Hearing scale (SSQ-12). These questionnaires then later assess whether the respective treatment improved the client's specific needs (to determine benefit and satisfaction levels at their follow-up). **See sections 2.2 and 5.0 and Table 3** .

3. Further development of self-report tools for people with severe and profound hearing loss is required.
4. Consideration of the impact of the client's hearing loss on their close friends and family (third-party disability) should also be considered as part of the needs assessment to develop effective intervention strategies.
5. The role of communication partners should be examined to assess what strategies they employ to communicate the level of emotional support they provide and if they are involved in any of the device management. See Table 3 .

1.4. Developing a Comprehensive Treatment Plan

Objective

The final part of the assessment is to use all the information gathered so far to counsel the client and their communication partner on the results of the assessment and undertake joint decision making to complete the treatment plan.

Based on the analysis of:

- The pure tone audiogram, speech testing results, and the impact the hearing loss might have on communication.
- Any relevant audiological and non-audiological history which may influence any treatment option plus assessment of current communication strategies.
- Priorities from the goals set in the needs analysis.

Options for managing their hearing needs should be discussed, outlining the potential benefits and limitations of each option. All options should promote independence and encourage self-management. This understanding is established through a process of counseling, information sharing, education, and discussion.

- Commonly this will include the fitting of hearing aids as part of the treatment plan. **See section 2.0** .
- Counseling and rehabilitative support is essential. **See section 3.1** .
- Communication tactics, speech reading and advice on making the most of their hearing is vital for people with severe and profound hearing loss and should not be overlooked. It is particularly important to link this information back to their needs analysis. **See section 3.2** .
- Assistive listening devices that work on their own and/or with hearing aids should be routinely discussed, linking back to their needs analysis. Important aspects are consideration of remote microphone systems to improve communication in adverse situations and a practical demonstration of any appropriate device offered. **See sections 2.2.1, 2.2.2, and 3.4** .
- Referral for a cochlear implant evaluation if appropriate. **See section 2.3** .
- Signposting/referring on to other organizations and support groups for people with hearing loss. **See section 3.3** .
- Referral for medical or surgical treatments, if these might be suitable.

- These options are then recorded in a treatment plan.

Recommendations (See Appendix 1: Section 1.4.)

1. Hearing care professionals should conduct all the procedures outlined in a person-centered manner, which is linguistically and culturally sensitive.
2. Hearing care professionals should recognize that the client is an expert about the impact of their hearing loss.
3. Amplification discussions should be transparent about what the client can expect from a change in any amplification. **See section 2.0** .
4. Treatment options should always consider options wider than amplification. Technology is always improving but on its own is generally not enough to overcome the issues they are experiencing. **See section 3.0** .
5. The conversations about cochlear implants need to be considered in terms of an opportunity for the client to explore another intervention which would improve auditory outcomes. **See section 2.3** .
6. All treatment options should be agreed and recorded in a personalized care plan, considering the client's preferences, including goals, and giving the client a copy. See Table 4 .

   A. This plan should be initially based on information gathered at the assessment phase and is determined in conjunction with the client and their communication partner.
   B. It should be flexible and updated on an ongoing basis.

2. Selecting Technology

Key Concepts

- Improve speech audibility while avoiding loudness discomfort.
- Provide acceptable speech quality.
- Preserve or enhance usable acoustic cues.
- Improve signal-to-noise ratio (SNR), ease of listening, and listening comfort in background noise.
- Support best possible communication via cell/mobile or landline telephones.
- Have convenient and reliable connections to hearing-assistive technology.
- Limit maximum output to avoid further hearing damage.

Severe and profound hearing loss impacts communication in several ways, including inadequate speech audibility; loudness sensitivity as a result of a small dynamic range; and susceptibility to background noise. In addition to threshold elevation, clients with severe and profound hearing loss are likely to experience poor frequency selectivity and distortion due to cochlear dead regions. Accordingly, these clients require hearing aids that achieve the following goals:

2.1. Prescribing and Fitting Hearing Aids

While there is a large body of evidence for clients with mild and moderate hearing loss, there is substantially less evidence that supports clinical decision-making when selecting and fitting hearing aids for clients with severe and profound hearing loss. In addition, some of this evidence was obtained using older-generation hearing aids with signal processing dissimilar to today's choices. In the sections that follow, evidence was drawn from all available sources: best practice for clients with mild and moderate loss, and expert opinion to recommend technology, selection, and fitting procedures for clients with severe and profound hearing loss.

The various features and components of an optimal hearing aid fitting are outlined in a short joint study (BAA and BSA, 2019). [89]

2.1.1. Amplitude Compression

Objective

Clients with severe and profound hearing loss should be fitted with compression parameters which result in improved speech audibility and avoid distortion of usable speech cues. Output limiting should be appropriately set to avoid loudness discomfort or auditory damage due to overamplification.

Recommendations (See Appendix 1: Section 2.0, 2.1.1.)

1. Clients with severe and profound hearing loss should be fitted using multichannel wide-dynamic range compression (WDRC) rather than linear amplification. This offers the greatest opportunity to maintain audibility and loudness comfort across a range of speech and sound levels in the environment.
2. Hearing care professionals should use the lowest compression ratio that provides acceptable speech audibility. To maximize intelligibility of conversational speech while preventing loudness discomfort, low input levels may not be fully audible to some clients. It is not recommended to use high compression ratios to compress the entire speech range into the client's dynamic range, as those high compression ratios may distort useful speech cues such as variations in speech envelope. See Table 5 .
3. The number of channels on the hearing aid should be sufficient to adjust frequency-gain characteristics for the client's audiogram and to provide suitable noise reduction and feedback management. High compression ratios (>3:1) across a very large number of channels should be avoided if possible, as there is some evidence that this may affect availability of spectral cues. There is a lack of evidence as to whether a larger number of channels will impact benefits of digital noise reduction or feedback reduction for clients with severe and profound loss.
4. The existing evidence suggests that slow-to-moderate rate WDRC results in best outcomes for many clients with severe and profound hearing loss. Accordingly, it is suggested that fast-acting WDRC be used when it is determined that benefits (i.e., audibility of low-intensity speech sounds) will outweigh the drawbacks (i.e., modification of the speech envelope) for that client. Fast-acting WDRC amplification may be a reasonable choice when a specific hearing aid with short time constants is desirable for other reasons (such as assistive device compatibility).

5. Extra care may be needed when transitioning clients who are accustomed to linear amplification to multichannel WDRC. In addition to counseling regarding expected differences (e.g., lower overall loudness) and benefits, some clients may benefit from a stepped adjustment period in which frequency-gain response is adjusted and trialed before increasing compression strength.

These recommendations are qualified by the fact that some studies on this topic used simulations or older hearing-aid technology, which were dissimilar to the systems in current-generation products.

2.1.2. Device Choices and Programs

Objective

Clients with severe and profound hearing loss should be fitted with programs that maximize available speech information. Careful attention should be paid to providing noise reduction, including appropriately fit directionality and a program that facilitates convenient use of a remote microphone.

Recommendations (See Appendix 1: Section 2.0, 2.1.2.)

1. Bilateral fittings are recommended whenever feasible. See section 2.1.5 in cases of asymmetric hearing loss with little usable hearing in one ear.
2. Automatic/adaptive directionality should be used rather than fixed directionality, to improve SNR when the signal and noise are spatially distinct and in varying locations.
3. Binaural (“ear to ear”) wireless directionality should be used when possible, although the benefits over monaural directionality may be limited to specific listening environments.
4. The hearing care professional should encourage the use of remote microphones which can be conveniently accessed. This may be in the form of an automatic program that activates when the remote microphone is active, or a manual program in which the listener selects remote microphone input. Control via cell/mobile phone apps, when available, can offer more control options than on-aid buttons or switches. **See section 2.2** .
5. Feedback should be controlled via digital feedback management. Passive feedback management (i.e., within-band gain reduction) may limit speech audibility or restrict the amplified speech range for some clients. Active feedback management should be engaged, and its function verified.
6. Custom earmolds with appropriate venting should be used rather than open or closed domes, as they will allow for maximum gain and minimize potential for feedback. To reduce feedback and other hearing aid problems, listeners with a history of occluding cerumen should be encouraged to schedule preventative cerumen removal.
7. For the phone, binaural listening can improve phone communication compared with monaural telephone listening. To achieve this binaural (“ear to ear”) wireless streaming, telecoil or Bluetooth input should be used.

2.1.3. Frequency Lowering for Clients with Severe and Profound Hearing Loss

Objective

Frequency lowering should be used in cases where the resulting improvements in high-frequency sound audibility result in better speech recognition than with traditional frequency-gain processing alone. After parameter adjustment, frequency lowering should be validated objectively and subjectively.

Recommendations (See Appendix 1: Section 2.0, 2.1.3.)

1. For clients with severe and profound loss, hearing aids should usually be fitted with frequency lowering turned off. See Table 6 .
2. If frequency lowering is necessary to improve audibility of high-frequency speech cues for a particular listener, there is some evidence that frequency compression results in better outcomes than frequency transposition for clients with severe and profound hearing loss.
3. Frequency lowering should be fit using a validated procedure, with the minimum strength necessary to provide adequate audibility, and evaluated during a trial period to ensure it is providing greater benefit than no frequency lowering. See Table 6 .

2.1.4. Prescriptions and Verification

Objective

Hearing aids for clients with severe and profound hearing loss should be fitted using real ear measures and a validated prescriptive target as the starting point for adjustments. After adjustment, real ear responses should be re-measured to evaluate audibility.

Recommendations (See Appendix 1: Section 2.0, 2.1.4.)

1. A validated prescriptive procedure should be used to guide frequency-gain settings.
2. Probe-microphone or coupler measurements (with measured Real Ear to Coupler Difference) should be used to assess signal audibility. If probe-microphone measures are not possible, a coupler measure is preferable to using hearing aid default settings (i.e., “click and fit” or “initial fit”). See Table 7 .
3. When hearing aid parameters are adjusted according to subjective judgments, every attempt should be made to maintain a level of speech audibility which supports aided speech recognition. A period of acclimatization or counseling may be useful especially when transitioning users to higher prescribed gain. Probe-microphone or coupler measurements should be used to confirm adequate signal audibility following adjustments.

4. Input signals for real-ear or coupler measures should represent the signal of interest (usually speech). Static noise or tone signals may result in aid behavior that is atypical for speech amplification.
5. Gain should be increased in cases of mixed hearing loss, usually by inputting bone-conduction thresholds when calculating prescribed aided output.
6. When dead regions are confirmed or suspected, gain may be provided in the frequency range of the dead region unless the client reports poor speech quality or loudness discomfort. **See section 1.1** .

2.1.5. Selecting Technology for Asymmetrically Severe and Profound Loss

Objective

When hearing loss is in the severe and profound range in only one ear, the level of hearing in the other ear should be considered in hearing aid–fitting decisions. Unilateral, bilateral, CROS, or BiCROS hearing aid fittings may be appropriate, depending on hearing thresholds, speech recognition, dynamic range, and the client's communication goals. Comprehensive guidelines for adult clients with severe and profound unilateral hearing loss has been published by the American Academy of Audiology (AAA) in their Clinical Practice Guidelines (2015). [98] In this section, we review evidence related to the use of BiCROS amplification due to the population these guidelines focus on, that is, severe and profound hearing loss in the better ear.

Recommendations (See Appendix 1: Section 2.0, 2.1.5.)

BiCROS amplification should be considered in cases of asymmetric hearing loss where one ear is unlikely to receive sufficient aided audibility to be useful or beneficial. As there is a lack of consistent evidence that speech in noise is improved with BiCROS versus monaural amplification in the better ear and because the speech-in-noise benefit will be affected by the specific environment, it is recommended that each client be encouraged to trial hearing aids with and without the transmitter in their everyday communication settings.

1. Real ear response should be measured with and without the BiCROS transmitter and the transmitter response adjusted so that the intended frequency-gain response is maintained on the better ear. Selection of a BiCROS transmitter with adequate technology level and range of adjustments will facilitate adjustment of the transmitter response.
2. To maximize recognition of speech in noise, both the receiver and transmitter components should be configured to have adaptive directionality. A convenient means of disabling the transmitter microphone, such as a volume control or on-off switch, may be useful in cases where the primary signal of interest is on the receiver side and the primary noise source on the transmitter side. When such features are included, the client should also be trained on their use.
3. Provide education/counseling to the client about how rerouting devices work and when they may be of benefit, by demonstrating to the client that rerouting overcomes the head shadow.

4. In addition to lack of binaural hearing aid benefit, auditory deprivation should be included in the shared decision making and counseling about whether binaural hearing aids or BiCROS amplification is better. Use of BiCROS amplification can result in auditory deprivation on the transmitter side, which may have long-term consequences for the client in terms of choice of ear for an implant or returning to a hearing aid in the future.

2.1.6. Maximum Power Output and Threshold Shift

Objective

Hearing aid gain and maximum output should be constrained to prevent damaging sound levels.

Recommendations (See Appendix 1: Section 2.0, 2.1.6.)

Due to the high sound levels produced by their hearing aids, clients with severe and profound loss are at risk for temporary and permanent threshold shift.

1. Maximum output levels should be measured as real-ear sensation levels using narrow-band signals. See Table 8 .
2. Compression limiting (rather than peak clipping) should be used to avoid distortion and limit signal output.
3. The hearing care professional should use hearing aids with frequency-specific adjustments for maximum output. The ability to adjust maximum output in specific bands will allow for a careful balance of output control without unnecessary headroom reduction.
4. Disabling the ability to increase manual volume controls above desired levels should be considered when the client is at risk of permanent threshold shift due to sound levels and unable to conservatively adjust volume (e.g., has poor dexterity or cognitive limitations). **See section 1.2** .

2.2. Prescribing and Fitting Remote Microphones

Key Concepts

2.2.1. Considerations for Recommending and Managing ongoing Use of Remote Microphone Systems

Objective

Hearing aids and/or cochlear implants are the most commonly fitted technologies for adults with severe and profound hearing loss. However, such devices do not meet all the communication needs of this population and remote microphone technology can be used to improve perfor-

mance, for example, when having conversations in noisy environments or when listening to a speaker at a distance.

The majority of research on such systems has been undertaken with children in classroom situations. The objective of this section is to summarize the evidence about recommending and managing the ongoing use of remote microphone systems for adults with severe and profound hearing loss. It also presents new evidence obtained in a recent qualitative study by Scarinci et al [100] that addressed this topic specifically.

Recommendations (See Appendix 1: Section 2.0, 2.2.1.)

1. Adults with severe and profound hearing loss can benefit from remote microphone systems in a range of situations and should be fully informed about them by hearing care professionals. This should be reviewed proactively on an ongoing basis. **See section 1.3** and Table 9 .
2. Communication partners of adults with severe and profound hearing loss experience third-party disability. This can be reduced when their partner makes use of remote microphone systems and they should be fully informed about them by hearing care professionals. **See sections 1.3 and 1.4** and Table 9 .
3. Having the opportunity to trial a remote microphone system is an essential part of decision-making for clients and communication partners.
4. Hearing care professionals need to set goals with clients and communication partners for the use of remote microphone systems.
5. Comprehensive instructions in a range of formats and ongoing education and support about remote microphone systems are needed for clients, communication partners, and hearing care professionals.
6. The complexity of remote microphone systems should be reduced for the benefit of clients, communication partners, and hearing care professionals.
7. Communication partners influence success with remote microphone systems and should be a part of decision-making, fitting, and ongoing management. **See sections 1.3 and 1.4** .
8. There is a need to increase community awareness of remote microphone systems.

2.2.2. Component Considerations for Remote Microphones

Objective

The various features and components of remote microphone systems are described in the American Academy of Audiology (AAA) Clinical Practice Guidelines: Remote Microphone Hearing Assistance Technologies. [103] The AAA guidelines focus on hearing-assistive technology for individuals from birth to 21 years. Many of the available features and rationale for selection are included and applicable to the young adult population with severe and profound hearing loss. Use of remote microphone systems, and therefore the component choice, for adults depends heavily on the communication demands experienced by the client.

Given the complexity of options available across manufacturers, the selection of remote microphone systems is ideally considered at the same time as the selection of the personal device, hearing aids, and/or cochlear implants. The benefit from such systems is most likely to increase with the simplicity of the arrangement. The hearing care professional should be aware that this can be impacted by the number of components that attach to a personal ear-level device ranging from two components such as audio shoe plus a wireless receiver to zero additional components such as a hearing aid/cochlear implant with wireless connectivity to a smartphone or a telecoil connected to a loop system. Another factor for simplicity that must be considered is the battery life and charging options. Some lifestyles that involve frequent travel make it difficult to work with multiple charging cords for transmitters/receivers.

Finally, the client's communication interactions at work, school, and the community must be considered to have optimal compatibility and maximum use of the features/components selected. Ideally, if a user enjoys theater, their personal remote microphone system could connect to the assistive technology provided at the performance hall in their community. Similarly, a personal remote microphone system would connect to the conference microphone provided at work for group meetings if applicable for persons in employment settings. It is very likely that remote microphone systems provided in higher education could be same as the client's personal system such that some components could be shared while enrolled in that program.

Recommendations (See Appendix 1: Section 2.0, 2.2.2.)

When used correctly, the remote microphone system will provide benefit in challenging communication situations beyond that obtained with the local microphone system (hearing aid and/or cochlear implant) according to the client's communication demands.

1. The system should provide wireless connectivity to components of interest to the client; examples include the client's smartphone, television, vehicle audio signals, inductive loop microphones, etc. **See section 2.2.1** .
2. The system should be composed of the minimal number of components to facilitate troubleshooting and minimize repairs in bilateral/bimodal arrangements with consideration of the financial constraints for the client.
3. The charging options and battery life should meet the communication needs and lifestyle of the client.
4. The system should efficiently interface with other assistive technology that may be provided based on requirements in employment and/or higher education settings. **See section 3.4** .

2.2.3. Remote Microphone Verification

Objective

The use of remote microphone systems has been shown to provide significant benefit for adults who use amplification to compensate for all degrees of hearing loss. After selecting and fitting the remote microphone systems, the particular device should be verified with both electroacoustic

and behavioral measures. The remote microphone system that delivers the signal via the personal hearing aid, such as a direct-audio input via a frequency modulated (FM) or digital modulation (DM) system, can be evaluated using existing electroacoustic test equipment and couplers.

Three documents that relate to the verification of remote microphone systems include the ANSI S3.47 standard for "Specification of Hearing Assistance Devices/Systems," [103] the AAA, [102] and the EUHA Wireless remote microphone systems—configuration, verification, and measurement of individual benefit. [104]

The ANSI S3.47 standard [103] includes recommended electroacoustic measurements that are like those recommended in ANSI S3.22 [105] standard for hearing aids and specific requirements for placement of the transmitting microphone and the receiver. These procedures allow comparison across remote microphone systems because prescribed input levels and equipment arrangements are used. [107]

The AAA [102] focuses on hearing-assistive technology for individuals from birth to 21 years. It is based on the American Speech-Language-Hearing Association (2002) guidelines, [108] which focused on real-ear, electroacoustic, and behavioral evaluation procedures. There are specific protocols in Supplement A of the AAA guidelines [102] for the electroacoustic and behavioral evaluation of ear-level remote microphone systems when used with clients who wear hearing aids or cochlear implants or who have normal hearing. When fitting remote microphone systems, it is important that such electroacoustic verification be performed to ensure that the wireless signal is received by the listener at a level above that of the environmental signals processed through the hearing aid, resulting in a favorable SNR. Research with these protocols suggests that variations exist in electroacoustic performance across remote microphone systems even when tested with the same personal hearing aid device and highlights the importance of electroacoustic verification. [109] In addition to electroacoustic verification, behavioral verification may be performed. Typically, this is not necessary for adults with hearing aids because there is an abundance of research supporting the benefit that can be achieved. However, for verification of remote microphone systems for use by clients with cochlear implants, behavioral evaluation is necessary. Protocols are suggested in both the AAA (2011) [102] and EUHA (2017) [104] guidelines and include comparison of speech recognition in noise performance when listening with the personal device alone (Cochlear Implant or Hearing Aid) to that obtained when listening with the personal device connected with the remote microphone system. Benefits achieved with remote microphone technology over use of the personal device alone may be as great as 61%. [21]

Following verification, the client and their communication partner will need instruction on the care and use of the chosen technology to realize the benefits of remote microphone systems in their real-world environments. In addition to the electroacoustic and behavioral verification in the clinical setting, the validation of the benefit depends on outcome measures following use of the remote microphone systems in everyday communication settings. A comprehensive tool to verify benefit across multiple communication activities is called the TELEGRAM [102] which allows rating of difficulty with and without the remote microphone systems for communication on the Telephone,

Employment, Entertainment, Groups, Recreation, Alarms. Ratings are also determined for the client's knowledge of legislation relating to assistive technology and their members of their family with whom they may frequently communicate. See Table 10 .

Recommendations (See Appendix 1: Section 2.0, 2.2.3.)

1. If a hearing aid is part of the remote microphone systems, it should first be evaluated to ensure adequate function as described in section 2.1.4 “Hearing aids: Prescriptions and verification.”
2. The output of the remote microphone systems should not exceed that of the hearing aid.
3. The remote microphone system should not add significant additional circuit noise.
4. The remote microphone system should not cause an increase in distortion, as described in ANSI S3.47. [103]
5. Electroacoustic verification should indicate that the frequency response of the personal hearing aid alone matches the frequency response when the hearing aid is coupled with a remote microphone.
6. As observed in the clinical setting, the client's behavioral performance with the remote microphone system should be significantly better than without it, as measured by the AAA, 2011 [102] method (see the description in Appendix 1: section 2.2.3, Recommendation 6).

2.3. Referral for a Cochlear Implant

Key Concepts

2.3.1. Be Comfortable in Starting the Conversation with Clients on Cochlear Implant

Objective

Evidence shows that for the appropriate candidates, there are large, life-changing benefits postimplantation, the magnitude of which cannot be achieved using hearing aid technology alone. Educating and counseling our clients regarding the continuum of available hearing technologies equips them with the knowledge that hearing aids need not be the final stop on their hearing journey. Conventionally, aided acoustic hearing may not afford high levels of speech understanding alone but when combined with a cochlear implant, some bimodal listeners demonstrate significantly higher speech understanding and sound quality than provided by the cochlear implant or hearing aid alone.

Recommendations (See Appendix 1: Section 2.0, 2.3.1.)

1. Ensure that your client's hearing aid fitting is optimal and that additional technologies such as remote microphones and other assistive listening devices have been prescribed where appropriate. **See sections 2.0 and 2.2** .

2. Understand your national/local criteria for cochlear implant referrals. Candidacy criteria for each country/region are different and it is vital to know which of your clients would be suitable candidates, including when bilateral cochlear implantation may be an option.
3. Consider referral for a cochlear implant long before the point of failure with hearing aids. Hearing aids need not be the final stop on their hearing journey.
4. Start the conversation by introducing the cochlear implant as a part of a continuum of care that starts with hearing aid use and ultimately progresses to cochlear implant use. See Table 11 .
5. Ensure your client's chances of achieving their maximum auditory potential by beginning the conversation about cochlear implant early in their audiological care. The conversation can start well before your client reaches criteria levels.
6. Referral by the hearing care professional is in essence a suggestion that their client seeks additional information about cochlear implants. Candidacy will be determined by a multidisciplinary team.
7. Encourage clients to consider assessment for a cochlear implant and help them recognize that they are agreeing only to an assessment and not consenting to implantation at that point.
8. Keep the referral pathway simple and clear. Hearing care professionals should make connections with their local cochlear implant centers to encourage queries and understand the local pathway.
9. Audit your performance regarding cochlear implant referral: monitor how many of your clients enquired about implants and the number, quality, and outcome of referrals. Add a section in the notes template for people with severe and profound hearing loss specifically about CI referral, to support continuity of care and audit of CI referral counseling in a service.
10. The hearing care professional should feel confident in returning to this conversation at regular points in the client pathway, as it is often a process rather than a one-off juncture.

2.3.2. Understand the Benefits of Bimodal Fittings

Objective

The continuum of care which starts with hearing aid use and ultimately progresses to cochlear implant achieves the maximum auditory potential by using both ears. A bimodal fitting is one with a hearing aid on one ear and a cochlear implant on the other. Aided acoustic hearing may not afford high levels of speech understanding alone, and when combined with a cochlear implant, bimodal listeners demonstrate significantly higher speech understanding and sound quality than provided by the cochlear implant or a hearing aid alone.

Recommendations (See Appendix 1: Section 2.0, 2.3.2.)

1. The hearing care professional should expect that cochlear implant candidates will continue to use and receive ongoing care of their hearing aid following implantation.
2. Bimodal listeners demonstrate significantly higher speech understanding and sound quality than provided by the cochlear implant or hearing aid alone. See Table 12 .

2.3.3. Understand the Limitations of Other Implantable Devices for This Population

Objective

The selection of available auditory implants has expanded in recent years such that there are now several potential treatment options. As a result, hearing care professionals not working with auditory implants may face some confusion regarding the best options for their clients.

Middle ear implants are designed to use mechanical energy to drive the inner ear with an implanted vibrational transducer attached to the ossicles, oval window, or round window membrane. Bone conducting hearing implants (also referred to as bone anchored implants) utilize bone conduction from an externally worn sound processor to stimulate the internal auditory system via percutaneous coupling to an osseointegrated titanium implant, transcutaneous magnetic coupling to an implanted titanium implant, or transcutaneous stimulus delivery via conventional oscillatory bone conduction transduction with the sound processor placed on a soft band or hard band—similar to bone conduction audiometry.

Middle ear implants require a functional and intact middle ear system and both middle ear implants and bone conducting hearing implants require sufficiently functioning inner hair cells for effective cochlear stimulation, as 95% of afferent auditory nerve fibers are innervated by our inner hair cells.

Auditory brainstem implants are used to treat total deafness in both ears caused by damage to the 8th nerve as a result of tumors or surgery, where hearing is not improved by hearing aids and/or cochlear implants. The procedure is suitable for a small proportion of patients who have complete hearing loss for whom no alternative treatment would restore hearing. Procedure numbers are generally low and are completed in a limited number of hospitals.

Individuals with bilateral severe and profound sensorineural hearing loss as discussed in these guidelines have a higher likelihood of having cochlear dead regions limiting their benefit from hearing technologies located peripherally to the lesion—namely extracochlear technologies such as hearing aids, middle ear implants, and bone conducting hearing implants.

Recommendations (See Appendix 1: Section 2.0, 2.3.3.)

1. For individuals with bilateral severe and profound sensorineural hearing loss, typically neither middle ear implants nor bone anchored implants are viable treatment options.
2. Hearing care professionals should seek information and support from relevant medical professionals for specific clients with auditory brainstem implants.

3. Rehabilitation: Psychosocial and Communication

Key Concepts

3.1. Help in Adjusting to Life with Severe and Profound Hearing Loss

Objective

Technology plays an important role in treatment options for severe and profound hearing loss. How well a client responds to any audiological intervention depends in part as to how well they can adjust to their everyday communication challenges and how they manage their personal relationships. The hearing care professional must therefore take steps to understand where they are in making this adjustment and offer support where needed to help them manage their hearing in everyday life, beyond providing hearing technologies.

Recommendations (See Appendix 1: Section 3.1.)

1. The hearing care professional should always check whether their client is able to follow their discussions in the clinic. The hearing care professional should be familiar with the local communication support options or have other strategies for communication such as typing notes throughout the appointment and sharing them with the client at the end. **See section 1.1** .
2. The hearing care professional should use appropriate language and terminology individualized to the client in any information and advice. Failure to check the client's understanding is the single most common reason for clients' limited compliance with recommendations and hearing care professionals' failure to offer appropriate interventions.
3. The hearing care professional should explore each client's individual attitudes to the severe communication challenges they face. These vary with personality, impact of the stigma of hearing loss, family and other circumstances, changes in their identity through hearing loss, sources of support, additional health issues, and hearing history. **See section 1.3** and Table 13 . This information should feed into the individualized person-centered counseling to support personal adjustment.
4. The hearing care professional should explore and address the psychosocial impact of the hearing loss, such as shame, guilt, anger, and embarrassment and acknowledge these in addition to providing strategies to reduce this. This should be delivered in a person-centered approach with the hearing care professional partnering the client, empowering them, and supporting them to adhere to the treatment interventions they have considered. **See section 1.4** .
5. The hearing care professional should include the third-party disability information gathered at the diagnostic assessment to cover information and support for the client's communication partners. **See sections 1.3 and 2.2.1** and Table 13 .
6. To bring about the behavior change necessary for clients with severe and profound hearing loss to achieve maximum amplification satisfaction and outcomes, the hearing care professional should go far beyond giving instruction/information. Use should be made of motivational engagement and the client should be offered the opportunity to develop effective self-management techniques.
7. More than any other client group, the hearing care professional should explore the client's beliefs about their outcomes with all the chosen interventions outlined in their individual management plan and help manage expectations at regular parts of their pathway. **See sections**

1.3 and 1.4 .

8. The incidence of clinical depression and anxiety in clients with severe and profound hearing loss is high. Early consideration and onward referral where appropriate are essential to ensure the client can derive maximum benefit from hearing devices and rehabilitation. **See section 1.2** .
9. Where appropriate the hearing care professional should help educate the client with self-management strategies, for example, on conversation repair strategies, lipreading, and adapting their environment.

3.2. Training to Develop Effective Communication Practices with Client and Family

Objective

All clients with severe and profound hearing loss will need to supplement their amplified hearing with speech reading and other communication strategies. Communication training, including auditory training, is a process designed to enhance the ability to interpret auditory experiences by maximizing residual hearing and by using other cues, for example, visual cues to add further information to the listening situation.

The hearing care professional needs to understand the client's presenting communication competence and style to recommend an appropriate program of communication training. In many circumstances, this type of support may be provided outside the clinic; so, the hearing care professional must maintain a good network of onward referral agencies.

Recommendations (See Appendix 1: Section 3.2.)

It is essential to discuss with the client how effective they believe their current communication strategies are, in their family, social life, workplace, and health care settings. If possible, direct observation of how the client communicates with the communication partner should be undertaken to supplement the client's self-report.

1. It is important to characterize the individual needs of each client and to tailor the communication training accordingly.
2. Time should be devoted to understanding the client's motivations and their perceived self-efficacy when considering how to improve their competence.
3. Where appropriate, the client will need help to understand the importance of devoting time and effort to communication training.
4. Most clients with severe and profound hearing loss will need communication skills training both on a one-to-one and on a group basis. If severely maladaptive strategies are observed, onward signposting to an external agency is required. See Table 14 .
5. Information should be provided on local speech reading classes, self-help groups, and other communication strategy training opportunities, together with some indication of how well suited such provision is for the client's personal situation. Assistance with establishing contact

with suitable providers should be offered. This requires the hearing care professional to maintain up-to-date knowledge of what is available in their local community and a good network with other agencies offering rehabilitation programs. See Table 14 .

6. The client should always be signposted to communication training and practice materials available online including synthetic avatars, DVD, and printed materials, either as a complement or as an alternative to attending a live course. See Table 14 .
7. The self-management of the client should be supported to enhance the motivation of the client and to achieve the best results.
8. Attention should be given to the communication strategies employed by the client's communication partners, with appropriate training made available to them where necessary.
9. The client should be offered training in how to bring about behavioral change in others so that they can manage communication partners who are unwilling or unable to attend for direct training.

3.3. Contact with Peers to Provide Support and to Reduce Isolation

Objective

If not managed well, the feelings of isolation, marginalization, and loneliness associated with severe and profound hearing loss can result in the client withdrawing from social contact, leading to adverse mental health consequences and increased risk of accelerated cognitive decline. The hearing care professional should always facilitate clients with severe and profound hearing loss to meet others with a similar degree of hearing loss, as peer support is the most effective and efficient way of averting these consequences.

Peer support plays an important role in adult hearing rehabilitation as peer support opportunities create a wider, more realistic understanding of the consequences of hearing loss for both the client and their wider support network. They share a range of hearing loss journeys which can be helpful for clients with severe and profound hearing loss. They help address the stigma, coming to terms with the severity of the hearing loss and provide a unique perspective that complements that of the hearing care professionals.

Recommendations (See Appendix 1: Section 3.3.)

1. All clients with severe and profound hearing loss should be encouraged to meet others who share a similar hearing history and degree of hearing loss, but most importantly share an understanding of the problems they are facing. This can be achieved through recommending local support or communication groups and/or virtual channels, e.g., online forums. See Table 15 .
2. Where possible, the hearing care professional should build and maintain a small network of adults with severe and profound hearing loss who are well-adjusted and who agree to be contacted by new clients. Training in managing confidentiality and client boundaries must be made available to these adults, with the opportunity for debriefing on a regular (though not necessarily frequent) basis.

3. The most powerful way to achieve peer support is through small-group experiences in a carefully managed framework. These might be highly structured groups, or more self-directed; what matters is that clients can meet other people facing similar challenges to share experiences and solutions.
4. It can be invaluable to include communication partners in such groups.
5. Group experiences may be offered in the clinic setting but are often available through external organizations such as local authorities and charities. The hearing care professional should maintain up-to-date knowledge of all such services and how to make referrals.
6. Referral into such a service is an urgent priority if the client has had a sudden loss or appears to have largely withdrawn from family and social life. Many clients identify these experiences as a turning point in coming to terms with and actively managing their hearing loss.
7. Information should be provided on all local and national organizations that offer contact, information, and support beyond the clinic (e.g., hard of hearing clubs, self-help groups, lipreading classes, associations for people of specific professional backgrounds). Help should be offered in identifying which organization or organizations are most relevant to each client with severe and profound hearing loss given the client's location, circumstances, and preferences.

3.4. Guidance in Selecting and Using Appropriate Assistive Listening Device Solutions

Objective

Hearing aids and cochlear implants have limitations for all listening situations and other devices can be useful either through device streaming or as standalone products. The hearing care professional needs to understand the client's most common or important communication situations (both near and far-field) to recommend appropriate systems to complement the hearing device, and then ensure that the client has an opportunity to trial these systems and practice with those that suit their needs best.

Recommendations (See Appendix 1: Section 3.4.)

1. Hearing care professionals should explore the situations that matter most for their clients. This should include both current activities and places the client used to enjoy but stopped attending when their hearing deteriorated (e.g., the theater, public meetings, and social gatherings). **See sections 1.3 and 2.2** and Table 16 .
2. The hearing care professional should maintain an up-to-date knowledge of the types of assistive listening solutions appropriate for each type of environment. This includes inductive loops, alerting devices, Bluetooth, and Wi-Fi for acoustic information as well as text-based communication support systems (including captions, subtitles, and surtitles for live and recorded performances as well as personal communication systems), especially recent developments using cell/mobile phone technology at minimal or no cost. **See section 2.2** .
3. Unless contraindicated, the hearing care professional should activate the t-coil where fitted and arrange for the client to experience a good working inductive loop, as this remains the most widespread and effective way to hear well in public spaces. **See section 2.0** .

4. The client should be provided with the opportunity to try any potentially helpful assistive listening devices, ideally on location (e.g., their own home and a social club).
5. If the clinic is not able to provide regularly updated assistive listening equipment and/or advice, relationships should be built with other local providers who can fulfill this requirement (e.g., charity or other hearing or sensory resource center).
6. The hearing care professional should remain up to date with any local authority provision or other sources of financial assistance in purchasing devices.
7. Where available, the client should be given information about hearing dogs and encouraged to explore their eligibility where interested.

4. Tinnitus

Key Concepts

4.0. Management of Tinnitus in Severe and Profound Hearing Loss Objective

Tinnitus is defined as the perception of sound in the absence of an external source. It is typically described by those who experience it as a ringing, hissing, buzzing, or whooshing sound and is thought to result from abnormal neural activity at some point or points in the auditory pathway which is erroneously interpreted by the brain as sound. Tinnitus can be either objective or subjective. Objective tinnitus refers to the perception of sound that can also be heard by the examiner and is usually due to blood flow or muscle movement. Most commonly, however, tinnitus is subjective; the sound is heard only by the person experiencing it and no source of the sound is identified. Tinnitus can be experienced acutely, recovering spontaneously within minutes to weeks, but is considered chronic and unlikely to resolve spontaneously when experienced for 3 months or more.

The objective of this document is to draw on evidence in the current scientific literature around tinnitus to identify, adapt, or create a set of best practice recommendations that are applicable specifically to adults with severe and profound hearing loss.

4.1. Medical Treatment

Objective

Subjective tinnitus is a highly complex condition with a multifactorial origin and, therefore, heterogeneous patient profiles. The hearing care professional should conduct a careful and thorough tinnitus history as part of the diagnostic assessment. A range of questionnaires are available to guide tinnitus history-taking (see Table 1 above and Table 17 .). An assessment tool such as a questionnaire should also be used to track the progress of the tinnitus treatment.

Recommendations (See Appendix 1: Section 4.1)

1. Otoscopic examination should exclude cerumen as a likely source of tinnitus from the constant wearing of earmolds.
2. The hearing care professional should refer the client for ENT investigation to exclude underlying medical abnormalities and medical treatment to relieve the tinnitus. **See section 1.1** .
3. The hearing care professional must refer the client for ENT investigation in the case of sudden onset of severe and profound hearing loss or acute tinnitus. This should be treated as a medical emergency and the client should be seen urgently. **See section 1.1** .
4. Returning clients with long-standing tinnitus should be reviewed at regular intervals and referred to ENT if changes are reported in the absence of progression in the hearing loss. **See section 1.1** .

4.2. Address the Hearing Loss

Objective

Subjective tinnitus affects 10 to 19% of the general population, increasing to as many as 30% of adults over the age of 50 years. The prevalence of tinnitus in individuals with hearing impairment is 50%, and a very similar percentage of tinnitus symptoms is observed in individuals with severe and profound hearing loss. For adults with profound hearing loss presenting for cochlear implantation, between 67 and 100% reported tinnitus. Tinnitus improved postsurgery in 28 to 51% of the cases and was abolished in 20% of the cases. However, there is no clear association between the severity of hearing loss and the severity of tinnitus perception (see Table 17).

Recommendations (See Appendix 1: Section 4.2)

1. It is vital to address the hearing loss as the first step in tinnitus management. If the hearing loss is aidable, then review the hearing aid fitting to ensure that the maximum audibility possible for environmental sounds as well as speech is achieved. **See section 2.0** .
2. If the hearing loss is not aid-able, consider referral for cochlear implant assessment to address the hearing loss as the first line of tinnitus management. Counsel the client that treating the hearing loss is likely to bring some relief from tinnitus. **See section 2.3** .

4.3. Therapies for Tinnitus

Objective

People with severe and profound hearing loss who suffer from a moderate to severe tinnitus are candidates for tinnitus specific therapy. Sound therapies, including sound enrichment strategies have limited benefits when severe and profound hearing loss is present. In the case of severe and profound hearing loss, Carlsson et al [8] found that 38% of those who reported tinnitus also re-

ported their quality of life to be negatively impacted. It is recommended that a treatment focusing on tinnitus-related anxiety or depression must be given early in the rehabilitation process in clients with severe or profound hearing impairment.

Recommendations (See Appendix 1: Section 4.3)

1. Treatment using tinnitus noise generators in hearing aids should be used with extreme care when severe and profound hearing loss is present. Avoid applying masking noise in speech programs due to restricted dynamic range (reduced range between audibility and loudness discomfort) and the critical importance of sparse speech cues.
2. When sound enrichment is used, choose a dedicated tinnitus noise generator or if the generator is already offered in a hearing aid, set up a separate-for-tinnitus-only hearing aid program. Given the severe and profound degree of hearing loss, ensure that the level of the enrichment sound is sufficient to be audible but not so loud as to be heard by a listener nearby.
3. Simple sound therapies include the use of sound enrichment from sources already in the home such as the radio, TV, or HiFi music system. For severe and profound hearing loss, recommending this type of sound enrichment must be approached with care. Ensure that the volume required to be effective will not mask out important safety and environmental sounds such as phone, doorbell, and alarms or cause undue disturbance to family or neighbors.
4. If the tinnitus is still disturbing, tinnitus-specific therapies are indicated. Referral for specialized tinnitus management should be considered. Cognitive behavioral therapy (CBT) is a recommended, evidence-based treatment. The intention of CBT is to modify dysfunctional behaviors and beliefs of the patients to reduce the tinnitus symptoms (e.g., sleep disorders), and to increase daily life functioning. CBT is usually applied by psychologists or specially trained audiologists. Tinnitus retraining therapy (TRT) is no longer recommended by current clinical guidelines but might provide relief to some individuals with tinnitus.
5. Due to the severity of hearing loss, any tinnitus therapies should be delivered face-to-face to enable optimum communication, and therefore success.
6. Consider referral for specialized treatment of anxiety and depression if these are suspected. Anxiety and depression are common cosymptoms of tinnitus and are generally more likely in individuals with severe and profound hearing loss. Any signs of clinical anxiety or depression should immediately initiate a referral to a suitable professional. **See section 1.2** .
7. Further research should be undertaken on tinnitus with a severe and profound hearing loss. Further evidence-based recommendations are required for this specialized population.

5. Measuring Outcomes and Long Term Management

Key Concepts

5.1. Measurement of Patient-Reported Outcomes and Assessment of Treatment Goals

Objective

The assessment of outcomes is a key part of evidence-based clinical practice, to assess the effectiveness of interventions, to enhance and monitor individual care, and to evaluate services. Currently, there is general agreement on the importance of measuring outcomes, but poor consensus about the most appropriate assessment tools and no questionnaires developed specifically for those with severe and profound hearing loss.

Recommendations (See Appendix 1: Section 5.1.)

1. At present, patient-reported outcome measures (PROMs) represent the most effective way of capturing comprehensive information about benefit of an intervention.
2. An outcome questionnaire should be used to assess functional performance, to identify need for amplification review, to help assess if goals have been met, and to identify needs for further rehabilitation. **See sections 1.3 and 2.2.1** . and Table 18 .
3. For maximum sensitivity and clinical usefulness, outcome questionnaires should be specifically in the hearing domain.
4. The chosen questionnaire should have proven reliability, validity, and sensitivity and have normative data available.
5. Outcome questionnaires for this population should capture the change resulting from an intervention but not be restricted to unaided/aided comparisons, as many patients will be long-term hearing aid users.
6. Future developments of alternative methods of capturing outcome data should be explored as they become available. For example, ecological momentary assessment offers potential, as it yields information that is less dependent on subjective recall.
7. An outcome questionnaire should be produced specifically for this population.

5.2. Assessing Need for Onward Referral

Objective

Hearing care professionals should ensure appropriate onward referrals are made to deliver best hearing outcomes.

Recommendations (See Appendix 1: Section 5.2)

1. Hearing care professionals should ensure they are aware of criteria for candidacy for cochlear implants and seek advice from their local cochlear implant service. **See section 2.3** . and Table 19 .
2. Aided speech performance should be regularly tested. This enables monitoring of functional benefit of hearing aids over time and is key to assessing candidacy for cochlear implant referral. **See sections 1.1 and 2.3 & Table 19** ..
3. Ensure hearing device provision is fully optimized before cochlear implant referral. The client should be made aware of options for additional technology such as remote microphones that may aid speech intelligibility in complex listening environments. The opportunity to trial should

be offered where possible and appropriate. **See sections 2.0 and 2.2** .

4. Referral to an ear, nose, and throat specialist may be indicated for a patient with conductive hearing loss if not previously investigated, or with any disease of the outer or middle ear that may hinder hearing aid use. **See section 1.1** .
5. Onward referral to other agencies should be made at any stage of the rehabilitative journey to ensure wider support for those with severe and profound hearing loss. **See section 3.0** .

5.3. Ensuring Appropriate Ongoing Management

Objective

The management of severe and profound hearing loss is an ongoing process of continued hearing device optimization and maintenance, promotion of self-management strategies, provision of advice and support, and onward referral where appropriate. Hearing care professionals need to continually develop their skills to optimally manage this complex group.

Recommendations (See Appendix 1: Section 5.3)

1. Clients with severe and profound hearing loss should have follow-up after an intervention to support them to optimally use their devices and manage listening environments. In general, this should be face to face as phone use may be a challenge without lipreading cues. Visual online follow-up may be appropriate. **See section 3.0** .
2. Clients with severe and profound hearing loss should have easy access to ongoing care and maintenance to ensure hearing aids are in good working order with well-fitting earmolds and frequent tubing changes.
3. Clients with severe and profound hearing loss should be directed to other sources of support and rehabilitative interventions. **See section 3.0** .
4. Clients with severe and profound hearing loss should be seen for regular review at least every 3 years, or more frequently if hearing changes, to check hearing and optimize amplification. **See sections 1.0 and 2.0** .
5. More frequent review may be indicated for clients close to cochlear implant criteria to ensure referral is not delayed. **See section 2.3** .
6. Hearing care professionals should be proactive in discussing cochlear implants with those with progressive hearing loss to raise awareness of this as a possible future treatment option. **See section 2.3** .
7. Professionals involved in the care of clients with severe and profound hearing loss should continue to develop their skills and knowledge in the audiological management of this population.
8. Hearing care professionals specializing in seeing clients with severe and profound hearing loss may benefit from shared learning communities with other services as numbers of clients per clinic may be low. This could incorporate case discussions, problem-based learning, and online forums.

6. Summary and Conclusions

Adults with severe and profound hearing loss need additional considerations for their assessment, treatment and follow up care when compared to their better hearing peers. To deliver appropriate care for this population they require additional time in a clinical setting so that the recommendations outlined in these guidelines can be delivered appropriately.

The hearing care professionals should care for the client beyond their condition and deliver person-centred care in developing their treatment plans through actively encouraging the client to be part of the joint decision-making process. Through getting to know the client and understanding their individual needs and preferences the clinical outcomes are likely to be more successful.

When presenting all the treatment options outlined in these guidelines it is important that the hearing care professional offers choices far wider than prescribing hearing aids. These guidelines address much more than the technical aspects of hearing device selection, fitting, verification, validation, and counselling within the context of a comprehensive treatment plan. Hearing aid technology alone will often not impact on the client's needs fully and other strategies outlined here should be discussed and considered with the client. When hearing aid technology is supplied, it should be fitted optimally so that the client gets maximum benefit from their technology.

Hearing care professionals should be comfortable in discussing cochlear implants with all clients who are on or around referral criteria. This should be considered as starting the conversation on this treatment option rather than the clients committing to this option by accepting a referral to a cochlear implant center. Ultimately, the client can decline this option as part of their treatment but hearing care professionals have a responsibility to outline all treatment options that a client may be suitable for.

Technology often plays a key role in the rehabilitation for this population and amplification devices and implantable systems, hearing and communication equipment and strategies for electric stimulation, will continue to improve and develop. In addition, specialized tools and methods to capture and measure different rehabilitative outcomes will be developed in the coming years too. All of this will benefit clients with a severe and profound hearing loss.

Throughout these guidelines there are assertions around the lack of evidence for this population. On occasions the authors have had to use non-direct evidence from pediatrics, cochlear implant studies and research for mild and moderate populations, or the evidence in some cases is at a lower level of recommendation than the authors would have liked. The research community needs to address this so that, at each review and revision of these guidelines the evidence is strengthened, and more is revealed. This research may lead to alternative treatment options beyond those outlined in these guidelines and may provide more clinical tools which are specifically designed for clients with severe and profound hearing loss, making them more specific and sensitive to this group.

With potential changes in delivery of care for these clients, new research, new tools and new treatments there is also a need for professional training. This should be considered by education providers of new hearing care professionals, professional bodies and by those who deliver continued professional development opportunities to those already in the profession. This is particularly needed if the hearing care professional only sees low numbers of clients with severe and profound hearing loss, annually.

Finally, once these recommendations are being used by hearing care professionals it is also recommended that the clients are encouraged to feedback on the services being delivered and their responses are considered by the hearing care professional.

6.1. Declaration of Interests from the Authors

6.3. Date for Review of Guidelines

These guidelines will be reviewed 5 years from publication in 2020. Revision is planned for 2025.

5. Measuring Outcomes and Long-Term Management

5.1. Measurement of Outcomes and Assessing if Treatment Goals have been Addressed

Key Concepts

5.2. Measuring Outcomes: Assessing Need for Onward Referral

Objective

5.3. Measuring Outcomes: Ensuring Appropriate On-going Management

Objective

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Appendix 1 - Summary of Evidence Applicable to each Recommendation

There are numerous review papers and opinion pieces in the field. Where possible only those reporting primary quantitative and qualitative findings are included in these guidelines.

Levels of Evidence

1. Systematic reviews and meta-analyses of randomized controlled trials
2. Randomized controlled trials
3. Non-randomized intervention studies
4. Descriptive studies (cross-sectional surveys, cohort studies, case-control designs)
5. Case studies
6. Expert opinion

Grades of Recommendation

A. Consistent level 1 or 2 studies
B. Consistent level 3 or 4 studies or extrapolations from level 1 or 2 studies
C. Level 5 studies or extrapolations from level 3 and 4 studies
D. Level 6 evidence or troubling inconsistencies or inconclusive studies at any level

Types of Evidence

Evidence of efficacy (EF) measured under "laboratory or ideal" conditions and evidence of effectiveness (EV) is measured in the "real" world.

Evidence sourced for mild-to-moderate hearing loss (MM), pediatrics (P) or cochlear implants (CI) is noted.

1. Audiological Assessment of Severe and Profound Hearing Loss

1.1. Obtaining Diagnostic Information

1.2. Assessment: Non-auditory Needs

1.3. Assessment: Understanding the Client's Self-perception, Motivation, Communication Needs and Treatment Goals

1.4. Assessment: Developing a Comprehensive Treatment Plan

2. Selecting Technology

2.1. Hearing Aids

2.1.1. Compression

2.1.2. Hearing Aids: Device Choices and Programmes

2.1.3. Hearing Aids: Frequency Lowering

2.1.4. Hearing Aids: Prescriptions and Verification

2.1.5. Hearing Aids: Selecting Technology for Asymmetrical Severe and Profound Loss

2.1.6. Hearing Aids: Maximum Power Output and Threshold Shift

2.0. Selecting Technology Continued

2.2. Prescribing and Fitting Remote Microphones

2.2.1. Remote microphones Recommending and Managing Ongoing Use

2.2.2. Prescribing and Fitting Remote Microphones: Component Considerations

2.2.3. Remote Microphones: Verification

2.0. Selecting Technology Continued

2.3 Cochlear Implants

2.3.1 Referral for a Cochlear Implant

2.3.2 Cochlear Implant: Bimodal Fitting

2.3.3 Other Implantable Devices

3.0. Rehabilitation: Psychosocial and Communication

3.1. Help in Adjusting to Life

3.2. Rehabilitation: Training to Develop Effective Communication Strategies, with Clients and Family

3.3. Rehabilitation: Contact with Peers to Provide Support and Reduce Isolation

3.4. Rehabilitation/Selecting and using Appropriate Assistive Listening Solutions

4.0. Tinnitus

4.1. Tinnitus: Check whether Medical Treatment is Required

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Figures and Tables

Table 1

Useful Tools for Obtaining Diagnostic Information

Tool	Reference
Speech tests	
AB word lists	Boothroyd A. Developments in speech audiometry. *Br J Audiol* 1968;2(1):3–10 [27]
AzBio sentence lists (available in multiple languages)	Spahr A, Dorman M, Litvak L, et al. Development and validation of the AzBio Sentence Lists. *Ear Hear* 2012;33(1):112–117 [28]
BKB-A sentence lists	Bench J, Kowal A, Bamford J. The BKB (Bamford-Kowal-Bench) sentence lists for partially-hearing children. *Br J Audiol* 1979;13(3):108–12 [29]
BKB-SIN test	Niquette P, Arcaroli J, Revit L, et al. Development of the BKB-SIN Test. Paper presented at: American Auditory Society Annual Meeting; 2003; Scottsdale, AZ [30]
CUNY sentence lists	Boothroyd A, Hanin L, Hnath T. A sentence test of speech perception: reliability, set equivalence, and short term learning. CUNY Academic works. https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1443&context=gc_pubs . 1985. Accessed February 9, 2019 [31]
CNC word lists (available in a range of dialects)	Peterson G, Lehiste I. Revised CNC Lists for auditory tests. *J Speech Hear Dis* 1962;27(1):62–70 [32]
HINT sentences (available in multiple languages)	Nilsson M, Soli S, Sullivan J. Development of the Hearing in Noise Test for the measurement of speech reception thresholds in quiet and in noise. *J Acoust Soc Am* 1994;95(2):1085–1099 [33]
QuickSIN	Etymotic Research. Quick Speech-in-Noise Test (Version 1.3) - User manual. https://www.etymotic.com/downloads/dl/file/id/259/product/159/quicksin_user_manual.pdf . Updated 2006 [34]
Words in Noise (WIN) test	Wilson R, Carnell C, Cleghorn A. The Words-in-Noise (WIN) Test with multitalker babble and speech-spectrum noise maskers. *J Am Acad Audiol* 2007;18(6):522–529 [35]
Tinnitus questionnaires	
Tinnitus Functional Index (TFI)	Henry JA, Stewart BJ, Abrams HB, et al. Tinnitus Functional Index - development and clinical application. *Audiology Today* 2014;26(6):40–48 [36]
Tinnitus Reaction Questionnaire (TRQ)	Wilson PH, Henry J, Bowen M, Haralambous G. Tinnitus Reaction Questionnaire: Psychometric properties of a measure of distress associated with tinnitus. *J Speech Hear Res* 1991 34(1) 197–201 [37]
Tinnitus Handicap Inventory (THI)	Newman CW, Jacobson GP, Spitzer JB. Development of the Tinnitus Handicap Inventory. *Arch Otolaryngol* 1996;122(2):143–148 [38]

Table 2

Useful Tools for Non-Auditory Needs Assessment (Some of these tools will not be administered by the hearing care professional but will be used by other health care professionals. It is important the hearing care professional understands the local setup for referrals and the use of these tools. See above.)

Tool	Reference
General health tests	
EuroQOL (EQ-5D)	EuroQol Research Foundation. EQ-5D-5L User Guide. https://euroqol.org/publications/user-guides . Updated 2019 [41]
Health Utilities Index (HUI)	Horsman J, Furlong W, Feeny D, Torrance G. The Health Utilities Index (HUI®): concepts, measurement properties and applications. *Health Qual Life Out* 2003;1:1–13 [42]
Nottingham Health Profile (NHP)	Hunt SM, McKenna SP, McEwen J, Williams J, Papp E. The Nottingham health profile: subjective health status and medical consultations. *Soc Sci Med* 1981;15(3):221–229 [43]
Short Form—36 Health Survey (SF-36)	Ware JE, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36): I. Conceptual Framework and Item Selection. *Med Care* 1992;30(6):473–483 [44]
Sickness Impact Profile (SIP)	Bergner M, Bobbitt RA, Carter WB, Gilson BS. The sickness impact profile: development and final revision of a health status measure. *Med Care* 1981;19(8):787–805 [45]
World Health Organization Measure of QOL (WHO-QOL)	World Health Organization (WHO). Microsoft Word – 95 FT 100 Q's.doc. https://www.who.int/mental_health/evidence/WHOQOL_100.pdf?ua=1 . Updated 1995 [46]
Tests for cognition/mental health	
6CIT Six-item Cognitive Impairment Test	Brooke P, Bullock R. Validation of a 6 item cognitive impairment test with a view to primary care usage. *Int J Geriatr Psychiatry* 1999;14(11):936–940 [47]
Beck Depression Inventory (BDI)	Beck AT, Steer RA, Ball R, Ranieri W. Comparison of Beck depression inventories – IA and II in psychiatric outpatients. *J Pers Assess* 1996;67(3):588–597 [48]
Cambridge Cognitive Examination (CAMCOG: short version of CAMDEX and CAMTAB app)	Huppert FA, Brayne C, Gill C, Paykel ES, Beardsall L. CAMCOG: a concise neuropsychological test to assist dementia diagnosis: socio-demographic determinants in an elderly population sample. *Br J Clin Psychol* 1995;34:529–541 [49] Cambridge Cognition Ltd. CANTAB app. www.camcog.com [50] Roth M, Tym E, Mountjoy CQ, Huppert, FA. CAMDEX: a standardized instrument for the diagnosis of mental disorders in the elderly with special reference to early detection of dementia. *Br J Psychiatry*

Table 3

Useful Tools for Understanding the Client's Self-Perception, Motivation, Communication Needs, and Treatment Goals

Tool	Reference
Expectation questionnaires	
Expected Consequences of Hearing Aid Ownership (ECHO)	Cox RM, Alexander GC. Expectations about hearing aids and their relationship to fitting outcome. *J Am Acad Audiol* 2000;11(7):368–382 [75]
Characteristic of Amplification Tool (COAT)	Sandridge S, Newman C. Improving the efficiency and accountability of the hearing aid selection process - use of the COAT. AudiologyOnline.com. https://www.audiologyonline.com/articles/improving-efficiency-and-accountability-hearing-995 . 2006. Accessed February 9, 2019 [68]
Needs analysis questionnaires	
Client-Orientated Scale of Improvement (COSI)	Dillon H, James A, Ginis J. Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *J Am Acad Audiol* 1997;8:27–43 [76]
Glasgow Hearing Aid Benefit Profile (GHABP)	Gatehouse S. Glasgow Hearing Aid Benefit Profile: derivation and validation of client centered outcome measures for hearing aid services. *J Am Acad Audiol* 1999;10:80–103 [77]
Glasgow Hearing Aid Difference Profile (GHADP)	Gatehouse S. Glasgow Hearing Aid Benefit Profile: derivation and validation of client centered outcome measures for hearing aid services. *J Am Acad Audiol* 1999;10:80–103 [77]
Hearing Handicap Inventory for the Elderly (HHIE)	Ventry IM, Weinstein BE. The Hearing Handicap Inventory for the Elderly: A new tool. *Ear Hear* 1982;3(3):128–134 [78]
Hearing Handicap Inventory for Adults (HHIA)	Newman C, Weinstein B, Jacobson G, Hug G. The Hearing Handicap Inventory for Adults: psychometric adequacy and audiometric correlates. *Ear Hear* 1990;11(6):430–433 [79]
Speech, Spatial and Qualities of Hearing scale (SSQ-12)	Noble W, Søgaard Jensen N, Naylor G, Bhullar N, Akeroyd M. A short form of the Speech, Spatial and Qualities of Hearing scale suitable for clinical use: The SSQ12. *Int J Audiol* 2013;52(6):409–412 [80]
Measures for communication partners	
The Hearing Impairment Impact-	Preminger J, Meeks S. The Hearing Impairment Impact Significant Other Profile (HIT-SOP): a tool to measure hearing loss-related quality of life in spouses of people with hearing loss.

Table 4

Useful Tools for Developing a Comprehensive Treatment Plan

Tool	Reference
A usable interpretation of individual management plans within adult rehabilitation questions and answers	Appendix 3 NHS Scotland: Quality Standards for Adult Hearing Rehabilitation Services - Audiology Services Advisory Group. http://www.knowledge.scot.nhs.uk/media/CLT/ResourceUploads/4076053/26fbc595-da89-4938-8c3d-a0511b747c2e.pdf . October 2008 [88]
Example of an individual management plan (IMP)	Appendix 5of the NHS Scotland: Quality Standards for Adult Hearing Rehabilitation Services - Audiology Services Advisory Group. http://www.knowledge.scot.nhs.uk/media/CLT/ResourceUploads/4076053/26fbc595-da89-4938-8c3d-a0511b747c2e.pdf . October 2008 [88]

Table 5

Useful Tools for Compression

Tool	Reference
Situational Hearing Aid Response Profile	Boys Town National Research Hospital. Situational Hearing Aid Response Profile (SHARP). Available at: http://audres.org/rc/sharp/ . 2014 [90]

Table 6

Useful Tools for Frequency Compression and Transposition

Tool	Reference
Frequency lowering fitting assistants	https://web.ics.purdue.edu/~alexan14/fittingassistants.html [91]
UWO Plurals Test	https://www.dslio.com/?page_id=314 [92]
Stimuli for verification of frequency lowering using Audioscan probe-microphone systems	https://www.dslio.com/?page_id=166 [93]
British Society of Audiology's practice guidance on the verification of hearing devices using probe microphone measurements	https://www.thebsa.org.uk/wp-content/uploads/2018/05/REMS-2018.pdf [94]
Phoneme Perception Test	https://www.phonakpro.com/au/en/resources/fitting-and-tests/phoneme-perception-test/overview-phoneme.html [95]

Table 7

Useful Tools for Prescriptions and Verification

Tool	Reference
Software for NAL-NL2 prescriptive procedure	https://shop.nal.gov.au/epages/nal.sf/en_AU/ObjectPath=/Shops/nal/Categories/Products/Hearing_Aid_Fitting_Prescriptions [96]
BSA Verification (2018)	British Society of Audiology (2018) Practice Guidance on the verification of hearing devices using probe microphone measurements. Available at: https://www.thebsa.org.uk/wp-content/uploads/2018/05/REMS-2018.pdf [94]

Table 8

Useful Tools for Maximum Power Output and Threshold Shift

Tool	Reference
SoundLog noise dosimeter app for iPhone	This free download, developed at NAL, measures noise levels and calculates noise exposure estimates. https://www.nal.gov.au/products/downloadable-software/soundlog/ [98]

Table 9

Useful Tools for Prescribing and Fitting Remote Microphones

Tool	Reference
Client Oriented Scale of Improvement (COSI)	Dillon H, James A, Ginis J. Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *J Am Acad Audiol* 1997;8:27–43 [76]
Goal Sharing for Partners (GPS)	https://idainstitute.com/tools/communication_partners/goal_sharing_for_partners/ [100]
Family Oriented Communication Assessment and Solutions (FOCAS)	Crowhen D, Turnbull B. FOCAS: Family Oriented Communication Assessment and Solutions: a new holistic tool for performance hearing needs assessments. Hearing Review. https://www.hearingreview.com/practice-building/focas-family-oriented-communication-assessment-solutions . 2018;20–26 [83]
TELEGRAM (Telephone, Employment, Legislation, Entertainment, Groups, Recreation, Alarms and Members of the family)	Thibodeau L. Maximizing communication via hearing assistance technology: plotting beyond the audiogram! *Hear J* 2004;57(11):46–51 [101]

Table 10

Useful Tools for Remote Microphone Verification

Tool	Reference
TELEGRAM (Telephone, Employment, Legislation, Entertainment, Groups, Recreation, Alarms, and Members of the family	Thibodeau L. Maximizing communication via hearing assistance technology: Plotting beyond the audiogram! *Hear J* . 2004; 57(11): 46–51 [101]
Client Oriented Scale of Improvement (COSI)	Dillon H, James A, Ginis J. Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *J Am Acad Audiol* 1997;8:27–43 [76]
Goal Sharing for Partners (GPS)	https://idainstitute.com/tools/communication_partners/goal_sharing_for_partners/ [100]

Table 11

Useful Tools for starting the Cochlear Implant Conversation with Clients

Tool	Reference
Practical guidance on assessing and counseling an adult for a CI referral section in "It's time to talk about cochlear implants"	*British Academy of Audiology: (BAA Guideline) It is time to talk about Cochlear Implants.* https://www.baaudiology.org/app/uploads/2020/04/CI_BAA_Dickinson_FINAL_BAAtitle4.pdf [109]
An information leaflet from your local cochlear implant center	
A demo implant and speech processor, available on request from manufactures. Find out which implants your local center uses	
The British Cochlear Implant Group (BCIG) Web site holds a great deal of general information on CIs and what to expect following a referral	https://www.bcig.org.uk [110]
Local recipients' group, e.g., the National Cochlear Implant Users Association (NCIUA) provides a wealth of information for potential candidates for implantation and	https://www.nciua.org.uk/your-implant/user-experiences/ [111]

Table 12

Useful Tools for Bimodal Fittings

Tool	Reference
Guidelines part 2 bimodal fitting	
Practical guidance and background information and evidence for fitting a hearing aid with a contralateral CI	Gifford R, et al. Guidelines for best practice in the audiological management of adults with severe and profound hearing loss. Part 2: Bimodal fitting (2020, unpublished data)

Table 13

Useful Tools for helping Clients in Adjusting to Life with Severe and Profound Hearing Loss

Tool	Reference
Adjusting to life with severe and profound hearing loss	
IDA institute tools	
Motivation Tools (the line, the box, and the circle)	https://idainstitute.com/tools/motivation_tools/?tx_idatoolbox_toolboxpagelist%5Bcontroller%5D=Toolbox&cHash=0d5d18956ebeaf1aef89cf06d78f3350 [84]
Goal Sharing for Partners (GPS)	https://idainstitute.com/tools/communication_partners/?tx_idatoolbox_toolboxpagelist%5Bcontroller%5D=Toolbox&cHash=b0753dadbeb8cb94fd02cb5294fd3407 [100]
Living Well Tools	https://idainstitute.com/tools/living_well/?tx_idatoolbox_toolboxpagelist%5Bcontroller%5D=Toolbox&cHash=9751b11308f242e60f8a2bebe98c2706 [86]
Expectation questionnaires	
Expected Consequences of Hearing Aid Ownership (ECHO)	Cox RM, Alexander GC. Expectations about hearing aids and their relationship to fitting outcome. *J Am Acad Audiol* 2000;11:368–382 [75]
Characteristic of Amplification Tool (COAT)	Sandridge S, Newman C. Improving the efficiency and accountability of the hearing aid selection process - use of the COAT. AudiologyOnline.com. https://www.audiologyonline.com/articles/improving-efficiency-and-accountability-hearing-995 . 2006. Accessed February 9, 2019 [68]
Measures for communication partners	
The Hearing Impairment Impact-Significant Other Profile (HII-SOP)	Preminger J, Meeks S. The hearing impairment impact significant other profile (HII-SOP): a tool to measure hearing loss-related quality of life in spouses of people with hearing loss. *J Am Acad Audiol* 2012;23(10):807–823 [81]
Significant Other Scale for Hearing Disability (SOS-HEAR)	Scarinci N, Worrall L, Hickson L. The effect of hearing impairment in older people on the spouse: development and psychometric testing of the Significant Other Scale for Hearing Disability (SOS-HEAR). *Int J Audiol* 2009;48(10):671–683 [82]
Family Oriented Communication Assessment and Solutions (FOCAS **)**	Crowhen D, Turnbull B. FOCAS: Family oriented communication assessment and solutions: a new holistic tool for performance hearing needs assessments. Hearing Review. https://www.hearingreview.com/practice-building/focas-family-oriented-communication-assessment-solutions . 2018;20–26 [83]

Table 14

Useful Tools for training to Develop Effective Communication Practices with Client and Family

Tool	Reference
Online rehabilitation tools and training modules	Hearingsuccess portal Comprehensive place for online auditory training resources to support the journey to better hearing www.HearingSuccess.com [112]
Computer-based auditory training programs	Henshaw H, Ferguson MA. Efficacy of individual computer-based auditory training for people with hearing loss: a systematic review of the evidence. *PLoS One* 2013;8:e62836 [113]
Rehabilitation groups	Group sessions to support self-management and to support clients with skills to live with their hearing loss. Groups can be either led by clinicians or by peers
Active communication education (group program)	https://shrs.uq.edu.au/active-communication-education-ace [114]
IDA Institute tools	
Motivation tools (the line, the box, and the circle)	https://idainstitute.com/tools/motivation_tools/?tx_idatoolbox_toolboxpagelist%5Bcontroller%5D=Toolbox&cHash=0d5d18956ebeaf1aef89cf06d78f3350 [84]
Group aural rehabilitation	https://idainstitute.com/tools/group_ar/?tx_idatoolbox_toolboxpagelist%5Bcontroller%5D=Toolbox&cHash=cae163518219f0d96686399844027fbf [115]
Speech reading	
Online speech reading and lipreading practice tools (free)	https://www.lipreading.org/ [116]
	http://www.storiesforlipreading.org.uk/ [117]
	https://www.lipreadingpractice.co.uk [118]
	https://www.wikihow.com/Read-Lips [119]
	https://www.readourlips.ca/ [120]

Table 15

Useful Tools for Contact with Peers to Provide Support and to Reduce Isolation

Tool	Reference
Find your local association	
	U.S. organization providing information and peer contact https://www.hear-it.org/ [121]
	UK self-help charity for people with acquired severe/profound hearing loss https://www.nadp.org.uk/ [122]
	Contact your local or national audiology association for information about established services, e.g.: https://www.hearinglink.org [123] Hearing Link UK: UK charity facilitating peer contact and delivering group-based peer programs http://www.actiononhearingloss.org.uk/ [124] UK charity supporting people with hearing loss, deafness, and tinnitus
	Contact your national association of people who are deaf or hard of hearing. https://www.ifhoh.org/ [125] International Federation of Hard of Hearing People. International organization influencing policy http://www.hearingloss.org [126] Hearing Loss Association of America. U.S. umbrella organization for self-help groups http://www.betterhearingaustralia.org.au/ [127] Better Hearing Australia (National) Australian independent consumer organization https://www.audicus.com/hearing-loss-support-groups/ [128] Hearing Loss Association of America database

Table 16

Useful Tools in Selecting and Using Appropriate Assistive Listening Device Solutions

Tool	Reference
Client Oriented Scale of Improvement (COSI)	Dillon H, James A, Ginis J. Client oriented scale of improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *J Am Acad Audiol* 1997;8:27–43 [76]
Goal Sharing for Partners (GPS)	https://idainstitute.com/tools/communication_partners/goal_sharing_for_partners/ [100]
Family Oriented Communication Assessment and Solutions (FOCAS)	Crowhen D, Turnbull B. FOCAS: Family oriented communication assessment and solutions: a new holistic tool for performance hearing needs assessments. Hearing Review. https://www.hearingreview.com/practice-building/focas-family-oriented-communication-assessment-solutions . 2018;20–26 [83]
TELEGRAM (Telephone, Employment, Legislation, Entertainment, Groups, Recreation, Alarms and Members of the family	Thibodeau L. Maximizing communication via hearing assistance technology: plotting beyond the audiogram! *Hear J* 2004;57(11):46–51 [101]
Tools	
Apps such as LoopFinder which are emerging in the US have great potential, currently with very limited geographic coverage.	HLAA Web site: https://time2loopamerica.com/loop-locator/ [129]
US ABLEDATA: database	Tools and technologies to enhance life: https://abledata.acl.gov [130]
EU EASTIN: database	European assistive technology information network at www.eastin.eu [131]
AU NED: database	https://ilcaustralia.org.au/ [132] Independent Living Centres Australia National Equipment Database
CA ORTC: organization	Ontario Rehabilitation Technology Consortium (Canada)
Live performance	http://www.stagetext.org/about-stagetext/info-and-services/captions-subtitles-and-surtitles [133]
Hearing Dogs	
Find your local hearing dog provider	https://www.hearingdogs.org.uk/ [134]
	https://www.pawswithacause.org/what-we-do/assistance-dogs/hearing-dogs/ [135]
	https://www.akc.org/expert-advice/training/hearing-dogs/ [136]

Table 17

Useful Tools for Audiological Management of Tinnitus (Note that None are Specifically Designed for Severe and Profound Hearing Loss)

Tool	Reference
Tinnitus questionnaires	
Tinnitus Functional Index (TFI)	The TFI is very useful to find the domains of life that are affected by the tinnitus (i.e., sleep). Meikle MB, Henry JA, Griest SE, et al. The tinnitus functional index: development of a new clinical measure for chronic, intrusive tinnitus. *Ear Hear* 2012;33(2):153–176 [138]
Tinnitus Reaction Questionnaire (TRQ)	Useful to measure distress related to tinnitus. Wilson PH, Henry J, Bowen M, Haralambous G. Tinnitus reaction questionnaire: psychometric properties of a measure of distress associated with tinnitus. *J Speech Hear Res* 1991;34:197–201 [37]
Tinnitus Handicap Inventory (THI)	Used to measure the impact of tinnitus on daily life. Newman CW, Jacobson GP, Spitzer JB. Development of the tinnitus handicap inventory. *Arch Otolaryngol* 1996;122:143–148 [38]
Tinnitus Questionnaire (TQ)	The TQ is used to assess tinnitus severity and to evaluate the relationship between different aspects of complaint. Hallam RS, Jakes SC, Hinchcliffe R. Cognitive variables in tinnitus annoyance. *Brit J Clin Psychol* 1998;27:213–222 [39]
Tinnitus and Hearing Survey (THS)	The short survey can be administered as a screening tool to differentiate bothersome tinnitus from hearing difficulties. Henry J, Griest S, Zaugg T, et al. Tinnitus and hearing survey: a screening tool to differentiate bothersome tinnitus from hearing difficulties. *Am J Audiol* 2015;24(1):66–77 [40]
Tests for cognition/mental health	
Hospital Anxiety and Depression Scale (HADs)	Note that people showing signs of clinical anxiety or depression should immediately be referred to a suitable professional. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scan* 1983;67(6):361–370 [54]
Advice on potential referrals to an ear, nose, and throat, clinic	
Known conditions associated with tinnitus	See Table 7 on page S20 of Cima RF, Mazurek B, Haider H, et al. A multidisciplinary European guideline for tinnitus: diagnostics, assessment, and treatment. *HNO* 2019;67(1):10–42 [139]
Tinnitus support available at self-run associations	

Table 18

In the Absence of Population Specific Alternatives, the following Tools are Useful as Hearing Intervention Outcome Questionnaires for Clients with Severe and Profound Hearing Loss

Tool	Reference
Client-Orientated Scale of Improvement (COSI)	Individualized, based on up to five user-nominated goals, categorized and with improvement subjectively rated. Dillon H, James A, Ginis J. Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *J Am Acad Audiol* 1997;8:27–43 [76]
Glasgow Hearing Aid Benefit Profile (GHABP)	Based on four standard and four user-nominated situations, assessing aspects of auditory disability, auditory handicap, and hearing aid benefit. Gatehouse S. Glasgow hearing aid benefit profile: derivation and validation of client centered outcome measures for hearing aid services. *J Am Acad Audiol* 1999;10:80–103 [77]
Glasgow Hearing Aid Difference Profile (GHADP)	Based on four standard and four user-nominated situations, assessing aspects of auditory disability, auditory handicap, and hearing aid benefit. Gatehouse S. Glasgow hearing aid benefit profile: derivation and validation of client centered outcome measures for hearing aid services. *J Am Acad Audiol* 1999;10:80–103 [77]
International Outcomes Inventory for Hearing Aids **(IOI-HA)**	Seven-item questionnaire covering use, benefit, residual limitations, satisfaction, participation, impact of others, and quality of life. The questionnaire has also been used as an outcome measure for people using cochlear implants (IOI-CI). A version has also been developed for alternative interventions (IOI-AI) Noble W. Extending the IOI to significant others and to non-hearing-aid-based interventions. *Int J Audiol* 2002;41(1):27–29 [140] Cox R, Hyde M, Gatehouse S, et al. Optimal outcome measures, research priorities, and international cooperation. *Ear Hear* 2000;21 (4):106S–115S [141]
TELEGRAM (Telephone, Employment, Legislation, Entertainment, Groups, Recreation, Alarms, and	A graphical presentation of hearing needs that can be completed before and after any intervention and

Table 19

Useful Tools for Commonly Used Aided Speech Materials for Assessment of Suitability for Cochlear Implant Assessment

Tool	Scoring	Reference
AB word lists	**Words, phoneme**	Boothroyd A. Developments in speech audiometry. *Br J Audiol* 1968;7(3):368–368 [27]
AzBio sentence lists (available in multiple languages)	**Sentences**	Spahr A, Dorman M, Litvak L, et al. Development and validation of the AzBio sentence lists. *Ear Hear* 2012;33(1):112–117 [28]
BKB-A sentence lists	Sentences, key words	Bench J, Kowal A, Bamford J. The BKB (Bamford-Kowal-Bench) sentence lists for partially-hearing children. *Br J Audiol* 1979;13(3):108–112 [29]
BKB-SIN test	Sentences, key words	Niquette P, Arcaroli J, Revit L, et al. Development of the BKB-SIN Test. Paper presented at: American Auditory Society Annual Meeting; 2003; Scottsdale, AZ [30]
CUNY sentence lists	Sentences	Boothroyd A, Hanin L, Hnath T. A sentence test of speech perception: reliability, set equivalence, and short term learning. CUNY Academic works. https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1443&context=gc_pubs . 1985. Accessed February 9, 2019 [31]
CNC word lists (available in a range of dialects)	Simulated words	Peterson G, Lehiste I. Revised CNC lists for auditory tests. *J Speech Hear Dis* 1962;27(1):62–70 [32]
HINT sentences (available in multiple languages)	Sentences in noise	Nilsson M, Soli S, Sullivan J. Development of the Hearing in Noise Test for the measurement of speech reception thresholds in quiet and in noise. *J Acoust Soc Am* 1994;95(2):1085–1099 [33]
QuickSIN	Sentences. scoring by SNR loss	Etymotic Research. Quick Speech-in-Noise Test (Version 1.3) - User manual. https://www.etymotic.com/downloads/dl/file/id/259/product/159/quicksin_user_manual.pdf . Updated 2006 [34]

Reference Table Cross Referencing all Relevant General Guidelines (Not Specific to Severe and Profound Hearing Loss) with Each Section of the Current Guidelines

Guideline by topic	AAA Adult hearing loss (2006) [169]	AAA Algorithms & statements (2000) [369]	AAA Tinnitus (2001) [336]	AAA Remote mic for children (2011) [103]	AAA Unilateral S to P HL (2015) [98]	ANSI Hearing Assistive Systems (2014) [104]	ASHA Hearing aid fitting (1998) [370]	ASHA Aural rehabilitation (2001) [371]
Diagnostic assessment	X		X		X		X	
Non-auditory assessment	X		X		X		X	
Social needs and treatment goals	X		X		X		X	
Treatment plan	X		X		X		X	
Compression		X		X		X		X
Device choices and programs		X		X		X		X
Frequency lowering		X		X		X		X
Prescriptions and verification		X		X		X		X
Asymmetrical hearing loss		X		X		X		X
Threshold shift and MPO		X		X		X		X
Remote mic: Recommending and ongoing use		X		X				
Remote mic: Component								