



# Guidelines for Hearing Aid Fitting for Adults

ASHA Ad Hoc Committee on Hearing Aid Selection and Fitting

*The Guidelines for Hearing Aid Fitting for Adults were developed by the American Speech-Language-Hearing Association (ASHA) Ad Hoc Committee on Hearing Aid Selection and Fitting. Members of the committee are Michael Valente, chair; Ruth Bentler; Holly S. Kaplan, ex officio; Richard Seewald; Timothy Trine; Dennis Van Vliet; and Lawrence W. Higdon, Vice President for Professional Practices in Audiology, monitoring vice president.*

## Introduction

Technological advances in hearing aid design and selection and maturation of the audiology profession have led to significant improvements in the fitting of hearing aids over the past 2 decades. In recent years, objective real-ear electroacoustic measures have replaced functional gain and other behavioral measures as the preferred method of verifying hearing aid performance. The widespread introduction of computers has made the process of fitting hearing aids more accurate and efficient. Software is available to help calculate the prescribed real-ear and coupler gain and output. Additional software is available to suggest how the various settings on the hearing aids should be adjusted to ensure benefit for listening in a wide variety of acoustic environments.

The guidelines are designed to provide audiologists with suggestions for fitting hearing aids to adults as part of a comprehensive audiologic rehabilitation plan. For guidelines appropriate for fitting hearing aids to infants and children, the reader is referred to *The Pediatric Working Group of the Conference on Amplification for Children with Auditory Deficits* (1996).<sup>1</sup>

These guidelines are divided into six major stages that constitute the hearing aid fitting

process embedded in the rehabilitation plan: Assessment, Treatment Planning, Selection, Verification, Orientation, and Validation.

The **assessment** stage is essential to determine the type and magnitude of hearing loss. This is also when intervention is planned and candidacy for amplification is determined. At the **treatment planning** stage, the audiologist, client, and/or family/caregivers review the findings of the assessment stage and identify areas of difficulty and need. During the **selection** stage, the physical and electroacoustic characteristics of the desired hearing aids are defined. During the **verification** stage, the audiologist determines that the hearing aids meet a set of standardized measures that include basic electroacoustics, cosmetic appeal, comfortable fit, and real-ear electroacoustic performance. During the **orientation** stage, the audiologist counsels the client on the use and care of the hearing aids, fosters the client's realistic expectations of performance from the hearing aids, and explores the candidacy for assistive listening devices and audiologic rehabilitation assessment and treatment. During the **validation** stage the audiologist determines the impact of the intervention on the perceived disability attributable to the hearing loss.

These guidelines are not intended to precisely dictate how hearing aids should be fitted. Rather, they are intended to suggest several strategies that audiologists may choose from to maximize the probability of user satisfaction with and perceived benefit from amplification. Audiologists should exercise professional judgment in choosing which segments of the guidelines are appropriate to their clinical environment and individual clients. Although the emphasis of the guidelines is on the technical aspects involved in fitting hearing aids, audiologists are reminded that fitting hearing aids is an ongoing process that requires joint participation of the audiologist, client, and family/caregivers.

<sup>1</sup>The Position Statement of that document recommends specific procedures for each of the four stages in the fitting process for children. The four stages are identified as audiological assessment, preselection/physical characteristics, selection and verification of electroacoustic characteristics, and validation of auditory performance. The importance of a systematic, objective, and timely strategy for fitting amplification in infants and children is emphasized throughout the statement. The use of traditional comparative measures is discouraged. Further, audiologists are identified as the profession "...singularly qualified to select and fit all forms of amplification for children including personal hearing aids, FM systems, and other assistive listening devices" (p. 53). Finally, audiological facilities without sufficient expertise and/or sufficient physical resources to engage in pediatric fitting-related activities are encouraged to establish consortial arrangements with facilities that do.

Finally, it is not the purpose of these guidelines to discuss issues of marketing, business practice, and ethics in regard to dispensing hearing aids and other assistive listening systems. ASHA has reports and policies pertaining to these topics (ASHA, 1987, 1991a, 1991b, 1991c, 1994a, 1994c). ASHA member audiologists should adhere to the Cardinal Documents of the Association, with specific attention to the Code of Ethics (ASHA, 1994b) and the Model Bill of Rights: Clients as Consumers Receiving Audiology or Speech-Pathology Services (ASHA, 1995).

## Background

The American Speech-Language-Hearing Association (ASHA) recognizes that the successful fitting of hearing aids is a complex process. To achieve the greatest probability of successful hearing aid fitting, the audiologist should incorporate the following eight components in the context of an audiologic rehabilitation plan.

1. Hearing aid fitting services should be provided by an ASHA-certified and, where applicable, licensed audiologist or a clinical fellow audiologist under the supervision of an ASHA-certified and, where applicable, licensed audiologist.
2. It is essential that the audiologist, client,<sup>2</sup> and family/caregivers combine their efforts to achieve optimum outcome of the hearing aid fitting process.
3. The audiologist has sole responsibility for preselection of the appropriate electroacoustic characteristics of the hearing aids.
4. Probe microphone measures are the preferred method for verifying the real-ear performance of the hearing aids.
5. Thresholds of discomfort (TD) should be directly measured using frequency-specific stimuli when possible to accurately assess/adjust the appropriate output and/or compression characteristics of the hearing aids.
6. The treatment plan should include assessment and recommendations for assistive listening devices, other assistive technologies, and communication training when appropriate.
7. It is essential to assist the client and family/caregivers on what they can

<sup>2</sup>The term *client* is an American Speech-Language-Hearing Association publication convention for referring to individuals with disabilities who seek treatment. Sometimes in this document the term *patient* is used interchangeably with "client," particularly to refer to individuals seeking treatment within a medical setting.

realistically expect from amplification, assistive listening devices, and audiologic rehabilitation.

8. The assessment and validation process should include measures to document the outcome of the intervention.

## Comprehensive Audiologic Assessment

### A. Audiologic Assessment

The initial step in the fitting of hearing aids is a comprehensive audiologic assessment. This assessment is essential to determine the type and magnitude of hearing loss and the need for audiologic rehabilitation, including candidacy for amplification. As a result of the audiologic assessment, the individual may be referred for additional services (e.g., electrophysiologic tests, medical or surgical intervention, etc.) before further audiologic management. The minimal components of the assessment stage for hearing aid fitting include a comprehensive case history, otoscopic inspection, and audiologic assessment (ASHA, 1993). The latter includes thresholds of discomfort (TD) using frequency-specific stimuli (e.g., puretones, warbletones, 1/3 octave narrow-band noise) or estimating TD for later verification (Cox, 1983; 1985; Dillon & Storey, in press; Seewald et al., 1997; Storey et al., in press).

The audiologic assessment process should produce the following outcomes:

- identification of type and extent of hearing loss
- determination of need for medical/surgical treatment and/or referral to a licensed physician
- provision of audiometric results and recommendations through appropriate client and family/caregiver counseling
- determination of candidacy and motivation for audiologic rehabilitation (ASHA, 1984, 1990)
- determination of medical clearance as outlined by the Food and Drug Administration (Staff, 1977) or state law/regulation (Appendix A)

It is essential that all test results, correspondence, and other interactions with the client be documented in the client's chart. This documentation should be organized and reported in a manner that allows for later retrieval and easy communication of information to the client, other audiologists, and professionals (ASHA, 1984; Paul-Brown, 1994). The documentation should meet all applicable state and federal guidelines for record keeping.

## ***B. Candidacy and Rehabilitation Assessment***

In general, audiologic assessment data serve as the basis for defining the client's hearing loss, planning relevant intervention, and evaluating improvements in the client's situation following intervention. Although audiometric data are essential, they are insufficient for determining hearing aid candidacy and rehabilitative strategies. Rather, a client-centered approach to assessment is required for audiologic intervention with adults (Hyde & Riko, 1994; Lesner & Kricos, 1995). Collectively, the results of the nonaudiometric assessment process are necessary to plan, implement, and evaluate any audiologic intervention program with adults.

The assessment protocol should be designed to define, from the client's perspective, any effects of the impairment at both the personal activity level and/or social role level. Assessment tools developed for this purpose include, for example, the *Communication Profile of Hearing Impaired* (CPHI; Demorest & Erdman, 1986; Walden, Demorest, & Hepler, 1984), *Hearing Performance Inventory* (HPI; Giolas, Owens, Lamb, & Schubert, 1979), the *Hearing Handicap Inventory for the Elderly* (HHIE; Ventry & Weinstein, 1982; Weinstein, Spritzer, & Ventry, 1986), and the *Hearing Handicap Inventory for Adults* (HHIA, Newman, Weinstein, Jacobson, & Hug, 1990). Some tools are specifically designed for evaluating function both with and without amplification, such as the *Abbreviated Profile of Hearing Aid Benefit* (APHAB; Cox & Alexander, 1995) and the *Client Oriented Scale of Improvement* (COSI; Dillon, James, & Ginis, 1997).

In addition to assessing the impact of an auditory impairment on the everyday listening situation, additional information regarding the client's unique circumstances should be considered before designing a treatment program. General areas requiring consideration (Lesner & Kricos, 1995) include the client's physical status (craniofacial status, general health, visual status, manual dexterity), psychological status (cognitive and mental status, motivation, attitude), sociological status (employment, social and physical environments), and communication status (auditory speech perception, auditory-visual speech perception, conversational fluency).

## **Treatment Planning**

After completing the assessment process, the audiologist, client, and family/caregivers need to review the findings and identify areas of difficulty and need. Based on this analysis,

priorities are established and specific goals for intervention are jointly agreed upon. Further, the sequencing of rehabilitative strategies is established, including when and how benefit derived from treatment is to be evaluated.

In many cases, the fitting of hearing aids will be incorporated as an early component of the plan. Under certain circumstances, it may be appropriate to determine the benefit derived from hearing aids and structured hearing aid orientation before additional intervention strategies are planned and implemented. In other cases, hearing aid fitting will be performed concurrently with additional components of the plan.

When fitting hearing aids is a component of the plan, a number of preliminary decisions are required. Decisions on specific aspects of electroacoustic performance naturally fall to the audiologist. However, all other planning decisions should be made jointly, and active participation of the client and family/caregiver in decision making is strongly encouraged.

At the conclusion of this process, a joint decision is made to initiate the hearing aid fitting as **one** component of the management plan. Before initiating the fitting of hearing aids, it is important for the client and family/caregiver to develop a realistic understanding of the potential benefits, limitations, and costs associated with procuring amplification. This understanding is established through a process of counseling, information sharing, education, and discussion. Suggestions for counseling the client on the potential benefits and limitations of amplification will be presented in another section of these guidelines.

## **Hearing Aid Selection**

The goal of the hearing aid selection process is to define the appropriate physical and electroacoustic characteristics of the desired hearing aids for a particular individual using methods that will facilitate ordering, verification, and validation of the devices.

### ***A. Electroacoustic Characteristics***

Although no universally accepted method exists for expressing the ideal electroacoustic characteristics of hearing aids, there is a significant knowledge base for making rational and defensible decisions. It is the audiologist's responsibility to determine the requisite electroacoustic characteristics using methods that are based in current scientific knowledge. In general, the electroacoustic specifications should be compatible with the auditory characteristics and the personal needs of the client.

To adequately define the desired electroacoustic characteristics, decisions need to be made on frequency-gain characteristics, maximum output sound pressure level (OSPL90), and input-output characteristics (ANSI S3.22, 1996b or current standard).

*Frequency Gain Characteristics.* A variety of prescriptive formulae yield frequency-gain characteristics based on puretone thresholds and, in some instances, loudness judgments. These formulae are incorporated into commercially available software and implemented in many real-ear analyzers. Examples include:

- National Acoustics Laboratory-Revised (NAL-R; Byrne & Dillon, 1986; Byrne, Parkinson, & Newall, 1991)
- Berger procedure (Berger, Hagberg, & Rane, 1989)
- Memphis State University procedure (Cox, 1988)
- Prescription of Gain/Output (POGO; McCandless & Lyregaard, 1983; Schwartz, Lyregaard, & Lundh, 1988)
- VIOLA component of Independent Hearing Aid Fitting Forum (IHAFF) protocol (Valente & Van Vliet, 1997)
- FIG6 (Gitles & Niquette, 1995)
- Desired Sensation Level [i/o] (DSL i/o; Seewald et al., 1997)

Although there are significant differences in the exact targeted values from the various prescriptive formulae listed above, the differences for average conversational inputs are relatively small; that is, there are not sufficient data to identify one of the prescriptive methods as superior to the others (Humes, 1996). Consequently, the prescriptive methods listed are those that the committee considered to be the most rigorously validated (NAL-R, Berger, MSU, and POGO) or those that prescribe additional electroacoustic parameters (see I/O characteristics).

Regardless of the specific method used, the frequency/gain characteristics ultimately need to be expressed in a 2 cm<sup>3</sup> coupler. Some prescriptive methods provide average corrections for conversion from 2 cm<sup>3</sup> coupler gain to real-ear gain. Alternatively, published average corrections (Bentler & Pavlovic, 1989; Gudmundsen, 1994; Mueller, Hawkins, & Northern, 1992) or custom corrections based on the individual's real-ear unaided response (REUR) and/or real-ear coupler differences (RECD) may be incorporated into the prescription. At a minimum, the frequency/gain characteristics need to be calculated for conversational-level inputs of 60-70 dB SPL (Byrne & Dillon, 1986; Cox & Moore, 1988; Pearsons, Bennett, & Fidell, 1977). If a hearing aid with nonlinear signal processing is ordered,

however, it may also be useful to calculate the desired frequency response for higher (e.g., 80-85 dB SPL) and lower (e.g., 50 dB SPL) input levels. This is discussed further under input-output characteristics.

Finally, when the hearing aid fitting is binaural, the prescribed gain for **each ear** should be **reduced** by 3–6 dB to compensate for binaural summation (Cox & Bisset, 1984; Cox, DeChicchis, & Wark, 1981; Hawkins, Prosek, Walden, & Montgomery, 1987; Markides, 1977; Skinner, 1988). Also, if the hearing loss is conductive or mixed, the prescribed gain for **each ear** needs to be **increased** by approximately 20–25% of the air-bone gap (Berger et al., 1989; Byrne & Dillon, 1986; Lybarger, 1963).

*Output Sound Pressure Level With a 90 dB Input (OSPL90).* The maximum output of the hearing aid in the 2 cm<sup>3</sup> coupler (OSPL90) should not exceed the targets developed from the TD made during the assessment stage. If suprathreshold loudness measurements are not available, then the desired OSPL90 should be calculated using a predictive method (e.g., Cox, 1983, 1985; Dillon & Storey, in press; Seewald et al., 1997; Storey, Dillon, Yeend, & Wigney, in press). Custom corrections based on the individual's real-ear coupler difference (RECD) may be used for deriving the 2 cm<sup>3</sup> coupler target values for OSPL90.

*Input-Output Characteristics.* For hearing aids with **linear signal processing**, the calculation of the desired frequency/gain characteristics and OSPL90 explicitly defines the input-output characteristics; that is, for a 10 dB change in the input there is a corresponding 10 dB change in the output until the maximum output is reached. As mentioned above, however, hearing aids that incorporate **nonlinear signal processing** may require additional specification. Specifically, it is necessary to define the desired static compression characteristics (compression threshold and ratio) or gain for multiple inputs in one or multiple frequency bands.

Although not extensively validated, several hearing aid selection protocols (e.g., IHAFF, FIG6, and DSL [i/o]) offer assistance in making decisions about input-output characteristics (Cox, 1995; Gitles & Niquette, 1995; Seewald et al., 1997; Valente & Van Vliet, 1997). In addition, it should be noted that it is not necessary to abandon traditional (single-target) prescription procedures (e.g., NAL-R) to select hearing aids with nonlinear signal processing. A traditional procedure can be supplemented with a consideration of the frequency-specific residual dynamic range of the listener to select appropriate input-output characteristics.

## B. Nonelectroacoustic Characteristics

Decisions about the nonelectroacoustic characteristics of the hearing aid (style, features, options, etc.) should be based on the management plan/needs assessment and the ongoing interaction with the client. Specifically, these factors should be considered:

- binaural or monaural fitting
- hearing aid style (e.g., BTE, ITE, ITC, or CIC)
- earmold/shell selection and configuration
- number and size of user controls
- directional/multiple microphones
- volume control preference (yes/no, raised, screw-set, etc.)
- telecoil and telecoil sensitivity
- compatibility with assistive listening devices, personal FM systems (ASHA, 1994a) and direct audio input
- programmable options
- remote control
- multiple memories
- color/shape of hearing aid
- additional system features

## Verification

Once the amplification goals have been determined and the hearing aids and earmolds (if applicable) received, the process of verification begins. In this context, **verification** refers to measures made to determine that the hearing aids meet a set of standards. Those standards include basic electroacoustics, cosmetic appeal, comfortable fit, and real-ear electroacoustic performance.

### A. Quality Control

Electroacoustic measurements should be performed according to the ANSI-S3.22 (ANSI S3.22-1996b or current standard) to determine whether the hearing aids meet their intended design parameters. Coupler measures of gain, frequency response, maximum output, battery drain, and distortion should conform to the published manufacturer's specifications (within stated tolerances) for the given brand and model. It is strongly recommended that the performance of the hearing aids also be measured according to the ANSI-S3.42 (ANSI S3.42-1992 or the current standard). This standard provides guidance for evaluating hearing aids in a test box using broadband signals. For example, the presence of an irregular frequency response at the higher input levels (80–90 dB SPL) may suggest the presence of intermodulation distortion (Revit, 1994). If the electroacoustic performance of the hearing aids does not adhere to the ANSI

S3.22-1996 (ANSI 3.22-1996b) or current standard, they should be returned to the manufacturer for adjustment or replacement.

Before fitting the hearing aids, a listening check, accomplished via a stethoscope or other coupling device, should be done to rule out excessive circuit noise, intermittency, and/or negative impressions of sound quality. If earmolds or custom hearing aids are ordered, it is necessary to ensure that their characteristics (i.e., type of tubing, venting, earmold style and material, etc.) match what was ordered.

### B. Physical Fit

The physical fit of the earmolds or hearing aids should be determined by assessing cosmetic appeal, physical comfort, absence of feedback, ease of insertion and removal, security of fit, microphone(s) location, and ease of hearing aid control operation.

### C. Performance

In order to determine how the hearing aids are performing for a given client, probe microphone measures should be made unless contraindicated by physical limitations (e.g., size of ear canal, drainage, excessive cerumen, etc.) These guidelines strongly support the use of real-ear measures, when applicable, as the **primary** method of verifying the performance of hearing aids. It is assumed that the examiner has a clear understanding of sources of measurement error (including insertion depth of the probe tube, stability of the probe tube location between measures, loudspeaker and reference microphone locations, calibration methods, etc.; Mueller et al., 1992).

Probe microphone measures are efficacious only when the appropriate reference is established relative to the amplification goals determined in the selection stage. That is, the target established in the hearing aid selection process should be the same target in the verification process, unless the fitting goals have been altered. In addition, probe microphone verification of a smooth response (Randolph, Bornstein, Giolas, & Maxon, 1981; Studebaker, 1974) and appropriate bandwidth should be established. Finally, verification of audibility, comfort, and tolerance should be ascertained.

1. **Audibility:** Verification of the audibility of a “soft” input level can be accomplished in several ways. The REAR can be obtained for a low-level signal (50 dB SPL); and the resultant output, relative to the measured or predicted threshold (in dB SPL), can be used to determine

audibility of soft sounds. Alternatively, and dependent on the degree of hearing loss, sound-field thresholds can be obtained. The measured thresholds should be between 20 and 30 dB HL (Valente & Van Vliet, 1997) at 250–6000 Hz (re: ANSI S3.6-1996a or the current standard). Sound field thresholds in this context should not be constructed as a measurement of gain for all inputs. Rather they are a measure of audibility of very soft inputs.

2. **Comfort:** Verification that average input levels will result in an amplified sound that is judged as “comfortable” can be accomplished in several ways. First, a real-ear insertion gain (REIG) measure can be obtained using a speech-weighted signal presented at 65 dB SPL. It is assumed that if the measured REIG for the 65 dB SPL input signal matches the NAL-R (or similar) target, then the amplified sound can be judged as “comfortable” (Byrne & Dillon, 1986). All of the prescriptive formulae noted in the Frequency Gain Characteristics section assume that the prescribed target represents the amount of gain required to allow average conversational speech (60-70 dB SPL) to be audible and comfortable. Second, a calibrated average speech signal (ANSI S3.6-1996a or the current standard) presented in the soundfield (60-65 dB SPL) can be used to elicit a subjective rating of “comfortable, but slightly soft,” “comfortable,” or “comfortable, but slightly loud” from the aided listener using the descriptors from the IHAFF protocol.
3. **Tolerance:** The goal of this verification stage is to ensure that high-level stimuli will not exceed the threshold of discomfort. This can be accomplished in several ways. First, a real-ear saturation response (RESR) can be obtained with the hearing aid set either at a user volume control position or at a volume control setting just below audible feedback, with a 90 dB SPL swept puretone signal (RESR<sub>90</sub>). The output targets or actual threshold discomfort should not be exceeded at any frequency.

An alternative to the above procedures has been proposed by Moodie, Seewald, and Sinclair (1994). Briefly, the RECD is measured for the client using an insert earphone. Having defined the coupler-to-earphone transformation, the transformation can simply be **added** to the measured OSPL<sub>90</sub> in the coupler to predict the RESR across frequencies.

Finally, a calibrated speech signal (ANSI S3.6-1996a or the current standard) presented in the soundfield (80–85 dB SPL) can be used to elicit a subjective rating from the aided listener of “comfortable, but slightly loud” or “loud, but OK,” using the descriptors from the IHAFF protocol.

## Hearing Aid Orientation

### A. Hearing Aid Use and Care

All individuals fitted with hearing aids should receive appropriate training, counseling, and referrals during a trial period. It is important for the audiologist to be familiar with state regulations and federal guidelines concerning minimum trial periods for hearing aids. Audiologic habilitation can be accomplished using a variety of learning modalities, including individual or group sessions, in a manner and communication method appropriate for the client and family/caregivers, covering these key topics:

- battery management/safety
- instrument features and landmarks
- use and routine maintenance
- working knowledge of hearing aid components
  - assistive listening device coupling
  - telephone use
  - storage
  - usage patterns/adjustment
- insertion and removal of instruments

### B. Expectations for Performance

Appropriately fit amplification systems should be free from unwanted feedback. In addition, the audiologist should strive to minimize the occlusion effect by appropriate venting, tone control adjustment, and/or insertion depth modification. Hearing in noise may continue to be problematic for the user; improved hearing typically means hearing more noise. The user can realistically expect:

- some degree of visibility (from any style of hearing aid)
- physical comfort
- improved, but not perfect, communication
- more benefit in quiet than noise

## Validation

Even though **verification** measures are made to ensure that particular electroacoustic characteristic goals are met, **validation** measures are necessary to determine the impact of the intervention. Validation that disability has been reduced and that appropriately established goals have been addressed should be included in each

comprehensive hearing aid selection and fitting process.

A number of tools have been suggested to be administered during the trial period, including the *Abbreviated Profile of Hearing Aid Benefit* (APHAB; Cox & Alexander, 1995) as a measure of disability and the *Hearing Handicap Inventory for Adults* (HHIA; Newman et al., 1990, 1991) or *Hearing Handicap Inventory for the Elderly* (HHIE; Newman & Weinstein, 1988; Ventry & Weinstein, 1982; Weinstein et al., 1986) as measures of handicap. One of these, an inventory developed at the National Acoustic Laboratories, the *Client Oriented Scale of Improvement* (COSI; Dillon et al., 1997), provides for an individualized assessment of particular situations that cause communication difficulty to the person with hearing loss both before and after intervention.

Measures of speech perception can be obtained using either objective or subjective methods. Because interpretation of the speech signal is basic to communication, the primary goal of amplification should be the audibility of that speech signal. A number of speech tests are available and can be used to assess aided versus unaided speech perception ability. The audiologist needs to consider stimulus (phonemes, nonsense syllables, words, sentences), presentation level(s), noise type, and signal-to-noise ratio. Equally important is allowing sufficient time to test with enough items to get an accurate assessment. Alternately, an estimation of aided audibility can be obtained (ANSI, S3.5, 1969; Humes, 1991; Mueller & Killion, 1990; Pavlovic, 1991).

## Conclusion

Because of the rapid introduction of technological advances, these Guidelines for Hearing Aid Fitting for Adults must be viewed as a dynamic document; content and implementation will change as new knowledge is transferred and new technology introduced. Audiologists must keep abreast of new developments if they are to provide comprehensive audiologic management to persons with hearing loss.

## References

- American National Standards Institute.** (1969). *Methods for calculation of the articulation index* (ANSI S3.5). New York: Author.
- American National Standards Institute.** (1992). *Testing hearing aids with a broad-band noise signal* (ANSI S3.42-1992). New York: Author.
- American National Standards Institute.** (1996a). *Specification for audiometers* (ANSI S3.6-1996). New York: Author.
- American National Standards Institute.** (1996b). *Specification of hearing aid characteristics* (ANSI A3.22-1996). New York: Author.
- American Speech-Language-Hearing Association.** (1984). Definition and competencies for aural rehabilitation. *Asha*, 5, 37–41.
- American Speech-Language-Hearing Association.** (1987). *Private practice*. Rockville, MD: Author.
- American Speech-Language-Hearing Association.** (1990). Aural rehabilitation: An annotated bibliography. *Asha*, 33 (Suppl. 1), 1–2.
- American Speech-Language-Hearing Association.** (1991a). Report on private practice. *Asha*, 33 (Suppl. 6), 1–4.
- American Speech-Language-Hearing Association.** (1991b). Considerations for establishing a private practice in audiology and/or speech-language pathology. *Asha*, 33 (Suppl. 3), 10–21.
- American Speech-Language-Hearing Association.** (1991c). Business, marketing, ethics, professionalism in audiology: Annotated bibliography (1986–1989). *Asha*, 33 (Suppl. 3), 39–45.
- American Speech-Language-Hearing Association.** (1993). Preferred practice patterns for the professions of speech-language pathology and audiology. *Asha*, 35 (Suppl. 11), i–viii, 1–96.
- American Speech-Language-Hearing Association.** (1994a). Guidelines for fitting and monitoring FM systems. *Asha*, 36 (Suppl. 12), 1–9.
- American Speech-Language-Hearing Association.** (1994b). Code of Ethics. *Asha*, 36 (Suppl. 13), 1–2.
- American Speech-Language-Hearing Association.** (1994c). *Development and management of audiology practices*. Rockville, MD: Author.
- American Speech-Language-Hearing Association.** (1995). Model bill of rights: Clients as consumers receiving audiology or speech pathology services. *Asha*, 37, 37.
- Bentler, R. A., & Pavlovic, C. V.** (1989). Transfer functions and correction factors used in hearing aid evaluation and research. *Ear & Hearing*, 10, 58–63.
- Berger, K., Hagberg, E., & Rane, R.** (1989). *Prescription of hearing aids: Rationale, procedures and results* (5th ed.). Kent, OH: Herald Publishing House.
- Byrne, D., & Dillon, H.** (1986). The National Acoustic Laboratories (NAL) new procedure for selecting the gain and frequency response of a hearing aid. *Ear & Hearing*, 7, 257–265.
- Byrne, D., Parkinson, A., & Newall, P.** (1991). Modified hearing aid selection procedures for severe/profound hearing losses. In G. A. Studebaker, F. H. Bess, & L. Beck (Eds.), *Vanderbilt hearing aid report II* (pp. 295–300). Parkton, MD: York Press.
- Cox, R. M.** (1983). Using ULCL measures to find frequency-gain and SSPL90. *Hearing Instruments*, 34, 17–21, 39.
- Cox, R. M.** (1985). A structured approach to hearing aid selection. *Ear & Hearing*, 6, 226–239.
- Cox, R. M.** (1988). The MSU hearing instrument prescription procedure. *Hearing Instruments*, 39, 6–10.

- Cox, R. M.** (1995). Page ten: A hands-on discussion of the IHAFF approach. *Hearing Journal*, *48*, 10, 39–44.
- Cox, R. M., & Alexander, G. C.** (1995). The abbreviated profile of hearing aid benefit. *Ear & Hearing*, *16*, 176–183.
- Cox, R. M., & Bisset, J. D.** (1984). Relationship between two measures of aided binaural advantage. *Journal of Speech and Hearing Research*, *49*, 399–408.
- Cox, R. M., DeChicchis, A. R., & Wark, D. J.** (1981). Demonstration of binaural advantage in audiometric test rooms. *Ear & Hearing*, *2*, 194–201.
- Cox, R. M. & Moore, J. N.** (1988). Composite speech spectrum for hearing aid gain prescriptions. *Journal of Speech and Hearing Research*, *31*, 102–107.
- Demorest, M. E., & Erdman, S. A.** (1986). Development of the communication profile for the hearing impaired. *Journal of Speech and Hearing Disorders*, *52*, 129–139.
- Dillon, H., James, A. M., & Ginis, I.** (1997). Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *Journal of the American Academy of Audiology*, *8*, 27–43.
- Dillon, H., & Storey, L.** (in press). The National Acoustics Laboratories procedure for selecting the maximum power output of hearing aids: Theoretical derivation. *Ear and Hearing*.
- Giolas, T. G., Owens, E., Lamb, S. H., & Schubert, E. D.** (1979). Hearing performance inventory. *Journal of Speech and Hearing Disorders*, *44*, 169–195.
- Gitles, T. C., & Niquette, P. P.** (1995). FIG6 in ten. *Hearing Review*, *2*, 28, 30.
- Gudmundsen, G.** (1994). Fitting CIC hearing aids—some practical pointers. *Hearing Journal*, *47*, 45–47.
- Hawkins, D. B., Prosek, R. A., Walden, B. E., & Montgomery, A. A.** (1987). Binaural loudness summation in the hearing impaired. *Journal of Speech and Hearing Research*, *30*, 37–43.
- Humes, L. E.** (1991). Understanding the speech-understanding problems of the hearing impaired. *Journal of the American Academy of Audiology*, *2*, 59–69.
- Humes, L. E.** (1996). Evolution of prescriptive fitting approaches. *American Journal of Audiology*, *5*(2), 19–23.
- Hyde, M. L., & Riko, K.** (1994). A decision-analytic approach to audiological rehabilitation. In J. P. Gagné & N. Tye-Murray (Eds.), *Research in audiological rehabilitation*. *Journal of the Academy of Rehabilitative Audiology*, Monograph Supplement, 337–374.
- Lesner, S. A., & Kricos, P. B.** (1995). Audiologic rehabilitation: A holistic approach. Chapter 2 in P. B. Kricos and S. A. Lesner (Eds.), *Hearing care for the older adult* (pp. 21–58). Boston, MA: Butterworth-Heinemann.
- Lybarger, S. F.** (1963). *Simplified fitting system for hearing aids*. Canonsburg, PA: Radioear.
- Markides, A.** (1977). *Binaural hearing aids*. London: Academic Press.
- McCandless, G. A., & Lyregaard, P. E.** (1983). Prescription of Gain/Output (POGO) for hearing aids. *Hearing Instruments*, *35*, 16–21.
- Moodie, K. S., Seewald, R. C., & Sinclair, S. T.** (1994). Procedure for predicting real-ear hearing aid performance in young children. *American Journal of Audiology*, *3*, 23–31.
- Mueller, H. G., Hawkins, D. B., & Northern, J. L.** (1992). *Probe microphone measurements: Hearing aid selection and assessment*. San Diego, CA: Singular Publishing.
- Mueller, H. G., & Killion, M. C.** (1990). An easy method for calculating the articulation index. *Hearing Journal*, *43*(9), 14–17.
- Newman, C. W., & Weinstein, B. E.** (1988). The Hearing Handicap Inventory for the Elderly as a measure of hearing aid benefit. *Ear & Hearing*, *9*, 81–85.
- Newman, C. W., Weinstein, B. E., Jacobson, G. P., & Hug, G. A.** (1990). The Hearing Handicap Inventory for Adults: Psychometric adequacy and audiometric correlates. *Ear & Hearing*, *11*, 430–433.
- Newman, C. W., Weinstein, B. E., Jacobson, G. P., & Hug, G. A.** (1991). Test-retest reliability of the hearing handicap for adults. *Ear & Hearing*, *12*, 355–357.
- Paul-Brown, D.** (1994). Clinical record keeping in audiology and speech-language pathology. *Asha*, *36*, 39–42.
- Pavlovic, C. V.** (1991). Speech recognition and five articulation indexes. *Hearing Instruments*, *42*(9), 20–23.
- Pearsons, K. S., Bennett, R. L., & Fidell, S.** (1977). *Speech levels in various environments: Project report on contract 68 01 2466*. Washington DC: U.S. Environmental Protection Agency.
- Pediatric Working Group of the Conference on Amplification for Children With Auditory Deficits.** (1996). Amplification for infants and children with hearing loss. *American Journal of Audiology*, *5*, 53–68.
- Randolph, K. J., Bornstein, S. P., Giolas, T., & Maxon, A.** (1981). The effects of frequency response smoothness and stimulus type of loudness discomfort level. *Journal of the Acoustical Society of America*, *70* (Suppl. 1), S105.
- Revit, L.** (1994). Using coupler tests in the fitting of hearing aids. In M. Valente (Ed.), *Strategies for selecting and verifying hearing aid fittings* (pp. 64–87). New York: Thieme Medical Publishers.
- Schwartz, D. M., Lyregaard, P. E., & Lundh, P.** (1988). Hearing aid selection for severe-to-profound hearing loss. *Hearing Journal*, *41*, 13–17.
- Seewald, R. C., Cornelisse, L. E., Ramji, K. V., Sinclair, S. T., Moodie, K. S., & Jamieson, D. G.** (1997). *DSL 4.1 for windows: A software implementation of the desired sensation level (DSL[i/o]) method for fitting linear gain and wide dynamic range compression hearing instruments*. London, Ont: Hearing Healthcare Research Unit, Department of Communicative Disorders, University of Western Ontario.
- Skinner, M. W.** (1988). *Hearing aid evaluation*. Englewood Cliffs, NJ: Prentice-Hall.



- 
- Staff.** (1977). Hearing aid devices: Professional and client labeling and conditions for sale. *Federal Register*, 42 (31), 9286–9297.
- Storey, L., Dillon, H., Yeend, I., & Wigney, D.** (in press). The National Acoustic Laboratories procedure for selecting the maximum power output of hearing aids: Experimental validation. *Ear and Hearing*.
- Studebaker, G.** (1974). The acoustical effect of various factors on the frequency response of a hearing aid receiver. *Journal of Audio Engineering Society*, 22, 329–334.
- Valente, M., & Van Vliet, D.** (1997). The Independent Hearing Aid Fitting Forum (IHAF) protocol. *Trends in Amplification*, 2, 1–30.
- Ventry, I. M., & Weinstein, B. E.** (1982). The Hearing Handicap Inventory for the Elderly: A new tool. *Ear & Hearing*, 3, 128–134.
- Walden, B. C., Demorest, M. E., & Hepler, E. L.** (1984). Self-report approach to assessing benefit derived from amplification. *Journal of Speech and Hearing Research*, 27, 49–56.
- Weinstein, B., Spritzer, J., & Ventry, I.** (1986). Test-retest reliability of the Hearing Handicap for the Elderly. *Ear & Hearing*, 7, 295–299.
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- Key Words:** amplification, audiologic rehabilitation, hearing aids, probe microphone measurements

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## Appendix

### Conditions Requiring Immediate Referral to a Physician Before Hearing Aids May Be Dispensed (Staff, 1977)

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- Visible congenital or traumatic deformity of the ear.
  - History of active drainage from the ear within the previous 90 days.
  - History of sudden or rapidly progressive hearing loss within the previous 90 days.
  - Acute or chronic dizziness.
  - Unilateral hearing loss of sudden or recent onset within the previous 90 days.
  - Audiometric air-bone gap equal to or greater than 15 dB at 500, 1000, and 2000 Hz.
  - Visible evidence of significant cerumen accumulation or a foreign body in the ear canal.
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## **Guidelines for Hearing Aid Fitting for Adults**

ASHA Ad Hoc Committee on Hearing Aid Selection and Fitting  
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