



PERSPECTIVES on

Hearing and Hearing Disorders: Research and Diagnostics



AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION **DIVISION 6**

Patrick Feeney

From the Coordinator

Welcome to another thematic issue of the Division 6 *Perspectives*. Dawn Konrad-Martin, Associate Coordinator, has worked with Craig Champlin, our Division Editor for *Perspectives*, to bring you an issue focused on hearing disorders in older adults. These articles explore various issues related to the aging auditory system, including mechanisms of age-related hearing loss, age-related changes in speech understanding abilities, issues related to hearing aid amplification, and strategies for improving hearing aid uptake in older adults. Contributing authors are from research and clinical centers across the United States and in Canada.

New CE Procedures

We have some exciting news for CEU Participants who read *Perspectives* for a self-study activity. Beginning in 2007, participants will be able to submit their responses to CE questions online.

The new system offers some great benefits, including

- Quick feedback about whether you received a passing score
- Documentation of activity completion
- Fast, easy submission of responses and forms
- An archive of your *Perspectives* CE records

Your responses to CE questions will take place in our secure, affiliates-only pages on the ASHA Web site. You will receive immediate feedback about your performance; a certificate of completion will be generated online.

As usual, questions will be published in each issue of *Perspectives*. Each issue will also include instructions to tell you how to access our secure pages to complete the self-study process!

Help Us Pilot the Program

To help pilot the program, we are asking CEU Participants for this issue to submit paper copy as usual and, in addition, to submit responses online. (See CE Instructions.) This will help us test the system in a variety of ways and will give volunteers the chance to practice.

The new system requires a modest fee (\$5), which will be charged online at the time you access the reporting forms. For the pilot test, that fee will be waived.

Other News

Your Division 6 Steering Committee held its first live "Web Event" in collaboration with Division 15 (Gerontology) on **June 20, 2006** in the discussion forums area of the ASHA Web site. (Access the archived content here: www.asha.org/Forums/showmessage.aspx?ForumID=8732&MessageID=248978 or from this page: [Certification/divs/.\) During these "office hours," recognized experts answered questions from a national audience about age-related changes in auditory function.](http://www.asha.org/about/Membership-</p></div>
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Audience members asked questions about the way age-related cognitive changes and other non-auditory factors influence communication and rehabilitation strategies and what aural rehabilitation strategies are most effective for older adults.

The Web experts were Kathleen Pichora-Fuller, PhD, professor, Department of Psychology, University of Toronto; Elizabeth Galletta, PhD, associate professor, Communication Disorders Department, Mercy College; Kassie Witte, MS, audiologist and speech-language pathologist, Hebrew Home for the Aged; and Susan Goldfein, MS, principal, Older Adult Consultation Services.

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Tremblay, K., Piskosz, M., & Souza, P. (2002). Aging alters the neural representation of speech cues. *Neuroreport*, 13(5), 1865-1870.

Zeng, F. G., Grant, G., Niparko, J., Galvin, J., Shannon, R., Opie, J., & Segel, P. (2002). Speech dynamic range and its effect on cochlear implant performance. *Journal of the Acoustical Society of America*, 111, 377-386.

Continuing Education Questions

1. Automatic/adaptive directional microphones

- a. are strongly recommended for all older listeners.
- b. should be used for all older listeners except those who live in quiet environments.
- c. should be considered for all older listeners due to their greater difficulty in background noise, but the final choice depends on patient needs and preferences.
- d. have been found to work only in situations where there is a single speaker and single stationary noise source.

2. Jenstad and Souza found that in comparison to older listeners aged less than 75 years, a group of listeners of advanced (75+ years) age showed

- a. poorer performance for both normal-rate and rapidly spoken speech.
- b. no difference in performance for normal-rate or rapidly spoken speech regardless of the compression parameters that were used.
- c. poorer performance on rapidly spoken speech, but only at high compression ratios.
- d. poorer performance on rapidly spoken speech, but only at low compression ratios.

3. Age-related cognitive changes are important to consider because

Considerations for Selecting and Fitting Hearing Aids for Older Adults

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The occurrence of hearing impairment among the older population is high; it is estimated that 40-45% of people over age 65 years and about 83% of those over 70 have some degree of hearing loss (Cruikshanks et al., 1998). The aging process results in declines in auditory thresholds and in an independent and faster decline in speech understanding (Divenyi, Stark, & Haupt, 2005). Hearing aids amplify sound, thus compensating for declines in thresholds, but they cannot improve speech understanding *per se*. This perhaps in part explains the poor uptake and use of hearing aids. As shown by MarkeTrak VII, only 32% of individuals, aged 65-74 years with hearing impairment, wear hearing aids; this number rises to about 45% for those in the 75-84 year age group and to about 58% for those 84 years and older. Interestingly, these numbers do not appear to relate to advances in hearing aid technology, in that these hearing aid adoption rates have remained steady since 1984 (Kochkin, 2005).

Many aspects of quality of life are negatively affected by hearing impairment. For example, a study conducted for the National Council on Aging (Kochkin & Rogin, 2000) compared

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- a. they refer to reduced speech of the central nervous system.
- b. they cause changes in learning, memory, and sensory processing that impact all aspects of audiology practice.
- c. they cause age-related changes in vision, but not in speech recognition.
- d. physicians provide cognitive test results when referring a patient.

4. Cortical evoked potentials (specifically, the N1-P2 response) are sensitive to which of the following speech features?

- a. Spectral differences between voiced stop consonants
- b. Spectral differences between voiceless fricatives

- c. Differences in consonant manner
- d. Consonant duration and voicing

5. Gatehouse and colleagues found that

- a. fast-acting WDRC was better than slow-acting WDRC for loudness comfort.
- b. older listeners with cognitive deficits recognized less speech with fast-acting than with slow-acting WDRC.
- c. older listeners preferred linear amplification to slow-acting WDRC amplification.
- d. at least three compression channels were needed to provide adequate speech audibility.

Hearing Aid Fitting

Continued from page 19

the reports of individuals with hearing impairment who did and did not use hearing aids on a number of psychosocial measures. They found that, as compared to users of hearing aids, non-users participated in significantly fewer social activities, reported significantly more anxiety, depression, emotional instability, and paranoia. In addition, the non-users reported lower self-esteem and less warmth in their interpersonal relationships. Furthermore, significantly more family members of the non-users reported their relative with hearing impairment displays anger/frustration, poor cognitive abilities, and introverted behavior than did family members of hearing aid users. On the positive side, acquisition of hearing aids resulted in improvements in multiple aspects of life, including reports of improved relationships at home, better self-esteem, increased sense of safety, and decreased dependence on others (Kochkin & Rogin). These positive impacts were reported by both the individual with hearing impairment and their relatives; although, interestingly, the relatives tended to report greater improvement than did the individual with hearing impairment.

For all of these reasons, auditory rehabilitation should be considered a priority. The purpose of this paper is to highlight some of the important user-related factors to consider when selecting and fitting hearing aids for older individuals and to present research supporting the suggestions. The issues that will be discussed are changes in lifestyle, fine motor skills and visual acuity, perception of hearing loss in older age, slower cognitive processing, and participation of family members in the rehabilitation process.

Changes in Lifestyle

With age comes changes in lifestyle and, thus, changes in com-

munication needs (Erdman & Demorest, 1998). As communication needs change, so do the priorities individuals have regarding what they want from hearing aids. This was demonstrated by Meister, Lausberg, Kiessling, von Wedel, and Walger (2002), who studied four groups of participants ranging in age from 20 to 91 years. They described to the participants eight hypothetical hearing aids in terms of the relative strengths and weaknesses of each aid on six attributes: hearing speech in quiet, hearing speech in noise, hearing aid sound quality, ease of handling, how much feedback the user would experience, and how well the user could localize sounds while using the hearing aid. Participants were told to rank order the hearing aids in terms of their preference for each. The results showed that up to the age of 73 years, understanding of speech in noise was the most important attribute, followed by understanding of speech in quiet, while the remaining attributes held similar and much lower importance. Over age 73 years, however, the importance of speech in quiet and speech in noise reversed, such that hearing speech in quiet became the most important attribute, followed by hearing speech in noise. The important message from these findings is that, when selecting hearing aid features, it is critical to consider the needs of the user. This is especially important for older individuals because, due to cognitive and physical limitations (see below), it can be more difficult for older individuals to learn to use and adjust to hearing aids than it is for younger individuals.

Recommendations. It is therefore recommended that the first step in aural rehabilitation be to establish the patient's listening needs and priorities. In order to do so, it is suggested that the patient completes a questionnaire such as the Client Oriented Scale of Improvement (COSI; Dillon, James, & Ginis, 1997) or the Glasgow Hearing Aid Ben-

efit Profile (GHABP; Gatehouse, 1999) prior to hearing aid selection. These questionnaires require patients to specify listening situations in which they either want to improve their ability to hear (COSI) or situations in which it is important to them to hear as well as possible (GHABP). The clinician can then focus aural rehabilitation towards a successful outcome in those particular listening situations. For some individuals, such as those whose primary need is communicating one-on-one in quiet listening environments, this might result in the selection of a hearing aid with minimal optional features. For an individual faced with more complex listening environments, a personal FM system with a wireless microphone might prove most effective for listening in noise. For others whose communication needs are primarily within their home, the audiologist might decide to provide one or more assistive listening devices (such as a telephone amplifier and an FM or infrared television access system) in lieu of hearing aids, in that limited needs combined with a decline in hearing aid benefit due to central presbycusis, might prove easier to use and be more effective for some older individuals (Hayes & Jerger, 1979).

Fine Motor Skills and Visual Acuity

With advancing age comes diminished manual dexterity and declining visual acuity. There are several aspects of hearing aid use and aural rehabilitation that require good fine motor skills and good visual acuity—the most obvious being manipulation and upkeep of the hearing aids. More specifically, hearing aid insertion, manipulation of the hearing aid controls, and handling the battery require fine motor skills, while cleaning the hearing aid and battery replacement require good visual acuity. A number of recent studies have shown poor manual dexterity to be associated

with poorer hearing aid outcome, less daily use, and lower satisfaction (Humes, Wilson, & Humes, 2003; Kumar, Hickey, & Shaw, 2000; Wilson & Stephens, 2002). Furthermore, in the Meister et al. (2002) study described above, the importance of the attribute "ease of handling" changed significantly across the age groups, such that it went from being the least important attribute for the youngest age group to being the third most important attribute for the oldest age group (after speech in quiet and speech in noise). In another study, it was concluded that ease of use of a hearing aid was a major factor in hearing aid preference among a group of elderly first-time users (Baumfield & Dillon, 2001). Even more dramatically, Parving and Philip (1991) reported that 40% of hearing aid users in their tenth decade (aged 90 and older) could not use the volume control wheel, 36% could not change the hearing aid battery, and 34% could not clean the hearing aid earmold. These studies underscore how important it is to select a hearing aid that is easy to handle if an individual has poor vision or poor fine motor skills. In regard to what style of hearing aid is easy to handle, the data are somewhat mixed. For instance, Upfold, May, and Battaglia (1991) evaluated subjects' ability to manipulate various aspects of their hearing aid, including insertion, removal, battery replacement, switching the aid on and off, and adjustment of the volume control. They found that In-the-Ear (ITE) hearing aids were the easiest to manipulate, followed by In-the-Canal (ITC) aids, with Behind-the-Ear (BTE) hearing aids being most difficult. Johnson, Danhauer, and Krishnamurti (2000) came to the same conclusion. On the other hand, a study by Stephens and Meredith (1990) found that BTE hearing aids were more easily handled than ITE devices.

Another major issue with handling hearing aids is battery re-

placement. In general, smaller hearing aids use smaller batteries. However, even the largest hearing aid batteries are only a few millimeters in diameter and thus are difficult to see and handle for many older individuals. At least two manufacturers of hearing aid batteries have worked on solutions to this problem. For instance, Duracell has designed Easytab batteries that incorporate a 1-inch long battery tab that is relatively easy to see and hold. The tab can be used to pick up and place the battery in the hearing aid battery compartment. Energizer has developed the EZ Change battery pack that uses a magnet and plastic arm in the battery pack itself to help guide the battery into the hearing aid compartment. These approaches avoid the need for the user to hold the battery and help them place it correctly in the hearing aid.

The success of the hearing aid counseling process is another aspect of aural rehabilitation that is affected by poor visual acuity in at least three ways. First, poor visual acuity results in a decreased ability to make use of speech reading cues. The use of speech reading cues can result in up to 50-60% better sentence identification over using auditory or visual cues alone (Walden, Busacco, & Montgomery, 1993). Furthermore, Walden, Grant, and Cord (2001) showed that the cues provided by speech reading were complementary to those provided by amplification; speech reading provided place-of-articulation cues, whereas amplification provided place, manner, and voicing cues. The second way in which poor visual acuity affects hearing aid counseling is during demonstration of use and maintenance of the hearing aids. The on-off switch, volume wheel, wax guards, microphones, left versus right ear markers, and batteries are all small and difficult to see and could leave the individual with visual impairment overwhelmed at the thought of using the hearing aids. Finally, being aware

that considerable information is imparted in a short period of time during hearing aid counseling, clinicians often provide patients with written materials to take home. Many pre-printed materials are not targeted to the older population; they use print sizes that are too small to be easily read, they provide much unnecessary information, and they are printed on shiny paper that is difficult to read in artificial light. For each of the above reasons, the clinician needs to take extra care to ensure that hearing aid users with comorbid vision loss can follow and understand the hearing aid counseling process. Individuals with visual declines are at a considerable disadvantage relative to normally-sighted individuals, even when communicating one-on-one in a quiet environment. In fact, Gitlin (1995) showed that the third most common reason that older people abandon the use of assistive technology was a lack of knowledge of how to use that technology, and Warland and Tønning (1991) found that the major complaint reported by a group of ITC hearing aid users was the feeling that they had received insufficient instruction on how to use the instruments.

Recommendations. It is critical that anyone receiving hearing aids can handle the aids and that they have a thorough understanding of how to use them. This is particularly important among older individuals, who might have lower self-efficacy, take longer to adjust to hearing aids, and be less motivated to try hearing aids than younger individuals.

Regarding handling the hearing aids, patients could complete the 3-item 'Manual Dexterity and Vision' scale from the Attitudes towards Loss of Hearing Questionnaire (Saunders, Cienkowski, Forsline, & Fausti, 2005) in order to determine whether poor manual dexterity and/or poor visual acuity are likely to affect the ability to use hearing aids successfully. Should the patient obtain a score indicative

of difficulties, the clinician should take extra care to select an easy-to-handle hearing aid with larger batteries. By carefully selecting hearing aid signal processing features, clinician can minimize the need for additional hearing aid buttons. For instance, a hearing aid that uses wide dynamic range compression (WDRC) negates the need for a volume control, whereas adaptive directionality avoids the need for multiple programs to switch between directional and non-directional modes. There are now even automatic/switchless telecoils that are activated when in the presence of a stationary magnetic field, such as when a telephone is held to the ear.

Concerning counseling, the clinician should ensure the counseling office is well-lit with incandescent overhead lighting to avoid creating glare (Kricos & Lesner 1995). The clinician should not sit in front of a window, so that visibility of his or her face is optimized during speech reading. The clinician should have a magnifying glass available that can be used when demonstrating the use and upkeep of the hearing aids (Smith, Kricos, & Holmes, 2001). Finally, the clinician should simplify the content of the counseling by omitting all redundant information. Among people over age 65, 44% read at the fifth grade level or below, and another 30% read at approximately the fifth to eighth grade level (U.S. Department of Education, 1993). Therefore, supplementary materials should be written in plain language; i.e. they should be written in the active voice; they should be direct, specific and concrete; and personal pronouns should be used (Center for Medicare Education, 2006). A variety of research shows that written materials should be printed in sans serif font with a minimum font size of 14-point and should have wide spaces between the lines. Multiple columns on a page should be avoided, the text should be justified on the left but

unjustified on the right, and the materials should be printed in high contrast colors on matte paper to prevent glare (American Printing House for the Blind, 2006; Erber, 2003).

Perception of Hearing Loss

There is considerable evidence that older individuals are more accepting of hearing impairment than younger individuals. Studies have shown that, for the same degree of impairment, older individuals report fewer difficulties than younger individuals (Gordon-Salant, Lantz, & Fitzgibbons, 1994; Lutman, Brown, & Coles, 1987; Uchida, Nakashima, Ando, Niino, & Shimokata, 2003) and that the level of impairment at which older individuals first report hearing difficulties is greater than the impairment at which younger individuals report difficulties (Merluzzi & Hinchcliffe, 1973). There are a number of possible explanations for this. The first is that older individuals might expect their hearing ability to diminish as they age and, thus, they accept it when it does. Another explanation is that a less active lifestyle results in hearing impairment having less impact upon daily function than for a younger, more active individual. Yet another possibility is that older individuals judge their own hearing ability in relation to others in their age group, and, therefore, tend to underestimate their hearing impairment (Maurer & Schow, 1995). Finally, it might be that many individuals are simply unaware that their hearing has deteriorated because onset of the impairment was very gradual. Regardless of the underlying explanation, misperception of hearing impairment probably manifests itself as a reluctance to acquire hearing aids or to embark on other aural rehabilitation.

Recommendations. The first step toward dealing with the misperception of hearing impairment is for the family of the hearing impaired

individual to understand this and to realize that the probability of a successful hearing aid outcome will increase if the hearing impaired individual accepts they need hearing aids (Brooks & Hallam, 1998; Jerram & Purdy, 2001). This is especially important in the over 50% of cases in which family members prompt acquisition of a hearing aid (Kochkin, 2005; Wilson & Stephens, 2002). The Performance-Perceptual test (PPT) of Saunders, Forsline, and Fausti (2004) might help some individuals become aware of their hearing impairment. In the PPT, actual and perceived ability to understand speech in noise is measured using the same test materials, test procedure, and unit of measurement. By comparing their actual and perceived ability, the extent to which individuals either underestimate or overestimate their hearing ability is obtained. It has been shown that individuals who overestimate their hearing report fewer difficulties than expected. In the author's experience, explaining this to individuals with hearing impairment can help them become more aware of their limitations.

When programming hearing aids for the older first-time hearing aid user, it is also important for the clinician to remember that it is likely that the individual has had hearing loss for many years and has, therefore, not heard high frequency sounds for a very long time. Thus, when high frequency amplification is initially provided, patients often react negatively to the sounds they have not heard for so long and often reject hearing aids on this basis alone. In order to deal with this, it is suggested that less high frequency amplification be given initially than would be prescribed for an experienced user. To this end, many hearing aid manufacturers now have algorithms in their fitting software that provide less hearing aid gain for first-time users.

Cognitive Changes

As discussed elsewhere in this issue, it is generally accepted that the

brain has limited cognitive resources available. Allocation of resources for one task drains availability for other tasks being conducted simultaneously. Thus, resources used for decoding an input signal, such as speech, drain some of the remaining resources available for processing that signal. In older individuals, the decline in cognitive abilities combined with sensory impairment (hearing loss) makes listening more effortful, which can result in speech being heard but not understood or remembered well (Pichora-Fuller, this issue). Older individuals, therefore, are probably less effective at processing informational counseling and will fatigue sooner than their younger counterparts with hearing impairment.

Another aspect of cognitive processing and aging that has also been discussed elsewhere in this issue (Souza, this issue) is the relationship between cognitive status among the older population and the ability to gain benefit from WDRC. Souza (this issue) found that older individuals with lower cognitive scores performed more poorly with fast-acting compression than with slow-acting WDRC, whereas the converse was true for individuals with better cognitive scores (Gatehouse, Naylor, & Elberling, 2006).

Recommendations. It is once more recommended that clinicians ensure that the content of all counseling is as simple and straightforward as possible and that it is supplemented with written materials that are printed in a large, clear font in high-contrast colors on non-glossy paper (Erber, 2003). Regarding selection of signal processing algorithms for older individuals, as discussed further by Souza in this issue, the evidence that, on average, older individuals will perform better with slow-acting compression than with fast-acting compression suggests short time constants should be avoided. To this end, some manufacturers have already implemented algorithms in their fitting software that automatically select longer compression time constants for patients over age 70 years.

Summary

As pointed out by Kaplan (1996), the goal of aural rehabilitation is to find the least expensive and most versatile durable system that will address as many of the user's communication needs as possible. Many of these recommendations above are not specific to older individuals but apply to anyone with any of the limitations described. However, because aging has global effects on the individual, these recommendations take on greater importance in rehabilitation of the elderly. Ultimately, it is the responsibility of the clinician to work with the patient to select the hearing aid most appropriate for the patient's physical limitations and lifestyle and to provide the patient with counseling and support to ensure that he or she can successfully use those hearing aids. Ideally, family members should be educated in hearing aid use and upkeep so that they can assist the hearing aid user as necessary.

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Continuing Education Questions

- 1. Establishing a patient's needs prior to hearing aid fitting is advantageous because**
 - a. some older individuals don't realize they need hearing aids.
 - b. it can help the clinician select the technology most suited to the individual's lifestyle.
 - c. an individual with poor eyesight might not be able to use hearing aids.
 - d. older individuals may not be able to choose a hearing aid for themselves.
- 2. The style of hearing aid most easily handled by individuals is**
 - a. behind-the-ear.
 - b. in-the-canal.
 - c. in-the-ear.
 - d. unclear because research data show mixed findings.
- 3. Counseling of older individuals can be complicated by the individual's**
 - a. political affiliation.
 - b. cognitive status.
 - c. lifestyle.
 - d. poor manual dexterity.
- 4. Written materials for older individuals should be**
 - a. written in plain language.
 - b. printed in minimal contrast colors.
 - c. printed on shiny paper.
 - d. printed in 10-point font.
- 5. Older individuals often perceive their hearing to be**
 - a. better than it really is.
 - b. worse than it really is.
 - c. a huge problem.
 - d. a bigger burden than when they were younger.