



# AUDIOLOGY

## INFORMATION SERIES



ASHA'S CONSUMER NEWSLETTER

### Asking Your Audiologist About Hearing Assistive Technology and Audiologic Rehabilitation

Over 28 million Americans with hearing loss might benefit from the use of hearing aids. It would be a fair assumption to suggest that the majority of the 6.5 million actual hearing aid users, when first fitted with their hearing aids, anticipated that purchasing their instruments would mark the beginning and end of their treatment process. The fact is that most hearing aid users are more likely to experience satisfaction with amplification after they undergo audiologic rehabilitation processes such as counseling and auditory training and complement hearing aid benefits by the use of appropriately selected assistive technology.



#### *What are audiologic rehabilitation and assistive technology?*

Audiologic rehabilitation (AR) refers to processes, techniques, and devices that aid in "facilitating adequate receptive and expressive communication in individuals with hearing loss."<sup>1</sup> AR is an interdisciplinary process drawing on the complementary and overlapping skills of the audiologist and speech-language pathologist.

Assistive technology (AT),<sup>2</sup> as applied to individuals with hearing loss, refers to any of a wide array of devices using auditory, visual, or tactile stimuli to convey information to:



- facilitate face-to-face communication and appreciation of broadcast media,
- enhance communication over the telephone,
- alert the user to a variety of environmental auditory situations.

#### FACE-TO-FACE AND BROADCAST COMMUNICATION



#### *Why do I need supplemental assistive technology if I already use hearing aids?*

Hearing aid users often ask why a supplemental device, an assistive listening device, is needed to facilitate communication: "Why do I also need this device? I thought that was what the hearing aid was for." To explain, there are three environmental factors that affect a listener's ability to understand live voice or broadcast media:

(1) Distance between the listener and sound source.

The intensity, or loudness, of a sound fades rapidly as it travels over distance. In fact for every doubling of distance, the sound's intensity decreases by 6 dB. Thus, as the distance between speaker and listener increases, even marginally, the listener, even with a hearing aid, has significantly less access to the signal (speech).

(2) Competing noise in the environment.

Most rooms have significant levels of background noise that compete with the spoken message of interest. This, combined with a lower volume of speech (see condition #1) explains why supplemental devices are sometimes necessary.

(3) Room acoustics.

Yet another factor makes listening and understanding even more difficult! Room acoustics vary widely. Sound waves bounce off reflective surfaces like windows, walls, unupholstered furniture, etc. and create a multitude of sound "images" that distort the signal even further and create additional problems for the listener. A normal hearing person usually finds these to be mere annoyances, but to the person with hearing loss, the situation can have a debilitating effect on the ability to accurately process speech.

ALDs,<sup>2</sup> then, are devices used with or without hearing aids to overcome the negative effects of distance, background noise, and room acoustics. These effects can be reduced or overcome by the use of ALDs. In summary, simply remember: **Hearing Aids + ALDs = Better Listening!**



*Are there devices that can help me in the theater, lecture, or concert hall, as well as when I am speaking to someone face-to-face?*

Yes there are, and these can be categorized into auditory and nonauditory systems. Many box offices advertise the free availability of ALDs. Usually, they collect a form of identification, such as a driver's license, as collateral for the device. If you do not see a posting, ask the clerk or speak to the manager about availability.

## Auditory Systems to Enhance Understanding



Consider a man wearing hearing aids seated in an audience of a large lecture hall or theater. He is having a difficult time understanding the speaker. True, the speaker's voice is amplified, but the words are indistinct. Remember that by the time the speaker's message gets to the man's hearing aids, it is already appreciably reduced in intensity (the distance factor—either from the speaker per se or a loudspeaker). His hearing aids do amplify, but the signal being amplified is distorted by the reverberant characteristics of the room and mixed with the room's noise (e.g., rustling papers, air conditioning, other people talking, etc.). Therefore the man in the audience is presented with an amplified, but somewhat distorted, signal of the speaker's message.

Using an ALD can improve this situation dramatically. When the speaker wears a wireless microphone, the signal is unaffected by poor room acoustics and background noise, because the microphone that is worn by the speaker delivers the signal directly to the man's ears or his hearing aids. Movie sound tracks are dealt with similarly. There are three ways that this is generally accomplished.

**Induction.** The earliest technology to direct the sound to the man in the audience is called loop induction. An electromagnetic field is established in the room by an installed loop coupled to the speaker's microphone. The man in the audience has a special switch on his instrument called a "T" (for telephone or telecoil) switch. When his aid is set to that position, a current is generated within a wire coil of the hearing aid that is an electrical copy of the speaker's message. This loop technology creates a clear signal unaffected by the other factors that are disruptive and affect understanding (referred to above). Further, because the hearing aid microphone is bypassed in the T-switch setting, room noise and echoes are not picked up by the hearing aid. If the hearing aid doesn't have a telecoil, the listener in lieu of the hearing aid can wear a special headset receiver that can receive the signal. Some hearing aids contain a microphone/telephone (M/T) position, which would enable a listener to hear signals arriving both from the loop and from the hearing aid microphone (as in being able to hear from comments from one's partner while listening to a lecture).

**Frequency modulation.** This type of ALD system is rather like a small radio broadcast system. It consists of an FM transmitter (worn by the speaker) and FM receiver (worn by the listener). In the induction system described above, the room has to be equipped with a special loop into which an electromagnetic field was created. With FM, or infrared (below) systems, a signal is sent directly from the speaker to the listener, similar to a radio station transmitting a signal to an individual's radio. The listener has the option of feeding the output of the FM receiver into a listening device such as an earphone headset or "earbuds" (commonly worn by teenagers using personal sound systems), or coupling it to a hearing aid via a small induction loop that fits around the neck (a neckloop).

**Infrared transmission.** This is a similar approach to FM except the sound is transmitted by invisible light. In this technology, captured sound is transmitted to a receiver containing a photo detector that picks

the infrared signal and converts it back to sound. As above, the listener has the option of using a hearing aid or other receiver with this technology. Infrared systems are frequently available in theaters and concert halls.

Smaller versions of these three systems can also be used to improve one's ability to hear television. This would be particularly useful in such locations as senior centers and nursing homes, places where high levels of background sounds are commonplace.

## Nonauditory Systems to Enhance Understanding

Visual systems can be used alone or in combination with auditory devices. Persons who are deaf, hard-of-hearing, and with normal hearing can benefit from these technologies. There are several nonauditory approaches currently in use. Some are "hi-tech," others are "lo-tech." There is also one, not yet marketed for persons with hearing loss, that holds promise for the future.

### Captioning

Closed captioning is now quite commonplace on U.S. television. It would be rare to find a new television that didn't have this feature already built-in. (Federal legislation passed in 1990 [PL 101-421] now requires televisions, with screens of at least 13 inches diagonal measurement to have built-in captioning.) Similarly, virtually all VHS and DVD movie rentals are also close captioned. Owners of older televisions may install a freestanding decoder box to view captioned material.

In real-time captioning, a written transcription of the speaker's message is projected by one of two techniques. In one approach, the text of a prepared speech is fed into a computer and then projection is synchronized with the speaker's actual presentation. The other approach utilizes specialized computer software and a person with court-reporter transcription skills to transcribe and project the speaker's message in virtual real-time. The obvious advantage of the virtual real-time technique is that it permits the captioning of

unscripted communication whereas the former approach is limited to prepared statements. The disadvantage is that it requires the active participation of a skilled court reporter.

## Notetaking



A low-cost approach, notetaking, incorporates the transparency projection of a speaker's text as an assistant points to the relevant sections on the screen. Alternatively, notes can be taken on an overhead projector while the speech is in progress if the text is unavailable beforehand. Yet another variation on the same theme involves the use of a computer. The typist-notetaker's output from the computer is projected either by using a projection pad on an overhead projector, or by sending the computer output into a multimedia projector. In some school settings, another student is designated as notetaker, using special paper that produces several copies.



## Computerized Speech Recognition

Low-cost commercial speech recognition software is now available and permits a speaker/writer to dictate to a computer with nearly the same ease and accuracy as dictating to a stenographer. Though developed as a word-processing productivity tool, this infantile, but steadily evolving technology holds obvious potential to populations with hearing loss wherever captioning or notetaking applications are currently being used.

## TELEPHONE TECHNOLOGY



*That's interesting but those technologies don't help me when I need to use the phone, do they?*

Different technologies are available to individuals with hearing loss requiring assistance while using the telephone. These devices are useful to persons who have hearing loss and who do not wear hearing aids, as well as those who are hearing aid users. In the latter instance, the hearing aid's microphone or telephone circuitry (the so-called "T-coil" is an optional feature on some hearing aid models) may be utilized in combination with the telephone. As discussed above, there are auditory and non-auditory systems.



## Auditory Devices

Systems working with telephones take many forms. Three basic technologies are:

- (1) Replacement handsets that provide additional amplification and, in some instances, noise reduction circuitry;
- (2) Amplifiers that are "hard-wired" between the phone and handset to boost the signal level delivered to the handset;
- (3) Portable amplifiers are battery-operated devices that offer "on-the-road" advantage of serving users who need access to a multitude of telephones. These devices either couple to the hearing aid magnetically (requiring a hearing aid with a telecoil) or acoustically (by using the hearing aid microphone).

## Non-Auditory Devices

For persons with profound hearing loss, telephone communication is rarely possible even when the signal is amplified. To meet their telephony needs, is the text telephone or TT (formally known as a telecommunication device for the deaf, or TDD<sup>3</sup>). With a TT, an individual types a message on one unit that is

received and visually displayed on another unit. The two devices communicate over conventional phone lines. One example use of the technology: calling a hospital or state or federal agency equipped with a TT to schedule an appointment (state message relay services make possible communicating with facilities that do not have TT equipment through use of operators communicating via TT and speech). A recent ruling by the FCC designates 711 for the access to relay operators nationwide.

Telecommunications for the Deaf, Inc. (TDI) publishes a yearly directory of text telephone numbers. This year's 674-page edition covers 40,000 residential and business entries and includes information and resources such as fax numbers, email addresses, information about the internet, relay service numbers, addresses and phone numbers for clubs and organizations serving individuals who are deaf, hard of hearing, deaf-blind or speech impaired. TDI is located at 8630 Fenton Street, Suite 604; Silver Spring, MD 20910-3803; 301-589-3006 (TTY); 301-589-3797 (FAX). *The 2000 TDI National Directory & Resource Guide* may also be ordered on-line: [www.tdi-online.org/publications.htm](http://www.tdi-online.org/publications.htm).

A newer but related technology is utilizing a personal computer (PC) as a "visual telephone." PC applications take two forms: (1) conventional electronic mail (e-mail), and (2) so-called "chatting," offering the advantage of two-way communication in virtually real-time.

## ALERTING DEVICES



*I don't wear my hearing aid to sleep and I'm concerned that I won't hear the phone or, worse, the fire alarm. Is there help for me?*

Products designed to assist in creating an awareness of environmental sounds and situations (a door knock and a fire, as respective examples) utilize additional variations of stimuli in their operation. These electronic devices may also make use of kinesthetic and air-stream stimuli. In some cases, the approach might not even be electronic, it may be canine. The hearing ear dog, the equivalent of the more common seeing eye dog, is trained to alert an owner with feedback on changing acoustical events.



That it is not unusual to find products like baby monitors for sale in general purpose electronics stores is but one indicator of how alerting devices have a range of applications that extend beyond the needs of those who have hearing loss.



Alerting devices address many needs. For example, doorbell ringing/knocking, telephone ringing, wake-up alarms, fire/smoke alarms. The forms of addressing these needs are almost as varied as the needs themselves. For example, to detect a phone ring, the phone may have a built-in light that flashes when the phone rings. A fire alarm could produce a bright strobe light and/or activate a transducer that would shake the sleeper's bed. In fact, systems exist that would permit the single-room monitoring of an entire house when appropriately equipped with sensors and feedback mechanisms.



*Most of this information seems geared to adults. Are there special considerations to be made when children are involved?*

Yes there are. One of the three "practical applications" offered in response to the last question of this publication (below) deals with infants and young children.

Frequency modulation systems (FM),<sup>4</sup> briefly described in an earlier section, have wide application in educational settings because of the long-recognized benefits that this technology provides in noisy and reverberant child care, preschool, and classroom environments. Specifically, the technology has been very useful in maximizing language learning and hearing capabilities—particularly speech understanding—in children with hearing loss striving to attain academic success. Studies have shown that the best results are achieved when implementation of an FM system is made early in the amplification fitting process. Benefits additional to those cited, and which contribute to the child's success in school, include increased attention span, reduced distractibility, and increased sound awareness. The ability to select, evaluate, fit, and dispense FM systems fall uniquely within the realm of the certified audiologist.<sup>5</sup>

FM (as well as infrared) systems can also be used to provide an enhanced speech signal in classrooms. This can basically be conceptualized as a PA system with the teacher using a wireless microphone/transmitter. In recent years, a great deal of evidence has accumulated testifying to the value of these systems.

Increased availability and usage of FM systems are due in large measure to the following three bills mandating access to technology for persons with hearing and other communication deficits: (1) the Americans with Disabilities Act (ADA), (2) the Individual with Disabilities Education Act (IDEA), and (3) Section 504 of the Rehabilitation Act.



*Okay, AT can help in three broad areas of application (face-to-face/broadcast communication, phone use, and improving environmental awareness). But how might I specifically benefit from AT? What are some practical applications?*

Reviewing the following three categories of needs may help if you are still uncertain about how assistive technology may help in your situation.

## **Assistive Technology in Places of Worship and Public Spaces**

While not often thought of or realized, even the most beautiful and popular houses of worship in the world can be acoustical nightmares for persons with hearing loss. Frequently large, open areas surrounded by, and filled with, hard, reflective surfaces, these highly reverberant structures are often difficult listening environments even for those with normal hearing sensitivity.

Religious institutions are not required by law to comply with the accommodations required by tenets of the Americans with Disabilities Act. For this reason, a multi-denominational campaign of the National Organization on Disability (NOD) called "2,000 by the Year 2000—Accessible Congregation Campaign" was launched among congregations across the country to reduce barriers to individuals with hearing loss and other disabilities such as vision impairments, mobility problems, and chronic illness. To an increasing degree, audiologists are contributing their expertise in the area of assistive technology and accommodation so that worshipers who drifted apart from their congregation because of hearing loss may once again feel a part of, and make a contribution to, this important facet of life.

To learn more about the "2,000 by the Year 2000" campaign visit NOD's web site at [www.nod.org/religion.html](http://www.nod.org/religion.html).

## Assistive Technology and New Federal Requirements

Federal employees with hearing loss and those interacting with federal agencies can soon expect wider utilization of assistive technologies in those settings. A portion of the Rehabilitation Act of 1973 was amended in 1986 to ensure that electronic and information technology developed, procured, maintained, or used by the federal government be accessible to people with disabilities. Called "Section 508," it was amended in 1998 to significantly expand technology access to those with disabilities. While the old version of Section 508 established non-binding guidelines for technology accessibility, the new version will create binding, enforceable standards and will incorporate these standards into Federal procurement regulations. Under the new law, Federal employees and members of the public who have disabilities must have access to and use of information and services that are *comparable to the access and use available to non-disabled Federal employees and members of the public*.

Requirements include compatibility with hearing aids, cochlear implants, assistive listening devices, and TDDs (refer to the above section on telephone technology). Other specifications address adjustable volume controls for output and product interface with hearing technologies.

Signed into Public Law by the President on July 13, 2000, the provisions of Section 508 were to go into effect on August 7, 2000. Implementation has now been delayed until six months after the Access Board publishes its final Section 508 standards. For additional information visit the Disability Rights Office at [www.fcc.gov/cib/dro/](http://www.fcc.gov/cib/dro/).

## Considerations in Geriatric Populations

As described above, while AT devices often are designed to function in combination with hearing aids, many devices are "stand-alone" in that coupling a hearing aid is not required. It is probably true that in no population is this flexibility more important than among older adults. Assistive technology devices frequently serve as a gateway to a more comprehensive audiologic rehabilitation program that may eventually include hearing aids. In other instances, lifestyle may be such that it is immediately apparent that an array of technology supplemental to hearing aids will be needed to meet the high listening requirements of an individual.

There are several reasons why an elderly client may prefer to use an AT device as a substitute hearing aid some or all of the time. For one, clients who are on fixed incomes may find the financial advantages of AT devices appealing. For another, many seniors unfortunately still feel stigmatized by hearing aids. They view hearing aids as another sign that they are getting older. This, in turn, makes them feel more dependent and less competent. Successful use of AT technology often makes users curious enough about hearing aids to try them and ultimately to discover that a complete audiologic rehabilitation program empowers them by increasing their independence and competence through improved communication. Both social and work lives improve as people feel less isolated.

## Ensuring the Development of Language (Spoken or Signed) in Infants, Toddlers, and Children in Schools

The most debilitating consequence of onset of hearing loss in infancy is its disruption of the infant's ability to acquire speech and language at its normal rate and extent. Hearing is the principle sensory modality by which language and speech are acquired. For that reason, the infant with hearing loss whose family chooses an auditory approach to learning language must have as much exposure to high-quality auditory stimulation as possible. When a child has a hearing loss, access to consistent auditory signals is difficult to accomplish with hearing aids alone.



An additional influence is the child's acoustic environment. The home day care or school environment is filled with distracting noises that degrade the quality of signal being received at the

child's ear. Using an FM system as described above or in combination with a hearing aid at an early age provides the child with a clear amplified signal that is relatively free from noise.

The combination of early detection of hearing loss and early use of amplification has been shown to have a dramatically positive effect on the language acquisition abilities of a child with hearing loss. In fact, infants identified as having a hearing loss by age 6 months can be expected to attain language development on a par with hearing peers by age 5.<sup>6,7</sup> Even children with mild hearing loss tend to have significant academic difficulties<sup>8</sup> and benefit substantially from use of some form of sound field amplification or FM system.



*Who should I see about whether or not I should consider the use of AT for managing my hearing loss?*

Navigating AT, with its numerous applications and myriad options, can be a daunting task.

Successful selection and utilization of AT requires a communication needs assessment by an audiologist. When conducting the needs assessment, the audiologist will consider the client's hearing loss, perceived listening needs, and current technology applications to select the most appropriate device(s), if warranted.

Individuals seeking to incorporate technology into their audiologic rehabilitation program should seek the services of an ASHA-certified audiologist. Your audiologist is trained and experienced in meeting your needs in a helpful and friendly fashion.

## Where to Get Help and Advice

Consistent with the U.S. Public Health Services' health goals for the nation initiative, Healthy People 2010,<sup>9</sup> ASHA promotes the prevention, early identification, treatment, and rehabilitation of children and adults with hearing loss by qualified professionals: ASHA-certified audiologists (CCC-A). A specific objective of the 2010 initiative is to "increase access by persons who have hearing impairments to hearing rehabilitation services and adaptive devices, including hearing aids, cochlear implants, or tactile or other assistive or augmentative devices." [emphasis added]

## Audiologists

Audiologists are professionals who administer and conduct hearing screening programs; evaluate and treat hearing loss, balance, and related disorders; recommend and provide appropriate technology, including hearing aids and hearing assistive devices and systems; and provide audiologic rehabilitation.

## Speech-Language Pathologists

Speech-language pathologists are professionals who evaluate and treat disorders of speech, language, voice, and swallowing. Using evaluation results, the speech-language pathologist designs and implements specific intervention programs to meet the communication needs of individuals.

### Qualified audiologists and speech-language pathologists have:

- a master's or doctoral degree
- the Certificate of Clinical Competence (CCC-A or CCC-SLP) from the American Speech-Language-Hearing Association (ASHA)
- a state license, where required



### To Find an ASHA-certified audiologist or speech-language pathologist near you, and for more information:

American Speech-Language-Hearing Association (ASHA)

10801 Rockville Pike  
Rockville, MD 20852  
1-800-638-8255

Email: [actioncenter@asha.org](mailto:actioncenter@asha.org)

Web site: [www.asha.org](http://www.asha.org).

*This document was developed by Henry J. Ilecki, Ph.D., CCC-A, Director for Audiology Practice in Industry and Private Practice. The contributions of Karen Beverly-Ducker, M.A., CCC-A, Director of Multicultural Resources, Mark Ross, Ph.D., CCC-A, Carol Silkwood, and Maureen Thompson, M.A., CCC-A to the preparation of this material is gratefully acknowledged.*

---

1 American Speech-Language-Hearing Association. (1984). Position statement on the definition and competencies for aural rehabilitation. *Asha*, 26, 37-41.

2 Historically, the term "assistive listening devices," or ALDs, was used to describe this form of technology, whether the appliance was auditory or nonauditory in nature. The more generic and precise "assistive technology" or "assistive device(s)" is preferred in current writing.

3 Also frequently referred to as a "TTY" (teletypewriter).

4 FM systems are a subset of the broader term, auditory trainer, which refers to any hard-wired, FM, infrared or other amplification system apart from a personal hearing aid.

5 American Speech-Language-Hearing Association. (1994, March). Guidelines for fitting and monitoring FM systems. *Asha*, 36 (Suppl. 12), pp. 1-9.

6 Yoshinaga-Itano, C., et al. (1998). "Language of early- and later-identified children with hearing loss." *Pediatrics*, 102, 1161-1171.

7 Moller, M. P. (in press). Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics*.

8 Bess, F., Dodd-Murphy, J., & Parker, R. A. (1998). Children with minimal sensorineural hearing loss: Prevalence, educational performance, and functional status. *Ear and Hearing*, 19, 339-354.

9 U.S. Department of Health and Human Services (2000). *Healthy People 2010*. See: [www.health.gov/healthypeople/Document/HTML/Volume2/28Vision.htm](http://www.health.gov/healthypeople/Document/HTML/Volume2/28Vision.htm).