ABSTRACT: Audiologists have come to realize that individual listeners have specific communication problems and corresponding functional goals that should be addressed during the process of hearing aid planning and selection. Conventional clinical procedures include the use of comprehensive needs profiles and/or open-ended questionnaires to define the specific listening situations where an individual has problems. Technology options can then be presented to the client in order to minimize if not eliminate those listening problems.

Needs assessment instruments have begun to include an expanded set of variables that aid in the selection of appropriate hearing aids and hearing assistance technology (HAT). The purpose of this article is to (a) review the hearing aid planning and selection stages from a historical perspective and (b) examine how a needs assessment is used to match specific hearing aid features and HAT accessories to a listener’s communication needs. A case study is included, emphasizing our goal to discuss these issues in a clinically relevant manner for both practicing clinicians and those at the pre-service level.

KEY WORDS: hearing aids, hearing aid selection, hearing handicap, aural rehabilitation

listeners who are hard of hearing often hold different opinions about the impact of their hearing losses on their daily lives, even when their audiograms are similar (Demorest & Walden, 1984; Ventry & Weinstein, 1982). For example, one listener with a mild-to-moderate sensorineural hearing loss may complain about an inability to hear grandchildren or television, but another listener with the same audiogram “gets by just fine.” Because hearing losses and listening demands are unique, aural rehabilitation has come to be viewed as a client-centered, holistic, interactive process that involves defining both the type of communication difficulties encountered by an individual listener and the desired outcomes from remediation that represent success (Bevan, 1999; Lesner & Kricos, 1995). Once needs and desired outcomes have been defined for an individual client, the audiologist can explain and explore the appropriate, realistic options for remediation.

One of the options for treating individuals with hearing loss involves fitting hearing aids and other hearing assistance technology (HAT) such as FM systems that can enhance residual hearing. Recent guidelines for fitting adults with hearing aids (American Speech-Language-Hearing Association [ASHA], 1998) divide the process into six distinct stages and describes the type of activities associated with each of them. The stages include:

- **Assessment**, where the type and degree of hearing loss are measured and the individual’s candidacy for amplification is explored;
- **Treatment planning**, where the client and his or her family members or caregivers identify areas of difficulty and need;
- **Selection**, where the desirable physical and electroacoustic characteristics of the prospective hearing aids (or HAT) are defined;
- Verification, where measurements are made to confirm that the hearing aids have met appropriate standards;
- Orientation, where the individual is counseled on the care and use of hearing aids; and
- Validation, where benefit and satisfaction are measured to ensure that communication difficulties have been reduced.

Underscoring each of these stages is the realization that the hearing aid fitting process must be personalized for the individual listener. This has not always been the case.

Audiology Internet bulletin boards contain examples of creative ways in which audiologists have used technology to solve unique listening problems. Listeners who are hard of hearing want to hear their white-water rafting guides, for example, as clearly as they hear their television sets (Van Vlier, 2000). This article focuses on various methods audiologists use to define the specific communication needs of an individual listener (treatment planning stage) and the techniques for selecting specific hearing aids or HAT (selection stage).

In theory, the needs assessment should drive the selection process. By that, we mean that the clients’ hearing characteristics and the demands on their hearing that they encounter throughout a typical day should be the most important factors in hearing aid selection. In practice, however, a systematic approach for directly matching many of the available hearing aid features or HAT to an individual’s communication goals, cosmetic preferences, and cost requirements has not been standardized. As lifestyles diversify and hearing aids become more “high tech,” audiologists have begun to investigate ways to align the needs and selection stages more closely (Dillon, James, & Ginnis, 1997; Jacobson, Newman, Fabry, & Sandridge, 2001; Johnson, Danhauer, & Krishnamurti, 2001; Palmer, 1992; Palmer & Mormer, 1997). This article reviews the hearing aid planning and selection stages from a historical perspective and offers a case study to illustrate how a needs assessment is used to match specific hearing aid features and HAT accessories to a listener’s communication needs.

HEARING AID PLANNING AND SELECTION: A HISTORICAL PERSPECTIVE

Hard of Hearing Listeners and Hearing Aids: The Early Years

Although the profession of audiology did not come into its own until the 1940s, hearing aids have been manufactured since the early 1800s. Berger (1970) chronicled the evolution of hearing aid styles and technologies from the 1800s through the 1960s. Early hearing aids were mechanical resonating devices that lacked a power source to increase sound. These instruments provided relatively small amounts of gain, primarily in the mid frequencies (Berger, 1970). Thus, the acoustic characteristics of these hearing aids could not be prescribed or adjusted for an individual listener. However, it is clear from Berger’s text that even in the 1800s, styles of hearing aids were diverse and were designed to address specific listening needs.

Although hearing health care was limited or nonexistent, listeners were able to self-select hearing devices from catalogs, presumably on the basis of their own lifestyle demands. Ear trumpets existed in a variety of sizes, styles, and materials. One style of ear trumpet included an attachment for the user’s spectacles (an early version of the eyeglass hearing aid). Another style, the acoustic cane, doubled as a walking aid when not in use as a hearing aid. Some devices were designed to transmit sound via bone conduction, presumably for listeners with conductive or mixed hearing losses. Unusual devices, such as the acoustic fan, acoustic beard, acoustic bonnet, and acoustic opera glasses, had applications for specific listening environments. Perhaps the most famous example of a custom hearing aid is the hearing throne, designed for King Goa VI of Portugal in 1819 (Berger, 1970).

With the advent of electric and electronic hearing aids in the late 1800s and early 1900s, hearing aid style evolved from portable to wearable, usually in the form of a body aid. In the 1950s, hearing aid design incorporated the newly developed transistor, and hearing aids became small enough to be worn behind the ear. Although the hearing aids of the 1950s had relatively poor fidelity when compared to today’s models, their frequency responses (i.e., the range of frequencies amplified by the hearing aid) were significantly better than those of their historical counterparts (Berger, 1970).

The Harvard Report

Once the ability to set and manipulate a hearing aid’s response to different frequencies was possible, hearing scientists began to investigate how electroacoustic characteristics affected speech intelligibility and sound quality. In 1946, the publication of a study known as the Harvard Report (Davis et al., 1946) had a major albeit flawed role in shaping the thinking regarding hearing aid selection. This study used an adjustable hearing aid and investigated the effect of frequency response on speech intelligibility. The authors found that one optimum frequency response was appropriate for nearly all of the study participants, regardless of hearing loss, and concluded that specifying a frequency response based on individual audiometric data was “wasteful of time and effort” (Davis et al., 1946, p. 87). Despite methodological shortcomings, this study led to the “one size fits all” approach to hearing aid selection. This was the prevailing view for the following 30 years and hindered the development of an individualized approach to hearing aid selection.

Specifying Electroacoustic Characteristics of Hearing Aids: Audiometric Considerations

A resurgence of interest in specifying electroacoustic characteristics of hearing aids based on individual audiograms occurred in the 1970s and continues today. Called the “prescriptive” fitting approach, the desired gain,
frequency response, and maximum output requirements of a hearing aid are calculated based on audiometric measurements such as threshold, most comfortable level, and loudness discomfort level. At present, there are almost a dozen competing, yet theoretically sound, methodologies for calculating electroacoustic characteristics, all based on individual audiometric measurements (ASHA, 1998). Despite the differing methodologies, Humes (1996) confirmed that there are few significant differences among them.

Whereas specifying the electroacoustic characteristics of hearing aids for an individual listener has become relatively straightforward, specifying many of the physical characteristics such as style or user controls relies on an ongoing, interactive counseling process (ASHA, 1998). Palmer (2001) divided the hearing aid selection process into two parts: things we measure (e.g., audiometric data) and things we ask about (e.g., style, size). Comprehensive approaches for selecting the desired physical and technical characteristics of hearing aids based on needs and preferences are currently being investigated (Jacobson et al., 2001; Johnson et al., 2001).

Selecting Hearing Aid Features and Options: Needs Assessment

Concurrent with the development of the prescriptive fitting approach in the 1970s was the development of questionnaires to assess the effects of an individual’s hearing loss on communication or other daily life functions. Bentler and Kramer (2000) compiled an exhaustive listing of self-report inventories. Self-reporting of hearing handicap or disability has served many purposes. Besides defining communication needs and abilities, self-assessment measures have been used to screen candidates for diagnostic or rehabilitative services, assist in advance planning for a diagnostic audiological evaluation, document benefit and satisfaction (outcomes measures) from rehabilitative treatments, determine compensation for accidental hearing loss, and collect demographic and research data (Schow & Gatehouse, 1990).

Several instruments have been designed specifically to measure the effects of hearing loss on the daily activities of a listener. Though more often used to measure quality of life before and after aural rehabilitation (McCarthy, 1996), these instruments assess communication needs at home, at work, and in social situations, and thus can be useful in selecting specific hearing aid features or HAT. Two of the earliest and most extensive instruments are the Hearing Performance Inventory (HPI; Giolas, Owens, Lamb, & Schubert, 1979; HPI-Revised, Lamb, Owens, & Schubert, 1983) and the Communication Profile for the Hearing Impaired (CPHI; Demorest & Erdman, 1987). Both of these profiles contain questions that define a listener’s communication experiences as well as feelings and attitudes toward hearing loss. A large number of test items (90 and 145, respectively) has made the HPI and CPHI unwieldy for general clinical practice.

There are questionnaires that are not exhaustive yet can be used to gather representative information. For example, the Hearing Handicap Inventory for the Elderly (HHIE; Ventry & Weinstein, 1982) and its companion version, the Hearing Handicap Inventory for Adults (HHIA; Newman, Weinstein, Jacobson, & Hug, 1990), are shorter and thus more clinically useful. Because the purpose of the inventories is to measure hearing handicap, many of the questions (e.g., Does a hearing problem make you irritable? or Does a hearing problem cause you to feel embarrassed when meeting new people?) are not directly applicable to hearing aid selection. Other questions (e.g., Does a hearing problem cause you to use the phone less often than you would like?) are relevant to hearing aid selection. In the absence of uniform methodology, audiologists in clinical practice occasionally construct their own questionnaires by cutting and pasting items from the various handicap inventories that can inform their own hearing aid recommendations.

Hearing Aid Performance Inventories

Self-assessment inventories have also been developed for measuring a listener’s perceived benefit from hearing aids. Although primarily designed and used for outcomes assessment, these inventories contain items that directly relate to a listener’s communication needs and can be administered to assist in the hearing aid or HAT selection process. For example, a question about a listener’s ability to hear in an auditorium might lead to the selection of a hearing aid with FM compatibility. Because there are many difficult listening environments, most of the hearing aid performance questionnaires, at least in their original forms, contain large numbers of items.

Two of the more widely used instruments are the Hearing Aid Performance Inventory (HAPI; Walden, Demorest, & Helper, 1984) and the Profile of Hearing Aid Benefit (PHAB; Cox & Gilmore, 1990). The original version of the HAPI contains 64 statements that are used to measure hearing aid benefit in four subsets of listening situations: noisy situations, quiet situations with the speaker in proximity, situations of reduced signal information, and situations involving non-speech stimuli. The HAPI has been shortened to 38 items (Schum, 1992) and more recently to 11 items (Hearing Aid Needs Assessment, HANA; Schum, 1999). Sample items from the HANA include, “You are at church listening to a sermon and sitting in the back pew,” and “You are at home listening to your stereo system.” Listeners rate each of the 11 statements in terms of how often they encounter the specific listening situation, how much trouble it causes, and how much help is expected from hearing aids. Although by no means exhaustive, some information from these instruments is relevant to hearing aid selection.

The PHAB was also developed to assess benefit from hearing aids. The test items reflect many common, difficult listening situations (e.g., I miss a lot of information when I’m listening to a lecture and I have trouble understanding dialog in a movie or at the theater) and listeners respond to each item twice: “without my hearing aid” and “with my hearing aid.” The PHAB was shortened to 24 items (Abbreviated Profile of Hearing Aid Benefit, APHAB; Cox & Alexander, 1995) for easier administration in the clinic and is available in a computerized version. Similar to the
HANA, the APHAB measures a listener’s ability to hear in diverse listening situations and therefore can be administered in advance of hearing aid selection as part of a needs assessment.

In summary, hearing handicap inventories and hearing aid performance profiles contain subsets of questions that can help define a listener’s communication difficulties and therefore may have direct applications to the hearing aid planning and selection stages. However, they were not intended to fully describe all of the needs or communication goals of an individual listener. Because inventories were designed for a variety of purposes, it is important for audiologists to familiarize themselves with the purposes of specific instruments and to select them appropriately to meet the goals of each clinical session.

### HEARING AID PLANNING AND SELECTION: CURRENT PRACTICE

In theory, there are two complimentary approaches for treatment planning and hearing aid selection when an individual is a candidate for amplification. The first approach would “build” an ideal hearing aid or HAT. It would involve compiling a list of all available hearing aid features and options and systematically ruling them in or out, depending on the listener’s needs or preferences. For example, one of the possible hearing aid features is a volume control. In this approach, questions would be constructed to determine a listener’s need or preference for this option. The answers would determine if this feature should be added to the listener’s hearing aid profile.

One complementary approach would be to define the specific communication difficulties and/or functional communication goals of an individual and then select only those hearing aid features or HAT options that directly address the problems without spending time on superfluous features. In this approach, questions would be constructed to determine a listener’s specific communication goals. If a listener’s only goal is to hear better at the bridge table, for example, then only those hearing aids or HAT that address this goal would be considered.

### Selection of HAT

Palmer (1992) took the first approach for selecting assistive device technology. She noted that audiologists commonly, albeit regretfully, consider HAT as an afterthought when hearing aids have failed to solve a specific communication problem. In order to facilitate the selection process, she defined HAT according to area of need (e.g., alerting, personal communication, and “specialty” devices) and categorized the three relevant variables that uniquely define a specific device: signal type (i.e., visual, auditory, or tactile), technology type (i.e., none, FM, infrared, hardwire, loop), and coupling type (i.e., microphone/unsigned ear, t-switch, direct input, earphone). A 21-item needs assessment statements list (e.g., I consistently hear the telephone ring at home, in the office, and in hotels when I am traveling) was compiled and incorporated into an interactive computer program (Palmer, Garstecki, & Rauterkus, 1990) for identifying desirable HAT. For example, if a client indicates that he or she has trouble hearing the telephone ring, then the pool of possible assistive devices that address this problem is activated. Subsequent questions narrow down specific device features, including whether a visual, auditory, or tactile alerting signal is preferred.

### The Hearing Demand, Ability, and Need Profile

A worksheet known as the Hearing Demand, Ability, and Need Profile was adapted from Palmer’s work and that of Healey (1992) for the purpose of categorizing listening problems that might be solved with HAT and/or hearing aids (Palmer & Mormer, 1997). The worksheet, shown in Figure 1, lists three categories of communication needs situations (alerting, personal communication, and other special situations). Next to the communication needs column is a row of environments where the problem could occur (i.e., home, work, traveling) and the possible cause(s) of the problem (i.e., hearing, noise, distance, and visibility). Finally, there is a column to indicate how the listener currently compensates for the problem. The worksheet is filled out by the audiologist during an interview and is specifically intended for specifying hearing aid features and HAT options based on the client’s need profile. A case study illustrating how the Hearing Demand, Ability, and Need Profile is used to define problems and select hearing aids and HAT that solve them is presented at the conclusion of this article.

Conceptualizing hearing aid selection as a problem/solution model provides a number of advantages for both the listener and the audiologist (Palmer, 2001). One of the primary advantages of the problem/solution model is that it allows the audiologist to narrow the focus of the treatment planning stage to the relevant variables for a given individual. This is important because the number of possible variables to consider in selecting hearing aids is growing rapidly. According to ASHA, the list of variables includes but is not limited to monaural/binaural fitting, style, earmold options, technology options, number and size of user controls, directional/multiple microphones, volume controls, telecoils, compatibility with HAT, programmable options, remote controls, color, shape, and other additional features.

### The Client Oriented Scale of Improvement

Because options are numerous and time is short, Dillon et al. (1997) created an open-ended questionnaire for defining specific communication goals that can be used to guide and narrow the hearing aid selection process. Called the Client Oriented Scale of Improvement (COSI), listeners who are hard of hearing are asked to nominate three to five specific communication environments in which they wish to hear.
Figure 1. A sample of the Hearing Demand, Ability, and Need Profile for describing communication needs of individual listeners.

<table>
<thead>
<tr>
<th>Description of Communication Activity</th>
<th>Communication Problem is Present…</th>
<th>The Problem is Due to…</th>
<th>Current Compensation</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>With Hearing Aid:</td>
<td></td>
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<td></td>
<td>on off on off on off</td>
<td>Hearing Noise Distance Visibility (describe)</td>
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<td>HOME WORK TRAVEL</td>
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<td>ALERTING</td>
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<tr>
<td>telephone bell</td>
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<td>doorbell</td>
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<tr>
<td>door knock</td>
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<tr>
<td>alarm clock</td>
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<tr>
<td>smoke alarm</td>
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<td></td>
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<td>siren</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>turn signal</td>
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<td></td>
<td></td>
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<tr>
<td>personal pager</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PERSONAL COMMUNICATION</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>telephone</td>
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<td></td>
<td></td>
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<tr>
<td>tv/stereo/radio</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>one-to-one(planned)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one-to-one(unplanned)</td>
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<td></td>
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<tr>
<td>group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>large room</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>OTHER COMM. NEEDS</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(e.g. stethoscope):</td>
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<td></td>
<td></td>
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<tr>
<td>Athletic activities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports:</td>
<td></td>
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</tbody>
</table>

Further information (e.g., status of hearing aids, telecoil, DAI, communication environment):

Recommendations (Assistive Technology, Communication Strategies, Environmental Manipulation):

but currently have difficulties. In other words, when prompted by the question, “My life would be easier if I could hear ______,” a listener fills in the blank with a difficult listening situation, be it a Friday morning staff meeting or Sunday dinner at Grandma’s. After three to five specific situations have been elicited, the listener is asked to rank them in order of importance. By defining and ranking specific difficult listening situations, the audiologist can recommend those hearing aid features or HAT that address the client’s problems and corresponding functional communication goals.

The COSI was designed to measure hearing aid benefit, which is calculated by the amount of improvement that the client perceives in each of the listening situations that were described as problematic. Dillon et al. (1997) pointed out that one of the drawbacks of traditional questionnaires concerns items that either are not relevant or are not important for a particular listener. For example, when a listener is asked about hearing at a party but rarely goes to one and, furthermore, does not care if communication is difficult when he or she gets there, then the answer to the question provides little useful information about the listener’s needs or goals. Using the COSI’s open-ended format, the answers are likely to be significant.

The Patient Expectation and Perception Worksheet

Palmer and Mormer (1997) modified the COSI to guide a client’s expectations about hearing aids and measure the listener’s perceived benefit after fitting. Their instrument is called the Patient Expectation and Perception Worksheet and is shown in Figure 2. In the first column, the specific communication goals defined by the listener (similar to the COSI) are listed. The succeeding columns represent degrees of listening success, ranging from hardly ever to almost always. In an interview process, the audiologist marks how a client currently functions (C), how a client expects to function with hearing aids or assistive listening devices (ALDs) (E), and what the audiologist perceives is a realistic expectation of benefit (.). After the hearing aids are fitted, the level of success perceived by the listener can also be indicated (A). If a patient has unrealistic expectations about what the hearing aids will do, it will be apparent from the discrepancies between the Es and the s, and the audiologist can counsel accordingly.

When specific communication problems have been identified, occasionally the audiologist must administer additional tests or ask additional questions to pinpoint the
Client is successful in this situation........

<table>
<thead>
<tr>
<th>Goal (list in order of priority)</th>
<th>Hardly Ever</th>
<th>Occasionally</th>
<th>Half the Time</th>
<th>Most of the Time</th>
<th>Almost Always</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
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</tr>
</tbody>
</table>

C = How the client currently functions (pretreatment or with current technologies)
E = How the client expects to function following intervention (hearing aids, HAT, etc.)
A = How the client actually perceives the level of success following intervention

appropriate solutions. For example, one of the most common communication problems of listeners who are hard of hearing is hearing speech in a background of other speech. The best way to improve the signal-to-noise ratio (SNR) in this difficult listening condition is by using directional or multiple microphones. However, there are several microphone configurations that provide varying degrees of assistance. Recently, Killion and Niquette (2000) developed a test that rapidly measures an individual’s ability to understand speech in background noise. The results are used to make specific recommendations regarding microphone options.

Other communication problems may require additional tests or questions before a specific solution is recommended. For example, many listeners report difficulty hearing in group situations, and fitting with two hearing aids is a common solution to this problem. Carter, Noe, and Wilson (2001) studied a subset of hearing aid users who did not function well with hearing aids in both ears, and suggested that a dichotic listening test could be used to identify them. In the problem/solution model, listeners who are candidates for binaural amplification would be given a dichotic test, and listeners who express a desire to be fitted monaurally would not. One advantage of the problem/solution model is that it helps the clinician in planning the session and using the available time efficiently. In essence, this model serves to help the clinician identify what procedures should be included and what others should be eliminated for this particular client and his needs as a listener.

SUMMARY (WHERE WE ARE AND WHERE WE ARE GOING)

Audiologists have come to realize that individual listeners have specific communication problems and corresponding functional goals that must be described. The goals are matched with technology solutions that specifically address these goals. Other variables such as style preferences or cost requirements have usually been defined informally. The current trend is for audiologists to create instruments that explicitly include more of these variables in the hearing aid planning and selection process.

Jacobson et al. (2001) created an inventory known as the Hearing Aid Selection Profile (HASP). The HASP contains 40 statements divided into eight categories: motivation, expectations, appearance, cost, technology, physical function, communication needs, and lifestyle. Items from the first two categories evaluate hearing aid candidacy, and items from the other six have direct application to hearing aid selection. Several of the categories, such as the listener’s level of comfort with technology and beliefs about health care costs, give the audiologist useful information that often is not provided from needs assessment worksheets. The HASP compares the response profile of a prospective hearing aid user with normative data to determine if he or she has greater or lesser motivation, expectations, needs, or preferences than the average hearing aid candidate. This information assists the audiologist in defining specific hearing aid features and counseling about benefits. The investigators present three case studies that reveal benefits and limitations of this new profile.

A holistic approach to hearing health care involves considering aspects of a patient’s physical, psychological, and social well-being in addition to communication needs (Lesner & Kricos, 1995). Johnson et al. (2001) developed a holistic checklist and flowchart methodology for matching “high-tech” hearing aid features (defined by the authors as completely-in-the-canal style, programmable capabilities, multimicrophone technology, and digital signal processing circuitry) to elderly listeners. Using a checklist-style worksheet, a client’s abilities or disabilities in each of the holistic domains are defined. Then, a flowchart is used to rule hearing aid features in or out, depending on information from the checklists. For example, if a client is in overall good health, has adequate financial resources, and wants to hear in many listening environments, he or she is
a good candidate for high-tech features. If not, other options are pursued.

The accuracy and efficiency of these new instruments has yet to be determined, but they indicate that the trend in hearing aid selection is to expand the list of variables beyond those associated with communication needs and abilities. New instruments will need to be flexible enough to incorporate additional variables as hearing aid technology evolves. These new developments may provide audiologists with improved methodologies for helping listeners meet their communication goals.

CONCLUSION

Audiologists use audiometric test data to define the type and degree of hearing loss and to calculate the appropriate electroacoustic characteristics of hearing aids. A subset of questions from hearing handicap inventories can be useful in defining a listener’s communication needs. Current practice employs comprehensive needs profiles and/or open-ended questionnaires to define the specific listening situations where an individual has problems. Technology options are presented to the listener as solutions to these problems. At times, it is necessary for audiologists to administer additional tests and questions to pinpoint a specific recommendation. Needs assessment instruments have begun to include an expanded set of variables that aid in the selection of appropriate hearing aids and HAT.

CASE STUDY

The following case study illustrates the problem/solution format for defining a listener’s needs and matching appropriate hearing aids and HAT. A 48-year-old woman came to our audiology clinic seeking to replace her current hearing instruments. She had a history of bilateral sensorineural hearing loss, first identified at age 12 following an episode of measles. According to the client, Ms. T., this hearing loss had been slowly progressive in nature. No amplification was used until she reached the age of 30 years. The client’s current amplification consisted of binaural Oticon (Somerset, NJ) E39 PL BTE hearing aids fitted with full shell lucite earmolds. Ms. T. had used these hearing aids successfully since they were initially fit. They were now 5 years old and she wished to have them replaced. The right instrument was “dead,” and the left instrument functioned with excessive feedback, particularly when she opened her mouth.

Ms. T. reported that she works full time in a professional setting where desk work, lecturing, group meetings, and conferences are part of her job. Of note, she reported that FM systems were currently in use in classrooms for clients at her workplace who are hard of hearing. Ms. T. also expressed a desire to maintain her active social life. Her frequent outings with friends and attendance at parties had become more stressful due to her impaired communication abilities. Ms. T. had previously discussed with her physician the possibility of a cochlear implant. Her hope was that she could remain functional using hearing aid and HAT amplification as long as possible before pursuing an implant.

Communication Needs Assessment

An inventory of Ms. T.’s hearing demands, ability, and needs, shown in Figure 3, revealed the following information. In the area of alerting, nearly all of her home and work needs were being met by the use of a hearing aid dog. The dog would alert her to the telephone ringing, doorbell or doorknocker, alarm clock buzzer, smoke detector, and any other sudden sound signals. In the area of personal communication Ms. T. mainly used a voice-captioned telecommunications device (VCO TTY) and the state relay service for telephone communication. She expressed a desire to use the telephone auditorily, an activity she had not found feasible with her current hearing aid T-coils. She used closed captioning and/or an infrared system for understanding speech on the television. For one-to-one conversations, she mainly used her hearing aids, sometimes coupling them with an FM system. For group and large room situations, she used her personal FM system, often unsuccessfully.

An analysis of Ms. T.’s specific goals for this new amplification fitting were as follows, listed in order of priority:

1. Understand speech in a one-to-one conversation with no hearing aid feedback.
2. Participate successfully in meetings occurring around a long conference table.
3. Understand the speaker’s words when sitting in the audience at a lecture.
4. Confidentially use an FM system at work, in proximity to other FM systems in use.
5. Communicate successfully on the telephone, preferably without relying on the TTY.

Audiologic testing was conducted and the client’s pure-tone audiogram and word recognition scores are shown in Figure 4. These results were found to be essentially unchanged from test results obtained previously in 1992.

Solutions

Ms. T. was obviously functioning with a very severe bilateral hearing loss, with limited word recognition ability. She expressed her strong desire to remain in the “hearing” culture, wishing to maximize the use of her limited residual hearing. She was very willing to use any and all (non-implanted) technologies that could facilitate her amplification goals.

Her case, summarized in the Appendix in the problem/solution format, required a few special considerations. Using the combination of hearing aids, FM system, and the various accessories described in the table, this fitting enabled Ms. T. to achieve her functional communication goals. After a trial period with the instrumentation, Ms. T. finalized her purchase of all the components described (her
employer financed a portion of the equipment deemed necessary for the execution of Ms. T.’s job duties). She currently feels that she will delay cochlear implantation for several more years if her functional communication abilities remain stable.

ACKNOWLEDGMENTS

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REFERENCES


Dillon, H., James, A., & Ginnis, J. (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.

Giolas, T. G., Owens, E., Lamb, S. H., & Schubert, E. D.
Figure 4. The pure-tone audiogram and word recognition scores of the case study listener.


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### APPENDIX. COMMUNICATION PROBLEMS AND THE TECHNOLOGY SOLUTIONS FOR THE CASE STUDY LISTENER

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
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<tbody>
<tr>
<td>The severity of her hearing loss and the need to control feedback from the necessary high-power aids</td>
<td>The Emplex II shell mold with Patriot canal ordered from Emtech Laboratories (Roanoke, VA)</td>
</tr>
<tr>
<td>The need to successfully couple an assistive listening device (ALD) to her hearing aids while avoiding the usual T-coil interference factors of computer and fluorescent lights</td>
<td>Binaural Rx Lin P BTE/FM hearing aids with Mini Tx-10 Pro FM transmitter ordered from AVR Sonovation (Eden Prairie, MN), avoiding the need for wearing or coupling to an FM receiver</td>
</tr>
<tr>
<td>The need to address the distance from meeting participants to Ms. T.’s hearing aid microphones at a long conference table, so that all speakers could be heard</td>
<td>CM3 Conference Microphone and 6 foot V cord from Centrum Sound (Sunnyvale, CA), allowing the addition of two microphones, remotely placed, into the auxiliary input of the AVR transmitter. Additionally, the AVR BTE/FM hearing aid allows for simultaneous operation of the FM receiver and hearing aid microphone to enable the listener to hear nearby conversation.</td>
</tr>
<tr>
<td>The need to address the issue of confidentiality in her use of an ALD system where FM systems are already in use in the building</td>
<td>Use of the AVR channel changeable boot, allowing for the changing of the FM channel so as not to coincide with channels under use by FM users on site</td>
</tr>
<tr>
<td>Her desire to use the telephone and television in an auditory manner</td>
<td>The AVR BTE/FM hearing aids have a powerful T coil, which enabled Ms. T to converse via telephone when necessary. Additionally, a Williams Sound Telelink (Eden Prairie, MN) was purchased so that telephone output could be coupled directly to the AVR FM transmitter. An auxiliary input cord, available from AVR similarly enabled the patient to directly feed output from a television, radio, or CD/tape player to the FM transmitter.</td>
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