Efficacy of Individual Auditory Training in Adults: A Systematic Review of the Evidence

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Abstract

A systematic review of the literature was conducted addressing the following question, “Is there evidence of improvement in communication skills through individual auditory training in an adult hearing-impaired population?” Keywords and authors were used as search terms in eight major indexes, and seven textbooks were reviewed for related references. The level of evidence that was accepted included randomized controlled trials, nonrandomized controlled trials, cohort, and before/after designs with or without control groups. Two hundred thirteen articles were identified during the preliminary search with 171 of these eliminated by review of abstracts because they did not meet the search criteria. Forty-two manuscripts were reviewed, with six meeting the evidence and search criteria. The strengths and weaknesses of these studies are highlighted, and the systematic review question is answered in light of these studies. In addition, elements critical to the future of auditory training research and clinical practice are offered.

Key Words: Adults, analytic, auditory training, aural rehabilitation, communication skills, feedback, synthetic, systematic review

Abbreviations: AR = aural rehabilitation; AT = auditory training; RCT = randomized controlled trial

Sumario

Se realizó una revisión sistemática de la literatura planteando la siguiente pregunta: “¿Existe evidencia sobre la mejora en las habilidades de comunicación a través del entrenamiento auditivo individual en una población de adultos hipocáusicos?” Se utilizaron palabras clave y autores para la búsqueda de términos en ocho índices principales y se revisaron siete libros de texto para encontrar referencias relacionadas. El nivel de evidencia que se aceptó incluyó estudios aleatorios controlados, estudios controlados no aleatorios, diseños de cohorte y de tipo antes/después, con o sin grupos control. Se identificaron doscientos trece artículos durante la búsqueda preliminar, eliminando 171 de éstos a través de la revisión de sumarios, dado que no cumplieron los criterios de búsqueda. Se revisaron cuarenta y dos manuscritos, encontrando seis que cumplían los criterios de búsqueda y evidencia. Se destacan las fortalezas y debilidades de estos estudios, se contesta la pregunta sistemática de revisión a la luz de estos estudios.

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When patients request rehabilitative services from audiologists, they often misguided claim that the problem they wish to correct is a loss of hearing. Experience has taught us that although hearing aids can adequately restore audibility for many individuals, the communication problems experienced by patients are often not satisfactorily resolved. This is because hearing is only the first step in a cascade of events leading toward communication. Kiessling et al (2003) described audition as a critical element of communicative interaction, but they indicated that audition alone does not guarantee communication. A series of essential components commencing with hearing and concluding with communication were identified by Kiessling et al. Between hearing and communication lie the important skills of listening and comprehension. They defined “hearing” as “access to the auditory world via the perception of sound”; “listening” as “hearing with attention and intention”; “comprehension” as “the reception of information, meaning, or intent”; and “communication” as “the two-way exchange of meaningful messages.” Sweetow and Henderson-Sabes (2004) used this format to propose a positive and negative feedback mechanism. Figure 1 depicts this structure showing that hearing initially affords access to acoustic information necessary, at least in part, for communication. Then, listening, comprehension, and communication interact with each other in a manner such that if listening skills are poor, communication is adversely impacted even if hearing is adequate. Conversely, if one properly uses linguistic and acoustic cues and effectively receives and transmits information by using good communication repair strategies, better listening will be encouraged. Yet despite this important theoretical relationship, audiologists may provide little more in the rehabilitative process beyond attempting to restore “normal” hearing levels via hearing aids. Schow et al (1993) indicate that while 86% of audiologists report providing rehabilitative services and 88% give hearing aid training, only 23% offer communication training. Therefore, it appears that many audiologists consider that “rehabilitation” is provided simply by imparting hearing aid training.

If this theoretical model adequately describes the factors needed for successful communication, patients receiving amplification should be offered some type of audilologic rehabilitation (AR). The term “audiologic rehabilitation” will be used in this paper because it is more inclusive and incorporates the variety of elements leading to communication than does the formerly used term “aural rehabilitation.” In fact, Alpiner defines aural rehabilitation as helping “individuals with auditory disabilities realize their optimal potential in communication” (1978, p. 3). Thus, AR may include any or all of the following: amplification, assistive listening devices, psychosocial counseling, counseling regarding

Figure 1. Elements of a communication feedback model.
communication strategies presented in either a group or individual format, and/or auditory training (AT), as defined below, to assist a listener in compensating for any degradation of the auditory signal due to internal (hearing loss) or external (noise) factors. Since the 1980s, the percentage of audiologists providing services beyond general hearing aid orientation has decreased, particularly in the areas of communication training and auditory training (Schow et al., 1993; Millington, 2001). There are a number of reasons that this trend may have begun and continues to occur. These include providing hearing aids via a “retail” as opposed to a “medical/rehabilitation” model, a lack of reimbursement for audiologic rehabilitation services, perception of excessive time and material requirements, and the lack of outcome evidence for individual rehabilitation to support the effort.

In another paper in this issue of JAAA, David Hawkins presents evidence that the provision of group counseling-based AR can produce positive outcomes. One of the classic limitations of group therapy, however, is the inability to provide individualized attention to patients, many of whom present unique problems and a wide range of abilities to remedy these problems. Thus, the question of individual AR, and, specifically, individualized auditory training, becomes relevant. The advantages of individual AR include personal treatment plans along with implementation of an optimal pace for the patient. On the other hand, it can be expensive to provide individual therapy from both a time and cost perspective. While a substantial body of literature exists supporting the impact of group informational AR, there are fewer reports available regarding the efficacy of individual auditory training.

The question to be explored in this paper is this: “Does evidence exist supporting improvement in communication skills through individual auditory training in an adult hearing-impaired population?” At the conclusion of this systematic review, we will speculate on the future of auditory training.

**METHODS**

**Inclusion and Exclusion Criteria**

The level of evidence accepted included randomized controlled trials, nonrandomized controlled trials, cohort, and before/after designs with or without a control group. All other designs were excluded from this evidence-based search. In a randomized controlled trial (RCT), a set of subjects are identified and then randomly assigned to two or more treatment groups. One group serves as the control group and receives no treatment or standard care. Cohort studies are prospective and generally assess a group of people who have been exposed to a similar treatment. There often is a comparison control group that has not received treatment. Unlike RCT, the assignment of subjects to groups is not under the control of the investigator (i.e., subjects are not randomly assigned to one of the groups; they assign themselves). In before/after designs, the outcomes of interest are assessed preceding and following a treatment. A control group generally is not included because the investigator does not wish to withhold treatment, but a control group may be included in certain circumstances. Other inclusion criteria included the following: subjects had to be adults with hearing loss, subjects could not be cochlear implant users, training paradigms had to be the independent variable (either analytic or synthetic training or some combination), the dependent variable had to be one or more outcome measures related to communication skills (e.g., understanding speech, self-perception of ability, etc.). In a general review of the auditory training literature, it becomes evident that investigations can be categorized by their focus on either analytic or synthetic training or a combination of the two. Analytic (or bottom up) training implies that the individual will practice identifying the sounds of speech rather than work at the word, sentence, or meaning level. Most commonly, analytic training includes consonant recognition. Synthetic (top down) training focuses on gaining the meaning of a message through various communication strategies including improved hearing, attention, use of context, repair strategies, and so on. Both types of training were included in this review, and there was some overlap of the two strategies in certain studies.

**Search Strategy and Data Extraction**

A systematic review of the literature was conducted. The methods of the review
followed the guidelines provided by McKibbon et al (1999), as explained by Cox in this issue. The key words for the search were “adult,” “hearing impaired,” “hearing loss,” “hard of hearing,” “hearing problems,” “auditory,” “aural rehabilitation,” “audiologic rehabilitation,” “training,” “learning,” “feedback,” “synthetic,” “analytic,” “top-down processing,” “bottom-up processing,” “communication training,” “perceptual training,” “listening training,” “communication skills,” “communication abilities,” “speech recognition,” “speech discrimination,” “frequency resolution,” “temporal resolution,” and “intensity resolution.” Key words were always combined so that only papers with adult subjects with hearing loss would be identified.

The databases searched included a key word search in MEDLINE, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Psych Info, EMBASE, Applied Social Science Index and Abstracts, and Rehabilitation Literature Index. In addition, seven aural (audiologic) rehabilitation textbooks (Rintelmann, 1994; Hull, 1997; Alpiner and McCarthy, 2000; Valente, 2000; Katz, 2001; Schow and Nerbonne, 2002; Tyemurray, 2004) were searched by hand to identify references that met the search criteria. Using the above search, names of authors who had contributed to this literature were identified, and these names were used in a related authors search conducted in PubMed in order to identify other, related works by these authors. The Web of Science Cited Reference search was used to identify articles using the target articles already identified as a reference. No limits were put on the date of publication, but language (English) was used as a limiting factor in the search.

Abstracts resulting from this initial search were reviewed in order to identify studies that met the inclusion/exclusion criteria. In total, 213 articles were identified for review, 171 were eliminated based on abstracts, and a final review was conducted with 42 manuscripts. (Figure 2 is a flow chart of this process listing reasons for exclusion.) Of these, only six met the inclusion criteria. Of the final articles accepted, two described experiments using analytic training, two used synthetic training, and two used a combination of analytic and synthetic training (Table 1). One of the studies that included both analytic and synthetic training compared the two methods, and the other study compared synthetic alone versus synthetic plus analytic.

The headings in Table 1 provide some of the categories used for data extraction. The reviews were subsequently combined, and any discrepancies were resolved through discussion of the investigators. The purpose of the study was articulated; the training was recognized as analytic or synthetic or both; the target population was described; and the study design was identified. The intervention (and therefore independent variable) was some type of training; the dependent variables were the outcome measures; and the specific groups were described. Finally, a summary of the results directly related to training and any weaknesses in the study were described. If, after data extraction, the study met all inclusion criteria, it was accepted into the systematic review and underwent quality assessment.

**Quality Assessment**

Study quality for the six selected investigations was assessed by the authors and included attention to:

1. Description of the randomization process, if it existed
2. Inclusion of a control group
3. Number of subjects and power analysis
4. Blinding of experimenters and/or subjects
5. Psychometrically sound outcome measures with a clear relationship to communication skills
6. Feedback used in the training paradigms
7. Follow-up examining long-term impact of training
8. Generalization to other materials or communication situations

Table 2 provides a summary of the quality of the studies that met the inclusion criteria for this systematic review. The first five criteria are standard ways to assess the inclusion criteria for this systematic review. The final three criteria were considered specifically because of the present topic of auditory training. The provision of feedback can have a significant positive impact on the successful outcome of training (Wolfle, 1951), so this was examined in each study. In addition, considering the cost in time and effort discussed previously, if
improvements attributed to auditory training do not maintain over a defined period of time, it would be difficult to support the clinical activity of auditory training. Ideally, successful auditory training would produce an improvement that would be generalized to other communication materials or situations. All eight criteria were considered important in the quality assessment of the studies.

Data Synthesis

Due to the lack of consistency between training paradigms, provision of feedback, and use of a variety of outcome measures, it is not possible to pool results across studies. Table 1 provides the detail needed for a qualitative analysis of the investigations. The results as they relate to the question posed in this systematic review are listed in the last column of Table 2 and are summarized as follows:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Design</th>
<th>Intervention</th>
<th>Outcomes</th>
<th>Results</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bode and Oyer (1970)</td>
<td>Before/After with control group</td>
<td>Training in two listening conditions with two response formats</td>
<td>CID W-22 M-Rhyme Test Semi-diagnostic test</td>
<td>Impaired listeners should receive training similar to the outcome measure</td>
<td>Small N, not randomized, not blinded, no follow-up, same day training because subjects would not come back</td>
</tr>
<tr>
<td>Walden et al (1981)</td>
<td>RCT</td>
<td>AR training alone AR + visual training AR + auditory training</td>
<td>Auditory consonant recognition Visual consonant recognition A-V sentence recognition</td>
<td>All groups improved with training, AR + visual and AR + auditory groups improved more than the AR alone group</td>
<td>Not blinded; cannot generalize beyond the male, VA population; no follow up</td>
</tr>
<tr>
<td>Kricos et al (1992)</td>
<td>RCT with pre- and posttest outcome measures</td>
<td>Training 4 weeks, 2 x per week, 1 hour or no training</td>
<td>HHIE Speech recognition test at various SNRs (signal-to-noise ratios)</td>
<td>Significant reduction in self-perceived hearing handicap and improvement in speech recognition in all subjects (control and experimental)</td>
<td>Not blinded, no feedback with training, no follow-up testing</td>
</tr>
<tr>
<td>Montgomery et al (1984)</td>
<td>RCT with pre- and posttest outcome measures</td>
<td>Training (50 hours) Control Group with AR but no A-V Normal hearing group</td>
<td>A-V sentence test</td>
<td>Experimental group improved more on the audiovisual sentence task than the control group</td>
<td>Deals primarily with A-V training, not just auditory, not blinded, no follow-up, difficult to generalize due to all male, veteran population</td>
</tr>
<tr>
<td>Rubenstein and Boothroyd (1987)</td>
<td>Before/After with no control group</td>
<td>Synthetic training Synthetic plus analytic training (8 1-hr private sessions over 4 weeks)</td>
<td>NST SPIN</td>
<td>Effect of training method was not significant. The gains achieved by both groups were not lost in the month following the end of training.</td>
<td>Not blind, small N, no control group, no feedback with training</td>
</tr>
<tr>
<td>Kricos and Holmes (1996)</td>
<td>Before/After with control group</td>
<td>Active listening training (1 hour, 2 x per week over 4 weeks) No training</td>
<td>CST HHIE CPHI</td>
<td>Only significant finding was for three subscales of the CPHI—active listening group was better than the control group</td>
<td>Subject variability impacted the ability to analyze the data, not blind, total of 8 hours of training over 30 days, no follow-up</td>
</tr>
</tbody>
</table>

Note: AR = aural rehabilitation; A-V = auditory-visual; CID W-22 = Central Institute for the Deaf Word List 22 (Hirsh et al, 1952); CPHI = Communication Profile for the Hearing Impaired (Demorest and Erdman, 1987); CST = Connected Speech Test (Cox et al, 1987); HHIE = Hearing Handicap Inventory for the Elderly (Ventry and Weinstein, 1982); M-Rhyme Test = Modified Rhyme Test (Fairbanks, 1958); NST = nonsense syllable test (Resnick et al, 1975); RCT = randomized controlled trial; SPIN = Speech in Noise Test (Bliler, 1984); VA = Veterans Administration.
Table 2. Summary of Study Quality

<table>
<thead>
<tr>
<th>Study</th>
<th>Blinding</th>
<th>Randomized to Groups</th>
<th>Control Group</th>
<th>Power Calculation</th>
<th>Validated Outcome Measures</th>
<th>Finding</th>
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</thead>
<tbody>
<tr>
<td><strong>Analytic</strong></td>
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<tr>
<td>Bode and Oyer (1970)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>C/T</td>
<td>A+</td>
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<tr>
<td>Walden et al (1981)</td>
<td>x</td>
<td>*</td>
<td>*</td>
<td>x</td>
<td>C/T</td>
<td>A+</td>
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<td><strong>Synthetic</strong></td>
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<tr>
<td>Kricos et al (1992)</td>
<td>x</td>
<td>*</td>
<td>*</td>
<td>x</td>
<td>C/T</td>
<td>S-</td>
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<tr>
<td>Montgomery et al (1984)</td>
<td>x</td>
<td>*</td>
<td>*</td>
<td>x</td>
<td>C/T</td>
<td>S+</td>
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<tr>
<td><strong>Synthetic and Analytic</strong></td>
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<tr>
<td>Rubinstein and Boothroyd (1987)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>*</td>
<td>S+ S/A+</td>
</tr>
<tr>
<td>Kricos and Holmes (1996)</td>
<td>x</td>
<td>x</td>
<td>*</td>
<td>x</td>
<td>*</td>
<td>S+ A-</td>
</tr>
</tbody>
</table>

*Note:* * = criteria met; x = criteria not met; C/T = cannot tell; A = analytic; S = synthetic; S/A = synthetic and analytic combined; *+* = significant improvement compared to pretest or to control group; *-* = no improvement compared to pretest or to control group.
• A+ = evidence of a statistically significant change in communication skill(s) after analytic auditory training (as compared with a pretest or a control group)
• A- = no evidence of a statistically significant change in communication skill(s) after analytic auditory training (as compared with a pretest or a control group)
• S+ = evidence of a statistically significant change in communication skill(s) after synthetic auditory training (as compared with a pretest or a control group)
• S- = no evidence of a statistically significant change in communication skill(s) after synthetic auditory training (as compared with a pretest or a control group)
• S/A = the auditory training combined both synthetic and analytic components

RESULTS

Study Characteristics

The details of the investigations that met the search criteria (Figure 2) are presented in Table 1. Only one of the six studies had a sample size over 25 individuals per group with the other studies ranging from 8 to 13 subjects per group. All six investigations had broad inclusion criteria with "sensorineural hearing loss" the most common descriptor. The subjects ranged in age from 19 to 85 years with three of the studies including only older adults (Rubenstein and Boothroyd, 1987; Kricos et al, 1992; Kricos and Holmes, 1996) and three of the studies including a large range from young adults to older adults (Bode and Oyer, 1970; Walden et al, 1981; Montgomery et al, 1984). Two of the studies included only male veterans (Walden et al, 1981; Montgomery et al, 1984) while the other four studies included males and females with little demographic data. Four of the studies included individuals with reported hearing aid use, and two of the studies specifically used new hearing aid wearers with the hearing aid fitting being part of a larger audiologic rehabilitation program (Walden et al, 1981; Montgomery et al, 1984).

The training paradigms varied widely, but the analytic training always focused on consonant recognition. The two studies that included synthetic auditory training did not include detailed descriptions of the actual training procedures. Four of the studies included some form of feedback during training (Bode and Oyer, 1970; Walden et al, 1981; Montgomery et al, 1984; Kricos and Holmes, 1996). Three of the studies included eight hours of training over a four week period with two one-hour sessions per week (Rubenstein and Boothroyd, 1987; Kricos et al, 1992; Kricos and Holmes, 1996). Another study was similar in terms of time frame with seven hours of training over ten days, but this training took place in the midst of a much larger audiologic rehabilitation program in which the subjects participated (Walden et al, 1981). The two extremes in terms of time included one investigation that included 50 hours of synthetic training over two weeks (Montgomery et al, 1984) and one investigation that included 125 minutes of analytic training in one day (Bode and Oyer, 1970).

One study (Montgomery et al, 1984) conducted training in quiet. All of the other studies used at least one noise condition in training. Only one study (Rubenstein and Boothroyd, 1987) included any type of follow-up testing after a period of time after the end of training. The authors reported that gains were not lost in the month following the end of training. A careful investigation of generalization will illustrate if improvement on a particular task (e.g., identifying nonsense syllables) extends to other tasks (e.g., understanding sentences in noise). None of the studies specifically investigated generalization of the training effects, but the posttest used in Montgomery et al (1984) revealed significant improvement after synthetic auditory training was presented by a different talker, thus suggesting some generalization. Walden et al (1981) did syllable training and subsequently found improved sentence recognition.

Findings

A review of Table 1 indicates that the studies used three outcome measures related to consonant recognition, eight outcome measures related to speech perception with formats varying from single words to sentences, and two measures of self-perception. In two (Bode and Oyer, 1970; Walden et al, 1981) of the three investigations
that included analytic auditory training (the third being Kricos and Holmes, 1996), a significant improvement in at least one outcome measure was found posttraining as compared to pretraining or to a control group. In two (Montgomery et al, 1984; Rubinstein and Boothroyd, 1987) of the three studies that included synthetic auditory training (the third being, again, Kricos and Holmes, 1996), a significant improvement in at least one outcome measure was found posttraining as compared to pretraining or to a control group. One study combined analytic and synthetic auditory training (Rubinstein and Boothroyd, 1987) and found that both synthetic alone and synthetic combined with analytic training produced a significant improvement in the understanding of high predictability sentences as compared to pretest measures. The authors concluded that the inclusion of the analytic training did not add anything to the result since a significant improvement was found with synthetic training alone. In the study that directly compared an analytic training method with a synthetic training method (included in the separate results above), results indicated that the group receiving the synthetic method showed significant improvement on a self-perception of communication measure as compared to the group receiving analytic training. This was the only study that included a direct comparison of the two types of training.

**Study Quality**

Study quality parameters are reported in Table 2. Randomized controlled trials offer the highest level of evidence and, as can be seen in Table 2, three of the identified investigations followed this design. Unfortunately, none of the investigations provided any information related to the blinding of the subject or the investigator. Without a control group, it is very difficult to attribute change to a particular auditory training method exclusively. Four of the six studies included a control group. None of the studies provided a power calculation that would indicate the number of subjects needed to identify a clinically interesting difference at a particular power level. All but one of the studies included small Ns per group (8 to 13 subjects), and several studies identified large variability between subjects as a limiting factor to identifying significant change post–

**DISCUSSION**

This systematic review provides very little evidence for the effectiveness of individual AT. However, there is some evidence supporting efficacy. While the literature does not produce unanimous or indisputable conclusions regarding the efficiency of individual auditory training, certain trends appear to be well supported. These trends suggest that synthetic training might be capable of teaching hearing-impaired individuals to better use active listening strategies that can translate into improved psychosocial function. Some studies further support the finding that speech recognition skills, particularly in noise, can be improved by synthetic training. Greater uncertainty remains regarding the contribution of analytic training; however, a number of issues may account for the lack of definitive results. Among these issues are the sensitivity of the outcome measures used in formulating conclusions and doubts regarding whether the optimal analytic training parameters have yet to be identified. Even so, the evidence uncovered in this review paints a more positive picture than the 50-year-old statement of Licklider and Miller (1951), who summarized psychoacoustic research in listener training at the time and concluded that there seemed to be no better way to teach listeners than to motivate them and have them listen.

**FUTURE DIRECTIONS**

Indeed, the question arises, how does one teach a hearing-impaired listener to listen? Perhaps lessons can be gleaned from the work of Wolfle (1951), who specified some critical aspects of learning theory that may be applicable to auditory training, including the following:

1. Distribution of practice should be suitable for the task to be learned.
2. Active participation by the learner is superior to passive receptivity.
3. Practice material should be varied so
that the learner can adapt to realistic variation and so that motivation during drill is improved.

4. Accurate performance records need to be maintained in order to evaluate progress and effects of training.

5. The most useful single contribution of learning theory is the provision for immediate knowledge given to learners regarding their performance (feedback).

There is no evidence that individualized audioligic rehabilitation or auditory training produces deleterious effects. Moreover, we know adults learn. Mature, neural systems that were once viewed as hardwired and immutable are now viewed as malleable and amenable to modification. Neuroscientists have investigated the adaptive properties of the central auditory system in adult animals by creating peripheral lesions. More recently, they have used noninvasive procedures to quantify neural plasticity in human subjects and have clearly demonstrated reorganization of cortical somatosensory maps following peripheral nerve damage or deafferentation of animal appendages (Robertson and Irvine, 1989; Rajan et al, 1993). Neural plasticity has been discussed with relationship to auditory learning (Palmer et al, 1998) and adaptation following hearing aid use (Silman et al, 1984; Moore, 1993; Neuman, 1996; Turner et al, 1996). In addition, neurophysiologic changes related to auditory learning have been documented (Tremblay et al, 2003). Functional magnetic resonance imaging findings have shown neural plasticity is not lost with age or with lack of neural stimulation, which is of interest considering the majority of hearing aid users are older people (Weinberger, 2004).

RESEARCH NEEDS

There is a need for evidence-based research to establish both the efficacy and efficiency of auditory training procedures. Despite the large number of articles that have been published related to auditory training, only a handful meet the rigorous scientific criteria set forth to qualify as evidence based in this paper, and even these have methodological flaws that make it difficult to reach a compelling conclusion related to auditory training.

This is regrettable since hearing-impaired individuals do appear to be able to improve their communication skills following training. However, until solid evidence is published, hearing health care professionals and third-party payers will remain skeptical of the need for such services. In addition to determining optimal training parameters and optimal outcome measures, research
must establish the cost-effectiveness of individual auditory training procedures. However, full acceptance of the effectiveness of individual training will not occur until the methodological limitations described earlier in this review are addressed. Specifically, studies must incorporate larger sample sizes. They must observe outcomes for extended periods following the conclusion of treatment. They must establish whether treatment effects are generalized beyond training parameters. They must provide detailed descriptions of the training protocols. They must use realistic yet ample training periods. If possible, researchers analyzing the data should be blinded to the assignments of treatment versus control groups.

CONCLUSIONS

The effectiveness of individual auditory training has yet to be firmly established. However, the advent of computerized programs and the strict observation of research principles such as those outlined above will help ascertain these important answers. Determining the effectiveness and efficacy of training is critical because patients will not regard listening programs to be important unless audiologists believe they are important. In order for audiologists to fully embrace the concept of auditory training, it is essential that the focus be placed on communication, not simply hearing. Research and development of time and cost-effective therapies must continue, and evidence-based investigations must be pursued and disseminated to hearing-health-care professionals, patients, and insurers.

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REFERENCES


