

THE USE OF HEARING AID OUTCOME MEASURES IN THE AUDIOLOGIC
TREATMENT OF OLDER ADULTS

Capstone Document

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Audiology
in the Graduate School of The Ohio State University

By

Allison E. Goff, B.A.

The Ohio State University

2013

Capstone Committee:

Christina Roup, Ph.D., Advisor

Christy Goodman, Au.D.

Gail Whitelaw, Ph.D.

Approved by

Advisor

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ABSTRACT

Hearing loss is the third most prevalent chronic condition affecting older adults in the United States. As healthcare moves toward an outcome-based design, audiologists must be able to document the effectiveness of hearing aid intervention. However, audiologists must also be able to choose an appropriate tool to assess clinical treatment. Clinicians therefore must ask, what is the evidence that hearing aid outcome measures actually assess hearing aid treatment? There are several domains of hearing aid outcome that can be measured, including benefit, satisfaction, residual activity and participation restrictions, and quality of life. There are also many issues to consider when choosing a hearing aid outcome measure, including which domains should be measured, the method in which data is obtained, and the stability of test results over time. While there is no standard protocol for hearing aid outcome measurement, this paper reviews the research evidence on the reliability of various questionnaires, as well as their potential to be used in audiologic practice.

ACKNOWLEDGEMENTS

I want to express my deepest gratitude to my family, friends, classmates, and professors for their unwavering support.

VITA

January 30, 1986.....Born – Indianapolis, IN
June 2004Diploma – Triad High School
June 2009B.A. Speech and Hearing Science,
The Ohio State University
September 2009 to present.....Graduate Student, Audiology, The Ohio
State University
June 2012 to June 2013Audiology Extern, Louis Stokes VA,
Cleveland, Ohio

Fields of Study

Major Field: Audiology

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CHAPTER 1

Overview of Outcome Measures

Hearing loss is the third most prevalent chronic condition affecting the geriatric population in the United States (Cox et al., 2000). Further, the most common cause of hearing loss is the typical aging process. Age-related hearing loss, or presbycusis, is gradual and impacts both ears equally, thus the patient is often unaware of the extent of their hearing loss. Despite the lack of awareness, however, presbycusis has been shown to drastically affect an individual's quality of life. For example, hearing loss has been shown to cause feelings of depression and isolation (Dalton et al, 2003). The most common form of treatment for age-related hearing loss is amplification through the use of hearing aids, which has been shown to improve an individual's quality of life (Cox et al., 2000).

A major focus of the current healthcare system is outcome-based treatment—that is, how effective is clinical intervention, and does it improve the quality of life for patients? Therefore, it has become necessary for clinicians to document treatment efficacy. This can be accomplished by utilizing outcome measures, which are tools specifically designed to assess the efficacy of clinical intervention. Outcome measures can be designed for specific clinical treatments; for example, there are several outcome

measures designed to measure the effectiveness of hearing aid treatment. Such measures can be used to demonstrate hearing aid benefit, as well as an individual's improved quality of life before and after treatment. However, research has shown that many audiologists do not use outcome measures in their clinical practice (Abrams, McArdle, & Chisolm, 2005). Researchers have therefore concluded that more evidence is needed on hearing aid outcome measures and how they can be utilized in common audiologic practice (Dillon & So, 2000). Indeed, the potential benefits of hearing aid outcome measures include counseling patients more effectively on the impact that hearing loss has on their quality of life (Cox et al., 2000; Gatehouse, 2003).

The overall purpose of an outcome measure is to assess a patient's performance after they have received treatment. In order to evaluate a given treatment, the clinician must be able to relate the clinical changes measured post- intervention to the patient's real-life performance. Specifically, in regards to amplification intervention, how is the patient performing with hearing aids in the real world? Equating clinical scores to real-life performance can benefit both patients and clinicians alike. First, it is important that the patient feel validated in their choice to pursue amplification. Outcome measures can thus be used to demonstrate to patients that they are better off with hearing aids than they were before trying amplification. Second, it is imperative that audiologists validate their own clinical decisions in terms of hearing aid selection and fitting practices. Modern healthcare has placed a strong demand on evidence-based practice. Therefore, audiologists—like any other type of clinician—must ensure that their clinical decisions are in the best interest of their patients. As a field, Audiology must be able to integrate

our own clinical experience with external evidence from systematic research. In doing so, audiologists can continue to improve their services (Abrams, McArdle, & Chisolm, 2005).

Outcome measures can be used to examine several different dimensions of hearing aid outcome, such as hearing aid benefit. Such measures can be objective (hearing-aid focused) or subjective (patient-focused) in nature, and each type can give a clinician insight into how the patient is benefiting from the hearing aids. In addition to hearing aid benefit, though, measures can be used to demonstrate other outcomes for patients who pursue amplification, such as improved quality of life or overall satisfaction with the hearing aids. It is important to keep in mind what each measure is designed to assess. For example, satisfaction is a complex process that differs from benefit in that it also includes the issue of value. As technology continues to advance, the cost of technology increases and, in turn, patients have higher expectations of hearing aid benefit and satisfaction (Abrahamson, Abrams, Cox, & Preminger, 2005). It is therefore important to select an appropriate tool or tools that accurately measure hearing aid outcome for the patient.

Outcome measures have the potential to be a vital part in any type of audiologic practice. Advances in technology and the medical field come at great economic cost, and the field of audiology is not exempt from this—in fact, cost is one of many factors that influence an individual pursuing hearing aids (Newman, Hug, Wharton, & Jacobson, 1993). Currently, there are few third party payers that provide hearing aid coverage. However, coverage for amplification will not increase until benefit is well-documented,

as third party payers typically require proof of medical necessity. Across the medical field, different specialties are required to demonstrate improved quality of life to justify medical expenditures. For example, pharmaceutical companies include quality of life measures during clinical trials of new drugs (Montano & Spitzer, 2009). Similarly, audiologists could use outcome measures in their clinical practice to demonstrate improved quality of life with hearing-related technology.

In general terms, outcome measures can be objective or subjective in nature. Objective measures provide information about what the patient is able to hear with amplification. For example, objective measures include word recognition tasks, which indicate the number of words the patient was able to correctly repeat while wearing their hearing aids. Such tests are easily administered and quantified, however they are not able to provide information about what problems the patient may be encountering in daily life. The clinical setting is carefully controlled, whereas the real world offers much more difficult listening situations. Therefore, subjective measures should also be used, as they reflect the patient's opinion. Subjective reports can thus provide another facet of hearing aid performance, and may not match objective measures of performance at all. Both types of measures are important, and it is imperative that the clinician keep in mind that subjective questionnaires simply do not measure the same thing as objective measures. Rather, subjective measures provide valuable information regarding the patient's perception of treatment (Abrahamson, Abrams, Cox, & Preminger, 2005).

There are many outcome measures to choose from that are designed to assess different aspects of hearing aid outcome. Several considerations and goals of outcome

measures should be kept in mind (Cox et al., 2000). First, the characteristics of an outcome measure can vary, depending on the purpose of the measurement. For example, measures of hearing aid benefit do not indicate patient satisfaction with amplification. Second, continued research is needed in the use of outcome measures in audiologic practice, as there is no set standard. Finally, audiologists should strive for a universally applicable outcome measure, which can be compared across patients and clinics.

One of the main goals of administering outcome measures is to improve the treatment plan for the patient (Cox et al., 2000). Therefore, the measure should be based on the individual patient. It is important that the audiologist treating older adults choose an assessment tool that is appropriate for the majority of elderly patients wearing hearing aids for the first time. Thus the clinician must consider item applicability. In other words, all of the test items should be relevant for each patient in terms of their underlying problem. The test items must apply to patients on a personal level; otherwise, the outcome measure does not have adequate face validity. Furthermore, the outcome measure should include a subscale that targets a specific issue for the patient, such as understanding speech in background noise. This is because a measure with items that are relevant to the patient is a more reliable measure and is more sensitive to treatment effects.

Finally, Cox et al. (2000) advocate for careful consideration on the part of the clinician when choosing an outcome measure. For example, if the clinician wants to assess a patient's aided performance in noise, the test items should be appropriate in terms of listening difficulty. In other words, the clinician should use a measure that is as

close to a real-life situation as possible. An example of such a test is the Speech in Noise (SIN) Test (Etymotic Research, 1993), which requires the patient to repeat sentences that are presented in background noise. This strive for realism also applies to outcome measures that come in the form of questionnaires, though. It is important for test items to be relevant to the patient. However, it is also critical that the clinician take into account the reading level required to complete the questionnaire. In general, the instructions and questions of the outcome measure should be at a reading level required to understand mainstream newspapers (Cox et al., 2000).

As can be seen in the above discussion, choosing an optimal outcome measure requires careful consideration. The audiologist must consider not only what aspect of hearing aid outcome is to be measured, but also which assessment tool is the most appropriate for the patient. Equally important, though, is whether to use an objective or subjective measure of outcome. Therefore, this paper will discuss the use of objective and subjective hearing aid outcome measures in the treatment of older adults with hearing loss.

CHAPTER 2

Objective Measures

The goal of objective outcome measures in audiologic practice is to assess the effectiveness of treatment intervention. In order to do this, Cox et al. (2000) suggest that a standardized measure should be used, rather than a measure that is patient-oriented. Using a standardized measure is recommended because such a measure enables a test of the actual treatment device—in this case, the objective outcome measure assesses the hearing aids themselves.

Objective measures commonly used in clinical practice are tests of speech recognition. Such tasks can range from isolated word recognition tests to sentences presented in varying levels of background noise. For example, the Maryland CNC Test is a test of recognition using monosyllabic words in quiet. There are variations of the test, including a 25- or 50-word list. The words were recorded by a male voice with the carrier phrase, “Say the *word* again.” Normative studies on the Maryland CNC Test have concluded that the measure can distinguish among varying degrees of word recognition ability (Causey, Hood, Hermanson, & Bowling, 1983; Causey, Hood, Hermanson, & Bowling, 1984). Several speech tests are also available that test recognition in background noise. Speech in noise tests are popular because they simulate listening

challenges in the real world. A commonly used speech in noise test is the Quick Speech In Noise (QSIN; Killion, Niquette, Gudmundsen, Revit, & Banerjee, 2004). The QSIN is comprised of 12 lists of six sentences presented by a female voice. The background babble increases with each sentence, thus decreasing the signal-to-noise ratio. The test measures the signal-to-noise ratio a listener requires to understand 50% of key words in sentences in a background of babble. Killion et al. (2004) concluded that the QSIN is a reliable measure and easy to administer. The Maryland CNC words or the QSIN can therefore be used to objectively measure hearing aid performance, as aided and unaided scores can be compared for any given patient.

Many speech tests have been developed for the objective measure of hearing aid benefit. However, Abrahamson, Abrams, Cox, and Preminger (2005) suggest using an objective measure that provides information about the change in audibility the patient achieves with amplification. In the past, hearing aid benefit was determined by comparing aided and unaided speech recognition scores, as well as by comparing a patient's performance using several different kinds of hearing aids. Over time, research demonstrated that these procedures lacked validity, and so clinicians began measuring functional gain using various prescriptive approaches (Abrahamson, Abrams, Cox, & Preminger, 2005; Connington, 2005). In the past decade, though, several studies have reported that an increasing number of audiologists are using real ear measurements in clinical practice (Aazh & Moore, 2007; Moore, 2006). With real ear measurements, the audiologist is able to determine if the hearing aid is amplifying sound adequately for the patient. Real ear measures have therefore become popular, as they enable the clinician to

objectively verify that the hearing aids are meeting target based on the individual patient's hearing loss.

There are several different types of real ear measures that can provide the clinician with information about the performance of the hearing aid. Speech mapping is a type of real-ear measurement that demonstrates how speech reaches the eardrum. The output of the hearing aid is recorded using a speech stimulus, with a microphone inserted into the patient's ear canal approximately 6mm from the eardrum. Before real ear measurements, clinicians could verify the functional gain of hearing aids using tones; however, a tonal stimulus is not meaningful to patients. Speech mapping thus enables the clinician to place an actual speech signal into the patient's comfortable listening range, which is calculated using a prescriptive target in the software. While the measurement is in progress, hearing aid output is displayed in real time. The speech recording, with its fluctuating amplitude and frequency, is displayed in a peak curve from 125 Hz to 8000 Hz. The result is averaged over time and plotted against the prescribed target gain based on the patient's hearing loss. The results therefore provide evidence to the clinician—as well as to the patient—that speech is being adequately amplified across the speech spectrum (Moore, 2006).

Research has shown that speech mapping is beneficial in terms of effective hearing aid counseling and orientation. For example, Cunningham, Eismenger, Lazich, and Lao-Davila (2002) reported that speech mapping is important to include during hearing aid counseling. Results of their study indicated that speech mapping helps the audiologist achieve effective hearing rehabilitation, as speech mapping was found to

significantly reduce the number of post-fitting follow-up visits. This was because the visual presentation of the real ear data reportedly made the hearing aid verification more meaningful to the patient, as the clinician was able to demonstrate how the hearing aids were programmed for the individual's hearing loss. Cunningham et al. (2002) reported that the patient receiving hearing aids for the first time had more confidence in the fitting process. Finally, Cunningham et al. (2002) concluded that clinicians who utilize real ear measures such as speech mapping are more likely to see significantly higher hearing aid benefit, satisfaction, and product retention.

As can be seen, objective outcome measurements can be used to demonstrate clinical hearing aid benefit. However, improvement in audibility is not the only goal of clinical intervention. Simply scoring higher on an aided word recognition test does not indicate overall treatment success. Similarly, real ear measures can verify that the hearing aid is functioning properly; but objective outcome measures do not validate the patient's opinion of the device. Thus the clinician must also measure patient's perception of benefit and satisfaction from the use of hearing aids.

CHAPTER 3

Subjective Measures

There is no single definition for hearing aid benefit because it can be measured several different ways. Generally speaking, hearing aid benefit refers to the improvements seen post-fitting compared to how the patient performs without amplification. Traditional objective measures can verify hearing aid benefit by indicating improved word recognition with amplification. However, many patients may not perceive benefit from amplification, even when they demonstrate hearing aid benefit on various clinical measures. For this reason, it is imperative that clinicians also administer subjective measures of hearing aid benefit. Hearing aid benefit can be measured objectively or subjectively; however, clinicians can also measure a patient's *satisfaction* with their hearing aids. Satisfaction is a component of benefit and deals with the patient's *perceived* benefit with hearing aids; that is, how well the individual believes they perform with amplification (Sandlin, 2000).

Objective measures can demonstrate hearing aid benefit in the clinic, but they may not be accurate indicators of hearing aid performance in the real world. Furthermore, even though speech-in-noise tests aim to simulate listening situations in real life, it has been found that such measures do not closely resemble the patient's opinion of

how they actually perform with hearing aids outside of the clinic. For example, Cox and Alexander (1992) found that there is a weak correlation between speech recognition measured in clinical tests when compared to patients' reports of speech recognition ability in real-life situations. These situations included simulated tests of speech in quiet, speech in noise, speech degraded by reverberation, and speech presented with visual cues. Therefore, self-report outcome measures are becoming more common in clinical practice (Cox, 2003).

Recently, an increasing number of audiologists began recognizing subjective measures as a scientifically valid way to measure real-world hearing aid outcomes. Over the years, several subjective questionnaires have been developed to assess benefit with amplification. In fact, with the ever-increasing number of self-report measures, it has become challenging for the clinical audiologist to choose the best measure for their patients (Cox, 2003). Indeed there are several factors for the clinician to consider when choosing a subjective measure to use with their patients.

Cox (2003) discussed the different requirements for self-report questionnaires, including technical requirements and non-technical requirements. When choosing a subjective measure, the clinician should consider the technical aspects of the measure, such as the reliability, validity, sensitivity, and norms of the test. The clinician must consider the reliability of the questionnaire in order to interpret differences between a patient's scores on the test. Similarly, the questionnaire must be a valid measure, meaning that the variables that could influence patients' responses must be known in order for the clinician to be confident in what is being measured. In other words, an

outcome measure with high validity actually measures what it is designed to measure. As previously stated, a patient may demonstrate different scores across different outcome domains; therefore, the clinician needs to know which outcome domains are being measured with any given questionnaire. Clinicians also must be mindful of the sensitivity of the measure; that is, the extent to which the test scores are able to identify a significant change in the patient's opinion or ability. Finally, it is critical that clinicians be able to generate norms from self-report questionnaires, as standardized measures have become a staple in the fields of medicine and research (Cox, 2003).

Audiologists must also consider the non-technical aspects of a subjective measure when choosing a test to use with patients. The non-technical considerations include patient burden, clinician burden, and scoring. Patient burden refers to the difficulties that patients experience when completing the test. A subjective measure can be difficult for older patients to complete if the type is too small, the reading level is too high, or if there are a large number of items to answer. Similarly, clinician burden refers to the difficulties that the audiologist experiences when learning to administer and interpret the test. The outcome measure should also be relatively easy to score, and the score should be objective in terms of its interpretation (Cox, 2003). Finally, the clinician must consider the utility of the outcome measure. The utility of an outcome measure refers to how useful the resulting data is in terms of counseling patients and planning treatment (Cox, 2005).

There is a lot for the audiologist to consider when choosing an outcome measure, whether the test be objective or subjective. However, if one knows the outcome domain

they wish to measure, selecting an appropriate test can be made simpler. One model of outcome measure domains has been presented by Abrams, McArdle, and Chisolm (2005) and uses the World Health Organization's (WHO's) (2001) International Classification of Functioning, Disability, and Health (ICF)—impairment, activity restriction, and participation restriction. Impairment refers to the negative impact a health condition has on functions or structures of the body. Hearing impairment is treated by improving audibility through the use of amplification, and a patient's improvements in audibility can be measured by functional testing or real ear measurements, as outlined above. However, the goal of audiologic intervention is to improve the patient's activity and participation restrictions, which are described below.

The WHO (2001) describes activity restriction as the limitations a person feels as the result of an impairment; for example, in the case of hearing loss, a person may be unable to hear others speaking. Participation restrictions, in turn, refer to the impact that the impairment and activity restrictions have on broader aspects of life. For example, a person with hearing impairment who cannot hear conversation may avoid social situations. In the activity domain, the goal of audiologic treatment is to improve a patient's speech understanding, as doing so will enable them to participate in conversation. However, for audiologic intervention to be considered effective, the patient's participation restrictions must be evaluated post-treatment. This can be accomplished by utilizing any of several different kinds of subjective outcome measures (Abrams, McArdle, & Chisolm, 2005).

In addition to the WHO's (2001) ICF domains described above, subjective measures can be designed to measure many different levels of hearing aid benefit that a patient may experience. Historically, there was no distinction between 'satisfaction' and 'benefit', as there was little distinction between 'handicap' and 'disability'. However, it was the WHO that redefined disability as activity limitation, and handicap as participation limitation. Now, because evidence-based practice drives clinical protocols, it is necessary for clinicians to distinguish hearing aid benefit from overall satisfaction with audiologic intervention. As Cox (2003) discusses, hearing aid outcome must be acknowledged as having multiple components. Various articles have presented several possible facets of subjective outcome measurement. The remainder of this review will focus on five different categories of self-report outcomes: benefit, satisfaction, residual activity limitations, residual participation limitations, and quality of life. In general, outcome measures of benefit and satisfaction focus on the hearing aids, whereas outcome measures of residual activity and participation limitations or quality of life focus on the patient, themselves.

Benefit and Satisfaction

A patient demonstrates hearing aid benefit if a change is quantified as a result of using amplification. Hearing aid benefit can be measured subjectively through the use of questionnaires. One questionnaire that evaluates hearing aid benefit is the Shortened Hearing Aid Performance Inventory for the Elderly (SHAPIE) (Dillon, 1994). Specifically, the SHAPIE is designed to evaluate the impact of amplification on a

patient's activity limitations. The questionnaire has two versions—one with 25 items and one with 40 items—and is a shortened version of the original Hearing Aid Performance Inventory (HAPI) (Walden, Demorest, & Hepler, 1984), which has 64 items. The items on the SHAPIE ask questions regarding how helpful the hearing aids are for the patient in various situations. The questions focus on hearing speech in general, but the SHAPIE also has a subscale on hearing speech in the presence of background noise. To answer the item, the patient selects one of five options, ranging from 'Very helpful' to 'Hinders performance'. The patient's responses are then added by the clinician and the overall score can be compared to the published data for the SHAPIE, which provides a range of scores that indicate clinically significant hearing aid benefit (Cox et al, 2000).

The SHAPIE has been found to be a reliable and sensitive test in terms of measuring hearing aid benefit (Dillon, 1994; Wong, Hickson, & McPherson, 2003). The SHAPIE has also been found to correlate with other dimensions of hearing aid outcomes. For example, Dillon, James, and Ginis (1997) reported that older adults who indicated hearing aid benefit on the SHAPIE also expressed overall satisfaction with their hearing aids. Baumfield and Dillon (2001) also used the SHAPIE to assess the relationship between hearing aid benefit and the patient's overall satisfaction. Baumfield and Dillon concluded that satisfaction with amplification correlated with SHAPIE benefit for older adults wearing hearing aids for the first time. Furthermore, Cox et al. (2000) reported the SHAPIE as an appropriate measure for clinicians to use with elderly patients because the item content is relevant for the patient population and the scores remain stable over time. However, as with any outcome measure, it is important for clinicians to keep the

individual patient in mind when interpreting the results. For example, patients who have a more severe degree of hearing impairment and who express more of a hearing handicap will often demonstrate more hearing aid benefit on a questionnaire like the SHAPIE. This is simply because there is more room for improvement once they are appropriately fit with amplification (Abrahamson, Abrams, Cox, & Preminger, 2005).

Generally speaking, satisfaction refers to the patient's perception of hearing aid benefit. However, it is important that the clinician be aware of the many different factors that can contribute to a patient's overall satisfaction with amplification. For example, a patient can be more or less satisfied with their hearing aids based on the cost and perceived value of the devices. On a more personal level, their feelings toward the clinician can also influence their overall satisfaction (Abrams, McArdle, & Chisolm, 2005). This is why it is so critical for audiologists to develop a trusting relationship with their patients.

Many factors can influence satisfaction and therefore it is important for the clinician to choose an effective measure to assess a patient's satisfaction with hearing aids. One questionnaire that incorporates several elements of hearing aid satisfaction is the Satisfaction with Amplification in Daily Life (SADL) (Cox & Alexander, 1999). As the name of the questionnaire implies, the measure is designed to assess a patient's satisfaction with their hearing aids in real life situations.

The SADL has been determined to be a reliable measure of patient satisfaction. It was developed by Cox and Alexander (1999) through structured interviews with hearing aid patients in order to determine which elements are most important for patients

receiving amplification. Initially, 14 different elements relating to overall satisfaction were compiled into a questionnaire. Results were obtained from hearing aid owners, and the different elements were analyzed and divided into four separate subscales: Positive Effect, Service and Cost, Negative Features, and Personal Image. The final version of the questionnaire resulted in 15 items that focus on the patient's perceived benefit with amplification. The assessment requires the patient to check one of seven options corresponding to how they feel amplification helps them in various situations; the possible answers range from 'Tremendously' to 'Not at all'. The clinician then has several options in scoring the questionnaire. The SADL yields a global satisfaction score, as well as a profile of the four subscale scores. The individual subscale scores can thus provide a more detailed picture of a patient's hearing aid satisfaction. Cox and Alexander concluded that the SADL is convenient to use clinically due to its relatively short length, yet it is comprehensive in its assessment of overall hearing aid satisfaction. However, the creators of the questionnaire also concluded that further research is needed in terms of its test-retest reliability, and to determine the clinical applications of the data.

Many subjective hearing aid outcome measures have not been thoroughly tested to determine their true potential for clinical applications. However, Hosford-Dunn and Halpern (2001) conducted a study on the clinical application of the SADL (Cox & Alexander, 1999). The study found that patient scores on the SADL were influenced by several variables, including: the age of the patient; their amount of experience with amplification; how many hours they used their hearing aids per day; their perceived hearing handicap; their degree of hearing loss; and, the cost of the hearing aids. The

authors found that, while such variables can indeed have an impact on hearing aid satisfaction, the relative importance of these variables to patient scores on the SADL was, in actuality, complex and very small. In fact, Hosford-Dunn and Halpern concluded that the SADL is a reliable measure of hearing aid satisfaction. Furthermore, the authors concluded that the test could serve as a gold standard for measuring hearing aid outcome, and could even provide a starting point in the development of a predictive model of hearing aid fitting success.

The subjective measures of benefit and satisfaction discussed above are hearing aid-focused. Such measures are useful; however, it is also necessary to utilize measures that are patient-focused. The following sections of subjective measures are thus focused more on the patient than the hearing instruments.

Residual Activity and Participation Restrictions

As defined by the WHO's (2001) ICF, activity limitations relate to a patient's ability to perform a typical daily activity in a normal manner. Thus, a hearing impaired person would experience difficulty in understanding conversational speech. It is important that both clinician and patient realize, though, that communication difficulties are usually not resolved in a single appointment. The patient may continue to experience hearing-related difficulties even after they have been wearing hearing aids for some time. It is therefore important for a clinician to measure a patient's activity limitations before and after treatment to determine treatment efficacy, as this measure can aid in ongoing treatment intervention.

One questionnaire designed to measure a patient's residual activity limitations is the Abbreviated Profile of Hearing Aid Benefit (APHAB) (Cox & Alexander, 1995). The APHAB can be compared to the SHAPIE in that both tests measure hearing aid benefit. However, the SHAPIE focuses on the hearing aids and measures change directly, whereas the APHAB focuses on the patient and treatment effect is determined by subtracting aided and unaided scores (Dillon, 2012). The APHAB is administered both before and after the patient has worn the hearing aids for a period of time. The clinician is then able to compare unaided with aided scores, as the aided scores indicate the percentage of time for which the patient continues to experience difficulty in daily activities (Cox, 2003).

Clinicians can use the APHAB global score to assess residual activity limitations, or the results can be divided into four subscales: ease of communication, listening in background noise, listening in reverberant conditions, and aversiveness of sounds. The questionnaire consists of 24 items, for which the patient is instructed to circle the answer that comes closest to their everyday experience. The patient must choose between seven answers, ranging from 'Never (1%)' to 'Always (99%)'. As previously mentioned, the outcome measure is designed to be administered before and after the patient receives amplification, and so the form itself has two answer columns: the first column is to be completed by the patient without hearing aids, and the second column is to be completed after the patient has had a period of time to adjust to amplification (e.g., one month) (Cox & Alexander, 1995).

Overall, the APHAB is a useful questionnaire for measuring a patient's activity limitations. Norms have been generated for the questionnaire, enabling clinicians to compare results across groups of patients. Scoring is also relatively simple for the APHAB. However, the APHAB has been criticized as an outcome measure in terms of patient burden (Cox, 2005). This is simply because some test items indicate many hearing-related problems with a high score, while other test items indicate extreme difficulty with a low score. Therefore, some patients may be confused by the wording of questions and thus their results will not reflect their true activity limitations. This is an example of why it is so important for audiologists to also give the patient verbal instructions before completing the questionnaire.

Hearing impairment can limit a person in terms of their normal role fulfillment. Even after being fit with hearing aids, the patient may experience some residual participation restrictions (e.g., avoiding social events). Thus it is important to assess the participation domain of hearing aid outcome. While there are not many outcome measures that measure participation limitations, a popular questionnaire is the Hearing Handicap Inventory for the Elderly (HHIE) (Ventry & Weinstein, 1982). The questionnaire exists in the full 25-item form, as well as the 10-item screening version. The full 25-item form consists of 12 social and 13 emotional questions, and so three separate scores can be obtained: emotional and social subscores, as well as the total score. The total score ranges from 0 to 100, with lower scores indicating less perceived hearing handicap (Ventry & Weinstein, 1982). The HHIE was designed to be administered before the patient receives hearing aids; however, it can also be used post-

treatment. To be used as a hearing aid outcome measure, the clinician simply instructs the patient to consider their level of difficulty in the various situations now that they have hearing aids (Cox, 2003).

The HHIE is a popular questionnaire for many reasons. First, it has been found to be very sensitive in terms of accurately detecting participation limitations. Second, the test is easy to score, as it has only three response categories: ‘Yes (4 points)’, ‘Sometimes (2 points)’, and ‘No (0 points)’. Third, while the HHIE has no published norms, several studies have been conducted which use the HHIE for measuring hearing aid outcomes (Dillon, James, & Ginis, 1997; Humes, Garner, Wilson, & Barlow, 2001; Weinstein, Spitzer, & Ventry, 1986), and so the HHIE has been reported as a reliable measure. Furthermore, this particular questionnaire has been found to be a cost-effective way to counsel patients about hearing aid use and realistic expectations (Vuorialho, Karinen, & Sorri, 2006). Finally, the HHIE is a strong measurement of hearing aid outcome because of its low clinician and patient burden. The questionnaire is easy for the audiologist to learn and interpret, and it is easy for the patient to complete (Cox, 2005).

It is also important for the clinician to consider possible changes that may be seen in outcome scores over a period of time. Patients require time to adjust to amplification, and so clinicians must be mindful of the time at which questionnaires are administered. Even though a new hearing aid wearer may indicate complete satisfaction from amplification shortly after the fitting, such a robust outcome could be expected to diminish over time (Humes, 2001). However, McArdle, Chisolm, Abrams, Wilson, and

Doyle (2005) found that HHIE scores remain relatively stable over the course of one year. Therefore, the HHIE has been found to accurately measure residual participation limitations not only after the initial fitting, but it can also be used during follow-up visits at least one year afterward. Thus the HHIE is an excellent tool for clinicians to help facilitate continuous care with their patients.

Quality of Life

The term *quality of life* (QOL) simply refers to how an individual feels about their own life. The National Institutes of Health (NIH) report that several factors can contribute to a person's QOL, including psychological and interpersonal issues, as well as overall health status. QOL assessment is important for the field of audiology because hearing loss can affect an individual's overall wellbeing. Hearing loss can have drastic effects on psychological wellbeing because an individual may develop a negative perception of self. Similarly, hearing loss can have a negative interpersonal effect, as it becomes difficult for the individual to communicate with others. Finally, hearing loss has been shown to result in poorer overall health due to the effects that it has on an individual's QOL (Montano & Spitzer, 2009).

In the past several years, healthcare has started focusing much attention towards QOL measurement. Health-related QOL measures are beneficial to clinicians because they assess treatment effectiveness and can be used throughout the medical field. As many factors can influence QOL, it is therefore considered as a multidimensional concept. Essentially, QOL assessment focuses on the impact of a disease and how it

effects the wellbeing of an individual; thus, QOL cannot be measured objectively.

Therefore, QOL measures benefit patients, as they focus on a patient's opinions and overall wellbeing (Fairclough, 2002).

Quality of life measurements are critical because they examine the patient from a psychometric perspective. Psychometrics deals with psychological measurement, and thus questionnaires are designed to examine a patient's attitudes and abilities. This is important for an audiologist treating someone with hearing loss because hearing loss can negatively affect an individual's abilities, attitude, and overall QOL. There are two types of QOL measures: disease-specific and generic (NIH, 1993; Montano & Spitzer, 2009).

Disease-specific questionnaires focus on the effects of a particular disorder and the treatment of the disorder (e.g., to what extent hearing aids improved the quality of life for a patient with hearing loss). Disease-specific measures are extremely useful for determining treatment efficacy, and thus many clinicians use them both pre- and post-treatment. However, it is important to keep in mind that the scores from different types of disease-specific measures cannot be compared. For example, the treatment efficacy of occupational therapy cannot be compared to any form of audiologic treatment if both interventions used a disease-specific outcome measure. While many clinicians may not feel the need to compare treatment effectiveness across different disorders, measures that examine overall health-related QOL (HRQOL) are being used more often now to determine which treatment interventions deserve third-party reimbursement. Thus, it is becoming necessary for clinicians to demonstrate and document treatment effectiveness. This can be done with the second type of QOL measurement, known as generic QOL

questionnaires. Generic measures assess overall health status. Such measures generally focus on physical and mental health domains, and are used widely throughout different healthcare modalities. Generic measures, unlike disease-specific measures, can be used to compare different types of treatment and their effect on QOL (Cox, 2005; Montano & Spitzer, 2009).

The focus of healthcare has shifted from objective assessment to QOL measurements because QOL is an outcome domain that enables clinicians, researchers, and insurance companies to compare various kinds of healthcare treatments. Indeed, the primary goal of any health treatment is to improve a patient's QOL (Cox, 2003).

Kochkin and Rogin (2000) found that hearing aid use was positively correlated with improvements in social life, mental health, and overall QOL. However, Bess (2000) also found that generic QOL measures are generally not sensitive to changes in QOL that result from wearing hearing aids. Thus Cox (2003) concluded that generic QOL measures need to focus not only on physical health status, but also on communication issues.

The World Health Organization's Disability Assessment Schedule (WHO-DAS II) (WHO, 2001) is a generic QOL outcome measure. The questionnaire contains 36 items that are divided into six separate domain scores. The items can be combined for a total score; or, they can also provide six individual domain scores in the areas of communication, mobility, self-care, interpersonal, life activities at home and work, and participation. Regardless of the domain, though, each item asks the patient how much difficulty they had in the past 30 days while performing a certain task or in a given

situation. For example, in the participation domain, a patient must rate how much difficulty they had in the past 30 days with joining in community activities. Responses are given on a scale from 1 (none) to 5 (extreme/cannot do). Clinicians add the 36 responses for a total raw score, which is then transformed into a standardized score. The standardized score ranges from 0 to 100, with 0 indicating an excellent state of health and 100 indicating a poor state of health (McArdle, Chisolm, Abrams, Wilson, & Doyle, 2005).

The six domains of the WHO-DAS II were developed to assess a wide range of disability and overall health status. Within the communication domain, two items relate to hearing loss, in particular. One item asks the patient how much difficulty they have in understanding what people say, and the other item asks about difficulty with starting and maintaining a conversation. The individual domain scores can be combined for a total score, which provides the clinician with information on the patient's overall health-related QOL (McArdle et al., 2005).

It is important for the audiologist to measure health-related QOL in patients because hearing loss has been shown to adversely affect quality of life (Dalton et al., 2003; Gatehouse, 2003). However, a common concern with health-related QOL measures is that they are not sensitive to hearing impairment, in particular. Abrams, McArdle, and Chisolm (2005) examined the sensitivity of the WHO-DAS II for 350 new hearing aid wearers and concluded that the WHO-DAS II is a sensitive HRQoL measure because it is responsive to hearing aid intervention. Chisolm, Abrams, McArdle, Wilson, and Doyle (2005) also found the WHO-DAS II to be an adequate outcome measure to use

with adults who have hearing loss. This is true for both the communication and participation domains of the test, as well as the overall score for the WHO-DAS II. Furthermore, Chisolm and colleagues (2005) found the questionnaire to be a reliable measure in terms of test-retest stability.

Although the WHO-DAS II was determined to be adequate for use in adults with hearing loss from a psychometric perspective, researchers also wanted to determine how *responsive* the measure was to hearing aid intervention. Hyde (2000) defined a measure's *responsiveness* as the extent to which changes in the outcome measure results are actually due to changes in the overall state of the patient. As previously mentioned, generic measures are often not responsive to hearing aid intervention simply because the questionnaire does not adequately cover the effects of that type of intervention. Therefore, McArdle et al. (2005) used the WHO-DAS II in a large study to assess QOL before and after hearing aid intervention for elderly individuals who had never worn hearing aids. In their study, McArdle and colleagues (2005) compared WHO-DAS II results to two disease-specific outcome measures, the APHAB and the HHIE. These measures were included because they assess residual activity and participation restrictions, and they have been found to be responsive to hearing aid intervention, as discussed earlier. Specifically, the HHIE contains thirteen items that focus on the emotional impact of hearing loss. Both measures, however, are disease-specific QOL instruments, though, as they assess the self-perceived psychosocial effects of hearing loss on the older adult (Montano & Spitzer, 2009).

In their study, McArdle and colleagues (2005) examined outcomes for the three instruments over the course of one year. This long time period was chosen because some studies have demonstrated that scores on subjective outcome measures diminish over time, despite objective test results remaining stable (Taylor, 1993; Humes et al., 2002). However, other studies have indicated that subjective outcomes are stable over time (Mulrow et al., 1992; Surr et al., 1998; Chisolm et al., 2004). Thus research has indicated a need for a generic QOL measure that is responsive to hearing aid intervention and stable over time. Therefore, McArdle and colleagues (2005) compared outcomes at two months, six months, and twelve months for the APHAB, the HHIE, and the WHO-DAS II.

McArdle et al. (2005) found that outcomes on the WHO-DAS II demonstrated significantly better scores after hearing aid intervention, similar to scores for the APHAB and the HHIE. The authors thus concluded that the WHO-DAS II does indeed reflect improved health status for older adults who are new hearing aid wearers and can therefore be used by audiologists to measure patients' QOL. Furthermore, improved health status was seen for the total score on the WHO-DAS II, as well as for the specific domains of participation and communication. Therefore, clinicians can utilize different aspects of the WHO-DAS II and have confidence in the results reflecting improvements that are actually due to the hearing aid intervention.

In summary, the current state of healthcare allocation has indicated that the field of audiology should be able to demonstrate HRQOL improvements after patients receive hearing aids (Beck, 2000). Research, however, has indicated that generic QOL

measurements often lack the necessary items needed to assess hearing aid intervention (Bess, 2000). The development of the WHO-DAS II, though, has provided audiologists with a generic QOL measure that is both responsive to hearing aid treatment and appropriate to use with an elderly patient population. Therefore, McArdle and colleagues (2005) concluded that audiologists should include a generic QOL instrument in their outcome assessment protocol, as this enables comparability of health-related QOL across different patient groups and treatment modalities.

CHAPTER 4

Standardized vs. Customized Measures

There are two types of subjective outcome measures available for clinical use: standardized and customized. Both types are readily available for use with clinical populations, however, research has indicated that standardized outcome measures are more commonly used than customized outcome measures in most clinical practices. This is due to ease of administration and scoring with standardized measures when compared to customized measures (Abrahamson, Abrams, Cox, & Preminger, 2005; Cox et al., 2000). A standardized test is one in which every patient responds to the same set of test items. Examples of standardized hearing aid outcome measures include the SADL (Cox & Alexander, 1999), the SHAPIE (Dillon, 1994), the HHIE (Ventry & Weinstein, 1982), and the APHAB (Cox & Alexander, 1995), discussed above. Standardized measures have several benefits for clinicians. For example, with standardized questionnaires, clinicians can generate norms for comparison across groups by compiling scores from their own patients. Thus, the audiologist is not only able to interpret the patient's individual results, but the individual results can also be compared to the results of a group of similar patients (Cox, 2003).

There are also criticisms against using standardized outcome measures due to the fact that some test items may not be relevant for all patients. While some clinicians may not consider this to be an important issue, irrelevant test items could result in an inaccurate assessment of hearing aid outcome. For example, any given patient may be asked questions on a standardized measure about situations that are not important to them. Furthermore, the standardized measure may not include items that are of extreme importance to other patients. Therefore, clinicians may desire to utilize a more customized approach to measure hearing aid outcomes. Hearing aid outcomes can also be assessed through structured, open-ended questions that the audiologist asks the patient (Stephens, Jones, & Gianopoulos, 2000). Regardless of the tool used, customized outcome measures include items that the individual patient designates as important listening situations in their own lives. Thus, customized measures have the advantage of always being relevant to the individual patient. Whether using a standardized or customized outcome measure, though, it is important for the clinician to keep in mind that each type has advantages and disadvantages. For example, while custom measures are focused on the individual patient, the data cannot be used to generate norms for comparison across groups as can be done with standardized measures. Thus, neither type of outcome measure is better in every clinical case. Indeed, research has shown that either type of subjective measure can be helpful in clinical practice—for both the patient and the audiologist (Cox et al., 2000; Cox, 2003).

Client-Oriented Scale of Improvement

The Client Oriented Scale of Improvement (COSI) (Dillon, James, & Ginis, 1997) is an example of a customized outcome measure that can be used in the field of audiology. In the COSI, the patient lists three to five situations in which they wish to hear better once they receive amplification. After being fit with hearing aids, the patient is asked to rate the change they perceive in the various listening situations. The patient has a choice of five responses which are 'Worse', 'No difference', 'Slightly better', 'Better', or 'Much better'. After the patient has assessed the changes they have experienced, the clinician asks a final, global question; for example, the audiologist may ask the patient how satisfied they are with their hearing aids overall. The patient then responds with 'Very dissatisfied', 'Dissatisfied', 'Neutral', 'Satisfied', or 'Very satisfied'. Assessing hearing aid benefit in each of the listening situations can assist the audiologist with hearing aid orientation and counseling. However, the final global question is also a valuable part of the COSI, as it assesses the patient's overall perception of benefit from the hearing aids (Cox et al., 2000).

Audiologists may choose to use the COSI in clinical practice because it is relevant to the needs of each individual patient. Dillon, Birtles, and Lovegrove (1999) reported that the COSI is used by many audiologists who treat a wide range of patient populations in a variety of clinical settings. However, it is important to keep in mind that a personalized outcome measure such as the COSI is not as quantifiable as standardized measures. That is, a standardized score can be compared to normative data, whereas the

COSI can only be used to assess the change that an individual patient experiences post-treatment (Cox et al., 2000).

Although the COSI is not standardized, it has been found to relate well to several standardized outcome measures. Dillon, Birtles, and Lovegrove (1999) found that improvements seen with the COSI were correlated with significant hearing aid benefit demonstrated via several standardized outcome measures. For example, in the study, patients who demonstrated hearing aid satisfaction using the SADL also demonstrated significant improvements on the COSI. However, this result is highly dependent upon the number of items the patient lists on the COSI. It is imperative that patients list three to five items, as fewer items can result in decreased accuracy of the overall assessment (Cox et al., 2000; Dillon, Birtles, & Lovegrove, 1999).

Research has indicated that some clinicians consider non-standardized measures to be an inefficient use of clinical time; however, clinical trials have indicated that the COSI is indeed brief when compared to many standardized questionnaires (Cox et al., 2000). Furthermore, the COSI has minimal patient burden. This is because the COSI is designed to address the patient's real-life concerns, and so the measure does not include irrelevant items as often seen with standardized measures. Research has also indicated that the COSI has a high rate of compliance and can be completed in a wide range of clinical settings (Dillon, James, & Ginis, 1997; Dillon & So, 2000). However, Cox et al. (2000) reported one major disadvantage involved with using the non-standardized measure: the COSI lacks face validity, meaning that generalizations cannot be made across patient populations. In other words, it is questionable to compare COSI results

across different cultures or ethnicities of patients, as the results cannot be generalized. Therefore, Cox et al. (2000) concluded that audiologists should consider using an outcome measure that enables comparisons on an international level.

CHAPTER 5

Additional Considerations and Discussion

With so many different domains of hearing aid outcome, clinicians may wonder how many domains should actually be measured in order to obtain a thorough assessment of a given patient's hearing aid satisfaction. To answer this, Cox (2003) suggests examining the relationships among the different domains of hearing aid outcome. Past research has indicated several different domains, and analyses of the domains resulted in two categories that help explain the difference between clinical outcome measures and real-life outcome measures (Cox et al., 2000; Kramer, Goverts, Dreschler, Boymans, & Festen, 2002). Simply stated, the multiple domains of hearing aid outcome can be divided into two categories: those which focus on the hearing aids, and those which focus on the patient. Therefore, it is impossible to completely assess hearing aid outcome by measuring only one domain. Thus, audiologists should utilize outcome measurements that examine the hearing aids as well as the patient's opinion (Cox, 2003).

One questionnaire that has become popular over the past decade for its international utility is the International Outcomes Inventory – Hearing Aids (IOI-HA) (Cox & Alexander, 2002). The questionnaire was developed to provide directly comparable data on an international level. The IOI-HA is available in 21 translations, all

of which have been analyzed and found to be psychometrically valid and reliable. Furthermore, the IOI-HA has very low patient and clinician burden and is easily interpreted. The questionnaire consists of eight items that assess the following hearing aid outcome domains: benefit, satisfaction, quality of life, use, impact on others, residual participation restrictions, and residual activity limitations (Cox, Stephens, & Kramer, 2002).

There are many choices of subjective outcome measures for the audiologist to use in clinical practice. Unfortunately, there are no specific clinical protocols for selecting outcome measures. Regardless, clinicians must use self-report measures in order to assess the patient's opinion in a systematic way, and the choice itself can be a daunting task. Further, the audiologist must decide whether they want to use a measure that requires a face-to-face interview with the patient, or one that can be completed by the patient. In terms of practicality, self-administered questionnaires are used most commonly (Cox et al., 2000).

Abrahamson, Abrams, Cox, and Preminger (2005) discuss the option for clinicians to mail outcome questionnaires to patients when there is a lack of clinical time. For example, the IOI-HA can be mailed to the patient one month after the initial hearing aid fitting. Abrahamson and colleagues found that many patients returned the questionnaires by mail, presumably for the opportunity to assess their own treatment and provide feedback. Clinicians can then follow up with the patient over the telephone, and are thus able to address any issues outside of clinical time. However, it is once again important to consider the material presented in the questionnaire; if the patient

misinterprets the instructions or the questions, results will be invalid. When possible, questionnaires should be completed in the clinic because they can help the clinician counsel the patient about their hearing aids. However, Abramson et al. also concluded that follow-up questionnaires completed by the patient at home can be beneficial, as the patient needs time to adjust to wearing amplification.

Some researchers have questioned the reliability of the 'paper-pencil method', in which the patient answers the questionnaire on their own as compared to having the clinician ask the questions directly. In fact, Noble (1979) found that patients tended to report higher degrees of handicap when they completed the questionnaire on their own. However, Kaplan, Hilton, Park-Tanjasirir, and Perez-Stable (2001) concluded there is no significant difference in sensitivity between the interview method and the paper-pencil method. It is important to note, though, that the results reported by Kaplan et al. were based on a questionnaire unrelated to hearing handicap. Further research is needed in the comparison of methods for hearing handicap questionnaires.

A final consideration in the use of outcome measures is whether patient scores can be expected to change over time. Cox (2003) concluded that a patient's score on various hearing aid outcome measures could be expected to change within the first few months following the hearing aid fitting. This is why it is critical for the audiologist to determine the proper time to administer the outcome measure. Humes (2001) discussed the importance of outcome scores remaining stable over time because, if scores are stable, then the results obtained one month post-fitting will be adequate for both research and the clinic. However, Humes also found that many hearing aid outcome measures are

not stable over time, as scores showed less improvement the longer patients wore hearing aids. This finding would thus mandate a longer period of follow-up for hearing aid patients. McArdle, Chisolm, Abrams, Wilson, and Doyle (2005), in contrast, reported that the HHIE and the APHAB scores obtained at 12 months were stable, and that the WHO-DAS II outcomes obtained at 6 months were stable. This is important for audiologists to keep in mind because these questionnaires are designed differently—the HHIE and APHAB are disease-specific outcome measures, whereas the WHO-DAS II is a generic quality of life measure. Thus, different types of questionnaires cannot be assumed to have equally stable results over time.

Conclusion

Subjective outcome measures are vital to audiologic treatment success. They not only help the audiologist counsel the patient on hearing loss and amplification, but they also help foster strong rapport between clinician and patient. Furthermore, subjective measurements are patient-centered and therefore do not require the clinician to compare data across different patients. In general, the focus of a subjective outcome measure is on the patient, and data from an individual patient can be used to assess clinical effectiveness (Cox et al., 2000). Choosing an ideal outcome measure can be a difficult task for any audiologist. The questionnaire should be an appropriate length (e.g., thirty items or fewer), and it must also be suitable for self-administration by older adults. Realistically speaking, there is no single questionnaire to use for every older adult who is fit with hearing aids; but, many reasonable choices are available. It is therefore important

for the clinician to utilize their best clinical judgment when selecting an outcome measure for each patient (Cox, 2005). Hearing aid satisfaction depends upon the individually weighted social, psychological, and financial changes the patient perceives with amplification. Indeed, many patients may be higher in one domain of satisfaction and lower in other domains. This is because overall satisfaction with amplification has multiple components. Over the years, clinical audiologists have desired a ‘realistic target’ for hearing aid satisfaction; however, satisfaction should be considered a ‘moving target’, as it greatly depends on the measurement tool the clinician utilizes (Cox, 2003).

Subjective measures enable comparison on an individual level and thus enable the clinician to assess treatment efficacy for a given patient. However, it would benefit the field of audiology to be able to compare hearing aid treatment across different patient populations. The outcome measures discussed above are therefore powerful tools for audiologists to use in everyday practice. Indeed, QOL measures have the potential to influence health care policy makers, as there is currently minimal reimbursement for hearing aids among most third-party payers (Montano & Spitzer, 2009).

There is an abundance of research examining various types of hearing aid outcome measures. However, research on the prevalence of outcome measures in clinical practice is somewhat lacking. Survey data compiled by Kirkwood (2006) indicated that less than 40% of audiologists routinely use hearing aid outcome measures. Kochkin and colleagues (2010) also examined the clinical protocols of practicing audiologists. In the study, hearing aid users were surveyed on the various aspects of their hearing aid fitting. Results indicated that clinicians did not routinely utilize either objective or subjective

outcome measures. Anecdotal evidence has also supported this finding, thus there is an obvious need to examine ways in which outcome measures can be incorporated into common clinical practice. It is also important for audiologists to review clinical practice guidelines published by their professional organizations. For example, the American Academy of Audiology does not recommend any specific measure of hearing aid outcome; however, clinical practice guidelines do indeed advocate for the incorporation of outcome measures into routine clinical practice (AAA, 2007). After all, it is only through hearing aid outcome measures that audiologists can be sure their patients have benefited from their treatment.

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