As outcome measures proliferate, how do you choose which ones to use?

By Larry Humes

1 Could you start by broadly defining what is meant by “hearing aid outcome measures”?

Generally speaking, “outcome measures” measure outcomes. That is, when hearing aids have been dispensed to a patient, we would like to know if this has been a successful intervention.¹

2 Why is this so important?

It is important to know the outcome for a variety of reasons. First, if the patient is to purchase and use the hearing aids, there should be some convincing evidence, both for the audiologist and the patient, that amplification is helpful. Second, many third-party payers require documentation of the benefits provided by amplification prior to reimbursement. Third, manufacturers of the devices are interested in documenting the success of their products and of emerging technologies.

3 This seems like something we should already know. Why is it of interest now?

I agree, it is something our field should already know. But, unfortunately, that’s not the case. That’s not to say that clinicians and researchers have failed to investigate and develop various hearing aid outcome measures over the past several decades. To the contrary, almost since audiology emerged as a profession immediately after World War II, audiologists such as Raymond Carhart were interested in ways to document the benefits provided by hearing aids.² However, initially the focus was on comparing the benefits afforded by different hearing aids. That is, is hearing aid A superior to hearing aid B?

4 I seem to have read many articles over the past 15-20 years describing the development of a wide variety of outcome measures, right?

Yes, that’s true. Various hearing aid outcome measures have been developed over the past two decades, some subjective and some objective measures of outcome.

5 What exactly do you mean by “objective” and “subjective” outcome measures?

There are several ways to describe or discuss hearing aid outcome measures. A classification scheme I’ve used in the past is to first divide them into “objective” and “subjective” categories based on the clinician’s ability to evaluate the response using external criteria.³

For example, if speech-recognition performance is one of the things to be measured after intervention with hearing aids, this can be measured either by administering a standardized speech-recognition test in which the responses are scored as correct or incorrect or it could be assessed using self-reported ratings of the perceived speech intelligibility. The former measure is considered objective because the response is scored by the clinician using an external criterion (the list of words spoken). The latter is considered subjective because

O ur guest author this month grew up in Indiana, and has spent his last 18 years as a professor at Indiana University, which truly qualifies him as a “Hoosier.” Hoosier. It’s an interesting word. To some it’s an old kitchen cabinet; to others, the term reminds them of an excellent basketball movie. It probably came from the English word hoozer, used to refer to anything unusually large. The first published U.S. definition, however, described a Hoosier as “a big, burly, uncouth specimen.”

Like Hoosiers, outcome measures also seem to mean different things to different people. With respect to hearing aids, is it all about amount of daily use? Performance on a speech intelligibility test? Reduction of emotional or social handicap? Benefit? Expectations that have been met? Satisfaction? Enjoyment of life? Or all of the above? We’ve talked quite a bit about outcome measures here on Page Ten. In one of our first installments Fred Bess discussed the HITE. A year later, we witnessed the birth of the APHAB. Later on, Stuart Gatehouse introduced the Glasgow benefit scale. Catherine Palmer suggested that we all find a new “PAL” and Patti McCarthy was HAPI and COSI!

In recent years we’ve been hearing a lot about “evidence-based practice.” That is, in the world of hearing aids, rather than going by “clinical intuition” or our best hunch, we use findings derived from research to guide us in making decisions regarding the selection of technology and fitting techniques. But many of our research conclusions will be only as good as the outcome measures that were used to formulate them. Which is why we are bringing in a Hoosier to help us out.

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If you’ve followed the audiology literature over the past decade, you’ve noticed that Dr. Humes is one of a handful of people who have helped us organize and assess the effectiveness of the many hearing aid outcome measures available. So after reading Page Ten, check out the references and read Larry’s other excellent articles on this topic.

Gus Mueller
Page Ten Editor
it includes no external standard by which the clinician scores the response.

In both cases, the purpose is to obtain a measure of aided speech-recognition performance, but one measure is objective and the other is subjective. Other aspects of hearing aid outcome can be measured in both ways as well.

6 I see you use the term "speech recognition." I know we use "word" recognition for PBs, but are other speech tests also considered recognition? Is, say, the HINT a recognition task? Understanding? A measure of intelligibility?

I use the term "speech recognition" to refer to any open-set speech-perception task, whereas "word recognition" is a subset of this more general term. "Word recognition" uses only words as stimuli, while "speech recognition" may also use nonsense syllables or sentences.

Also, I think many people equate the term "speech intelligibility" with "speech recognition." "Speech identification," on the other hand, refers to a closed-set or multiple-choice speech-perception task.

Finally, "speech understanding" is also a general term that is sometimes equated to "speech recognition," but can also be used to represent a deeper level of linguistic processing that is roughly comparable to "speech comprehension." In this case, we are interested not only in whether the listener perceived the stimulus accurately, but also whether the listener understood the meaning of the speech stimulus. A common method of assessing comprehension is to ask follow-up questions derived from the content of the spoken material.

7 What other aspects of hearing aid outcome can be measured both objectively and subjectively?

Well, in the previous example, we were concerned only with aided speech-recognition performance. Often, however, we are interested not only in the aided performance, but also in how much aided performance has changed relative to unaided performance. This is generally referred to as a measure of benefit, rather than performance.

Hearing aid benefit can be measured objectively by comparing aided and unaided measures of speech-recognition performance. It can also be measured subjectively through a wide assortment of self-report measures of benefit. The same is true of hearing aid usage. It can be measured subjectively through self-report and there are ways in which one can measure hearing aid usage, or at least measure the "on time" of the hearing aid, objectively.

8 Your last point intrigues me. How does one measure hearing aid usage objectively?

There are two main approaches. One is to measure the change in battery weight that occurs as oxide batteries discharge. The weight change is miniscule, though, so very sensitive scales are required to measure the change. This approach was used by Mark Haggard and colleagues 20 years ago, as well as by Mary Sue Fino, Fred Bess, and colleagues a decade ago.

Another approach to measuring hearing aid usage objectively took advantage of features available in some programmable hearing aids. For example, the multiple-memory hearing aids made by 3M several years ago included a "data logging" feature that indicated how long the hearing aid had been on.

With both these approaches, however, one knows only how long the hearing aid has been turned on, not necessarily how many hours it has been worn. That is, if the patient forgot to turn the hearing aid off when he removed it to go to sleep, this would be recorded as hours "on," even though it clearly does not represent hours of "usage." So, an objective measure is not necessarily more valid than a subjective measure. Interestingly, Haggard, our own laboratory, and, most recently, Catherine Palmer’s group have all found pretty good correlation between objective and subjective measures of hearing aid usage.

9 First you said there hasn’t been much work done on hearing aid outcome measures and implied that audiology was behind in that regard. Now you’re saying that several studies have been done in this area. Am I missing something here?

There have been many studies on outcome measures, but each has tended to examine only one aspect of hearing aid outcome, such as subjective benefit, and usually in a relatively small group of subjects.

10 What do you mean by an “aspect” of hearing aid outcome?

We’ve actually gained some insight into what I mean by “aspects” of hearing aid outcome in our earlier discussion of objective and subjective measures. Thus far, we’ve discussed aided performance, relative benefit, and usage. All three of these types of measures are possible aspects of hearing aid outcome that could be used to quantify the success of the intervention with hearing aids. And, we’ve seen that each of these three aspects of outcome can be measured using objective means or subjective means.

Another aspect of outcome that is often measured is hearing aid satisfaction. Probably the most broadly applied instrument in this area has been the various iterations of Sergei Kochkin’s MarkeTrak surveys for Knowles, initially developed and administered about two decades ago. Other satisfaction tools have been developed and validated more recently, including one by Robyn Cox and colleagues. Actually, recent research from our laboratory found that both these measures of hearing aid satisfaction were strongly and positively correlated. So, when satisfaction is thrown into the mix, you can see that we have a wide array of possible outcome measures, each designed to tap into various aspects of hearing aid outcome.

11 By my count, there are at least seven outcome measures that could be obtained from every hearing aid wearer: objective performance, subjective performance, objective benefit, subjective benefit, objective usage, subjective usage, and satisfaction. Do we need to measure all of them in every patient?

Ah, my friend, you have discovered the central question in this area, one that has, as yet, remained unanswered over all these many years of inquiry into hearing aid outcome measures!

12 That’s good to know. But aren’t you supposed to answer my questions?

Well, I’m trying, but there’s a reason your
Although these results differ from those that emerged from analysis of the two studies at Indiana University (IU) described previously, there is a fair amount of similarity in the findings. Basically, whereas two factors were needed to represent speech-recognition performance in the NIDCD/VA study, only one was needed to represent both of these aspects of outcome in the IU studies. Similarly, whereas subjective benefit and satisfaction emerged as separate aspects of outcome in the NIDCD/VA study, these measures represented a single combined aspect of outcome in the IU studies.

15 How do you explain the differences observed between the analyses of the IU studies and the NIDCD/VA study?

There were many differences between the studies, but a key one was that the NIDCD/VA project was not designed specifically to evaluate aspects of hearing aid outcome, whereas this was the primary purpose of the two IU studies. Consequently, the IU studies included not only multiple measures of speech-recognition performance, but also multiple measures of subjective benefit, satisfaction, and usage.

For the most part, the NIDCD/VA study focused on the comparative evaluation of the speech-recognition benefits provided by the three hearing aid circuits studied. As a result, the outcome measures used emphasized speech-recognition performance and subjective benefit, with minimal measures of hearing aid satisfaction and usage.

16 So, based on this information, do you have any specific measures to recommend for use by the responsible clinician who wants to document the success of the hearing aid intervention?

Well, research is ongoing, at our lab and elsewhere, to refine the nature and number of independent aspects of hearing aid outcome. In the interim, it would probably be most prudent to include at least one measure of speech-recognition performance, perhaps at a conversational level and with a typical signal-to-noise ratio, and to measure performance both aided and unaided.
and unaided.

I know that this latter suggestion, making unaided and aided measures of speech-recognition performance, runs counter to the analyses of the IU and NIDCD/VA studies. However, the problem with measuring aided (or unaided) speech-recognition performance alone lies in the interpretation of the score. Currently, predictive schemes based on the Speech Intelligibility Index (SII) or similar concepts are not accurate enough or practical to generate target scores to facilitate interpretation of aided-only speech-recognition performance.21 Jerry Studebaker continues to make good progress in this area,22,23 but it is not yet feasible to do so clinically.

17 What about subjective measures? Do you recommend any of them?

Yes. In addition to aided and unaided speech-recognition performance under representative or typical listening conditions, measures of subjective benefit, satisfaction, and usage should be obtained. In our experience, a nice tool that permits the measurement of all these aspects of outcome is the Glasgow Hearing Aid Benefit Profile (GHABP) developed by Stuart Gatehouse.24 In addition to yielding valid self-report measures of hearing aid benefit, satisfaction, and usage in one instrument, the GHABP also shares some of the attractive, structured-interview aspects of another self-report measure of subjective benefit, the Client-Oriented Scale of Improvement (COSI), developed by Brian Walden and colleagues.28 We’ve found it quite useful, although at 64 items it can be on the lengthy side.

Schum22 and Dillon30 independently developed abbreviated versions of the HAPI for use with elderly adults, while preserving many of the features of the full-length HAPI, in attempts to increase the clinical utility of this outcome measure. In addition, Robyn Cox and colleagues have developed and validated the Abbreviated Profile of Hearing Aid Benefit (APHAB) as a measure of subjective benefit comprising just 24 items,31 and the Satisfaction with Amplification in Daily Life (SADL) instrument as a measure of hearing aid satisfaction based on just 15 items.11

19 What self-report tool do you recommend for measuring hearing aid usage?

Here we’ve found the use of daily diaries (small pocket calendars) during the 30- or 60-day trial period to be useful, both for quantifying the hours of daily usage and for recording any problems with the instrument.

20 Whew, we’ve covered a lot of ground! Is there anything else I should have asked you?

No, not today. I think you now have a manageable set of outcome measures to start using with your hearing aid patients first thing tomorrow.

REFERENCES
