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IN THIS ISSUE

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Features

EDITOR

Brian Taylor, Au.D.
brian.taylor.aud@gmail.com

MANAGING EDITOR

Stephanie Czuhajewski, MPH, CAE
sczuhajewski@audiologist.org

GRAPHIC DESIGNER

Janet Roy

ADVERTISING

Stephanie Czuhajewski, MPH, CAE
sczuhajewski@audiologist.org

HOW TO REACH US

ADA Headquarters
1024 Capital Center Drive, Suite 205
Frankfort, KY 40601
Phone: 866.493.5544
Fax: 859.271.0607

www.audiologist.org

Departments

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Dawn Heiman, Au.D.

Looking back / looking ahead

Dear Respected Colleagues,

It is with great pride and appreciation that I look back on 2023, and particularly the AuDacity Conference in the picturesque setting of Bonita Springs, Florida. The collective spirit of learning, camaraderie, and growth that I witnessed was truly inspiring and defines our passionate profession. As you know, our annual conference serves as a beacon of knowledge and collaboration. The vibrant atmosphere was palpable, filled with the excitement of discovery and the shared commitment to advancing the profession of audiology.

One of the hallmarks of the AuDacity Conference was the diverse range of experts who graced our stages. Leading researchers from around the world provided information that was readily translatable to day-to-day clinical practice. We were privileged to learn from thought leaders and innovators, each contributing their unique insights and experiences to our collective understanding of audiology. Additionally, your invaluable contributions as a colleague within the membership added a special dimension to the wealth of knowledge shared.

Attendance at this year's conference was fantastic and truly heartening, reflecting the commitment of our members to continuous professional development. The overwhelming positive response to the courses offered is a testament to the dedication and enthusiasm of ADA's Education Committee. I extend my sincere appreciation to all those who participated, making this conference a resounding success.

Looking ahead, I am excited to announce that our next conference is slated for September 5-8, 2024 in Dallas, Texas. As we eagerly anticipate this upcoming event, I encourage each of you to mark your calendars and join us for another enriching experience. ADA is committed to providing a platform for the exchange of ideas, the advancement of knowledge, and the strengthening of professional connections. Together, we will continue to shape the future of audiology and ensure that our profession remains at the forefront of innovation and excellence.

In closing, I express my deepest gratitude to each member of our respected community. Your passion, dedication, and commitment to the field of audiology are the driving forces behind our collective success. As we carry the momentum from this year's conference into the future, I am confident that the Academy of Doctors of Audiology will reach new heights of accomplishment and impact.

Thank you for your unwavering support, and I look forward to welcoming you all at the 2024 conference, along with your 2024 president, Dr. Jason Leyendecker, where we will once again celebrate the pursuit of knowledge and the shared journey of audiology professionals.

Warm regards,

Dr. Dawn Heiman

Brian Taylor, Au.D.

Using the Quick SIN as the Default Speech Perception Test

Long promoted as a test used in the hearing aid selection and fitting process, the Quick SIN might be about to enjoy a rebirth of sorts. Since, however, surveys of clinical best practices suggest less than 30% of audiologists conduct any type of speech in noise testing, it is more apt to call it a birth. In late August, preliminary guidelines for replacing word recognition in quiet testing with speech in noise assessment using the Quick SIN in the routine test battery was published-ahead-of print at Ear and Hearing. The authors make a compelling argument — backed up with rigorous statistical analysis — that word recognition tests ought to be replaced with speech in noise testing for all adult routine audiological assessments. This is a big deal because, like amending the US Constitution and the Detroit Lions or Cleveland Browns winning the Super Bowl, there has been little meaningful change over the course of generations. In the case of routine hearing assessment, the basic word recognition in quiet testing protocol has remained unchanged for more than 50 years.

Scan the QR code to read Preliminary Guidelines

Be it a birth or re-birth, this is important news for clinicians for several reasons. First, the number one complaint of most persons with hearing loss is an inability to understand speech in the presence of noise, yet we test word recognition ability in quiet. Second, there is evidence suggesting that speech understanding ability cannot be predicted from word recognition in quiet scores, especially for individuals who score around 80% or better on words in quiet. As clinicians who routinely use the Quick SIN know, it is common for some individuals with a good word recognition score of, say, 88% to have excellent speech understanding ability in noise, while others with the same "good" score in quiet score poorly on the Quick SIN. Finally, because there has been a lack of guidance on exactly how speech in noise scores correspond to word recognition scores in quiet, clinicians – even those promoting the routine use of the Quick SIN — felt burdened by having to do two tests: the NU-6 in quiet to find PB-Max and the Quick SIN.

Fortunately, Matthew Fitzgerald and colleagues at Stanford University have made remarkable inroads in making speech in noise measures the default test of speech perception during the hearing assessment. They collected Quick SIN scores along with traditional pure tone thresholds and word recognition scores in quiet on a whopping 5,808 adult patients in their medical center. After collecting this data, their statistical analysis indicated the Quick SIN when combined with the patient's high-frequency pure tone average (HFPTA) accurately identifies individuals with good to excellent word recognition in quiet.

Continued on page 55

Stephanie Czuhajewski, MPH, CAE, Executive Director

Ownership of the Audiology Profession Requires Buy-in on Ethical Standards Worthy of Clinical Doctoring Professionals

ADA's mission is to advance practitioner excellence, high ethical standards, professional autonomy, and sound business practices in the provision of quality audiologic care. ADA has been long recognized as the leader in promoting ownership of the audiology profession through autonomous practice.

Yet, *ownership* of the audiology profession goes beyond practice ownership and professional autonomy in clinical decision-making. To truly own the audiology profession, audiologists must be recognized as trusted doctoring professionals who adhere to high ethical standards by practicing full-scope, evidence-based audiology and advocating for the best interests of their patients.

Scan the QR code to review ADA's Code of Ethics.

As ADA members are keenly aware, ethical standards in audiology are not merely suggestions. They are the foundation of trust and integrity in the patient-clinician relationship, safeguarding against conflicts of interest that undermine patient care.

ADA and its leaders strive to promote public policies that align with ADA's Code of Ethics. Recently, ADA had the opportunity to provide public comments to the Centers for Medicare and Medicaid Services (CMS) to address proposed CMS policy changes to the Medicare Advantage program.

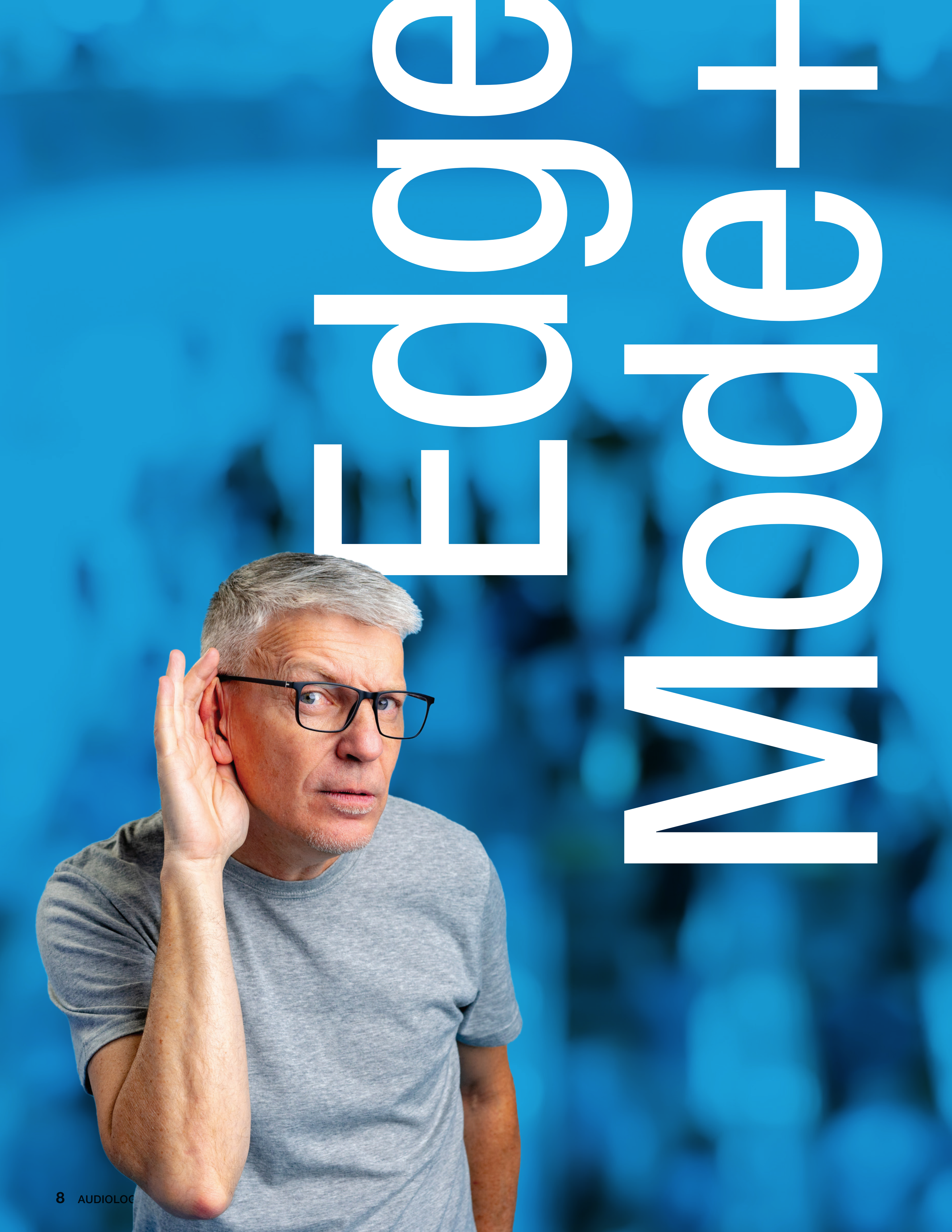
ADA asked CMS to implement requirements that will

- Promote transparency in the Medicare Advantage plan marketing of hearing "benefits" through clear language and disclosures about whether the benefit is funded insurance or a discount plan,
- Increase consumer awareness about the hearing benefits that they are entitled to receive under Medicare Advantage, including comprehensive diagnostic audiologic examinations (when medical necessity is established), and
- Assure that recommended audiologic treatments and interventions are based on the best available research and clinical expertise, rather than on commercial incentives.

Scan the QR code to review ADA's comments to CMS.

Please scan the QR code (above right) to read ADA's comments in their entirety. I hope that you will find these comments align with ADA's mission, values, and ethical standards that are worthy of a clinical doctoring profession. ■

Edge Mode+



On-demand processing improves speech recognition and listening effort in hearing-aid users

Brittany N. Jaekel, M.S. Ph.D., Jingjing Xu, Ph.D.

Introduction

Understanding speech in noise remains difficult for hearing aid users.[1] Per the MarkeTrak 2022 survey, hearing aid users were least satisfied with their ability to hear in the following listening situations: in a classroom or movie theater (70% satisfaction), conversations in noise or conversations with large groups (72% satisfaction), and in a lecture hall (72% satisfaction) – that is, environments that may be noisy and/or reverberant and contain many talkers.[1] While hearing aids have sophisticated noise reduction strategies, the MarkeTrak 2022 survey also found that the noise reduction capability of hearing aids was an area of least satisfaction among hearing aid users queried about the sound quality of their devices (i.e., 23% of respondents reported being dissatisfied or neutral on this metric).[1]

Beyond noise reduction strategies, acoustic environmental classification (AEC) is a feature of modern hearing aids that identifies and classifies the current listening environment, and then automatically applies environment-specific changes to the hearing aid's gain, microphone settings, and compression, in addition to noise reduction settings.[2] These environment-specific changes aim to improve speech intelligibility in a variety of listening situations; however, the classifier may sometimes be inaccurate, or the adjustments made by AEC may not be strong enough to combat noise in particularly challenging edge cases,[2] resulting in unsatisfactory outcomes.

In order to address these unmet needs, implementing an on-demand option for hearing aid users is highly desirable. One tool aiming to help Starkey hearing aid users in the abovementioned challenges is called Edge Mode+, which is an on-demand processing feature guided by artificial intelligence (AI).

How Edge Mode+ Works

Edge Mode+, when activated by the hearing aid user, prompts the hearing aid to classify the current acoustic environment and then apply additional specialized setting changes to noise reduction, directional microphone, gain, etc., over and above those supplied by AEC. These specialized setting changes are specific to the listener's current environment as well as the listener's goal, thus optimizing the user's listening experience. For example, a listener wanting to hear people more clearly might select Edge Mode+ Enhance Speech, while a listener wanting even more comfort in noise might select Edge Mode+ Reduce Noise. These classification and adaptation schemes were derived via machine learning, in which models were trained on a large number of real-life sound recordings, and further refined via input from both practitioners and listeners.

One goal of Edge Mode+ is to improve user outcomes – like speech understanding and listening effort – in the most difficult listening scenarios, while also adjusting for the user's intent for the listening interaction. In this article, results from two lab-based studies demonstrate the benefits of the Edge Mode+ feature in Starkey's Genesis AI hearing aids.

Study 1: Edge Mode+ Improves Speech Recognition

The first study assessed whether Edge Mode+ Enhance Speech improves listeners' speech recognition in noise.

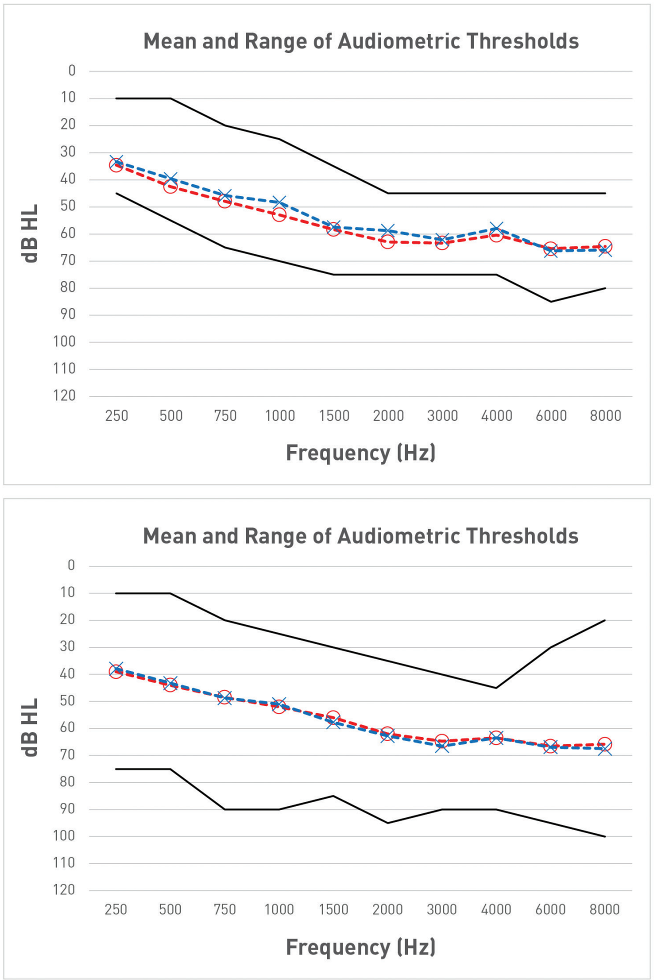
Twelve experienced hearing aid users (5 females, 7 males) wore Starkey Genesis AI 24 receiver-in-the-canal (RIC) devices (programmed to Starkey's proprietary fitting formula, e-STAT 2.0) with audiometrically appropriate occluded earbuds or earmolds. In general, participants had sloping mild to moderately severe hearing losses (Figure 1), and their age range was 42 to 84 years, with a mean of 71.1 years and standard deviation of 12.2 years.

For this experiment, the participants' task was to repeat sentences presented in the context of a real-life recording of restaurant noise. This noise was unique in that it included several noisy distractions that would be typical in a restaurant setting: people talking in the background, radio music playing, and clattering dishes. The target speech was always presented from the loudspeaker directly in front of the seated participant (0°), while noise was presented from the seven loudspeakers surrounding the participant (spaced at 45° intervals).

The restaurant noise was presented at 63 dB-A (summated). The level of the target speech was individualized for each participant. Specifically, speech was presented at the level needed for that participant to achieve approximately 70% correct speech recognition while listening in the restaurant noise with default hearing aid settings. This level was chosen to ensure that the listening task was neither too easy nor too difficult for participants. A brief pre-test was administered to determine each participant's individualized target speech level.

The target speech was lists of IEEE sentences[3] spoken by a female native speaker of American English. After each sentence, participants repeated what they heard, and were scored on the number of keywords reported back correctly (out of 5 keywords per sentence). Participants performed this speech task twice: once with default hearing aid settings (i.e., Edge Mode+ was disabled) and once with Edge Mode+ Enhance Speech enabled. The order of testing was randomized, and participants were masked to condition.

Figure 1.



Average audiograms for participants in Study 1 (top) and Study 2 (bottom). Blue symbols indicate thresholds for the left ear, and red symbols indicate thresholds for the right ear. Black lines indicate the maximum and minimum thresholds.

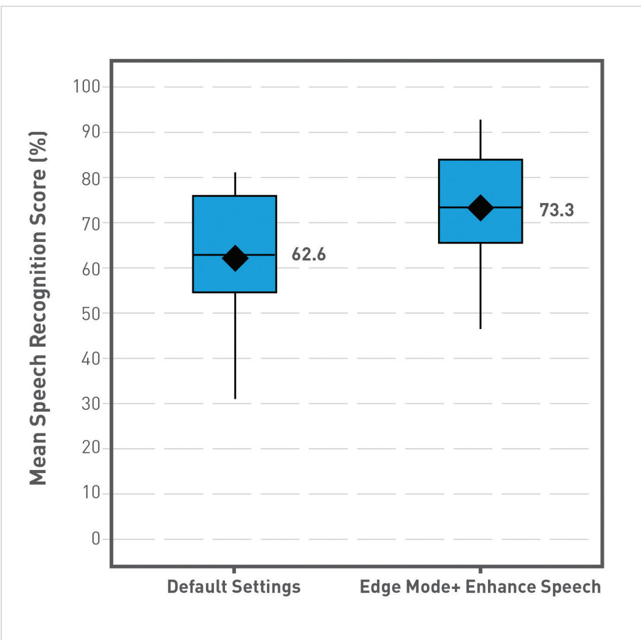
Hearing aid users were least satisfied with their ability to hear in the following listening situations:

classroom or movie theater	conversations in noise or large groups	in a lecture hall
70% satisfaction	72% satisfaction	72% satisfaction

(that is, environments that may be noisy and/or reverberant and contain many talkers.)

In the default hearing aid settings condition, participants, on average, recognized 62.6% of the speech in restaurant noise (Figure 2). When Edge Mode+ Enhance Speech was enabled, speech recognition improved by 10.7 percentage points to 73.3%. To analyze this change statistically, scores were transformed into rationalized arcsine units (RAUs), which can be interpreted similarly to percentages and allow for parametric statistical testing.[4] The improvement in speech understanding with Edge Mode+ Enhance Speech was statistically significant ($t(11)=2.55$, $p=0.027$). Thus, enabling Edge Mode+ Enhance Speech allowed participants to understand significantly more speech in a realistic, noisy background.

Figure 2.



These boxplots show participants' mean speech recognition scores for each listening condition. The diamond symbols indicate the average scores, and the horizontal solid black lines indicate the median scores. With default settings, participants achieved an average of 62.6% words correct, and with Edge Mode+ Enhance Speech, participants achieved an average of 73.3% words correct, an approximate improvement of 11%.

Study 2: Edge Mode+ Improves Listening Effort

The second study assessed whether Edge Mode+ could improve (i.e., reduce) listening effort in noisy environments. Listening effort has been defined as "the mental exertion required to attend to and understand an auditory message."[5] If Edge Mode+ can process incoming signals such that it is easier for the listener to understand speech, then mental exertion – or listening effort – should be reduced with Edge Mode+ compared to default hearing aid settings.

Twenty experienced hearing aid users (5 females, 15 males) participated in this study, and were fit with the same devices, fitting formula, and coupling strategy as described in Study 1. On average, participants had sloping mild to moderately severe hearing losses (Figure 1), and their age range was 42 to 84 years, with a mean of 71.2 years and standard deviation of 12.7 years. Note that a subset of these participants was also tested in Study 1.

The experimental task was the Adaptive Categorical Listening Effort Scaling (ACALES) test.[6] For this test, participants listened to English Matrix Test sentences[7] presented in a modulated background noise. While the noise remained fixed at a constant level, the loudness of the sentences varied across a range of signal-to-noise ratios (SNRs). After each SNR presentation, participants rated their listening effort: specifically, they were prompted to answer the question, "How much effort does it require for you to follow the speaker?" using a 13-point scale, ranging from "1 = No effort" to "13 = Extreme effort". A fourteenth option, "Only noise", was also available to participants, for situations when the speech was so soft in level that participants could perceive nothing but noise.

Participants completed the ACALES test twice: once with default hearing aid settings (i.e., Edge Mode+ was disabled), and once with Edge Mode+ Enhance Speech enabled. The test order was randomized and participants were masked to condition.

An Example

The type of data collected via the ACALES test is shown in an illustrative example in Figure 3 (that is, the information presented in Figure 3 is for explanatory purposes only and does not reflect actual data collected in the experiment). Listening effort ratings are plotted as a curve, demonstrating how listening effort ratings change across SNRs. In this

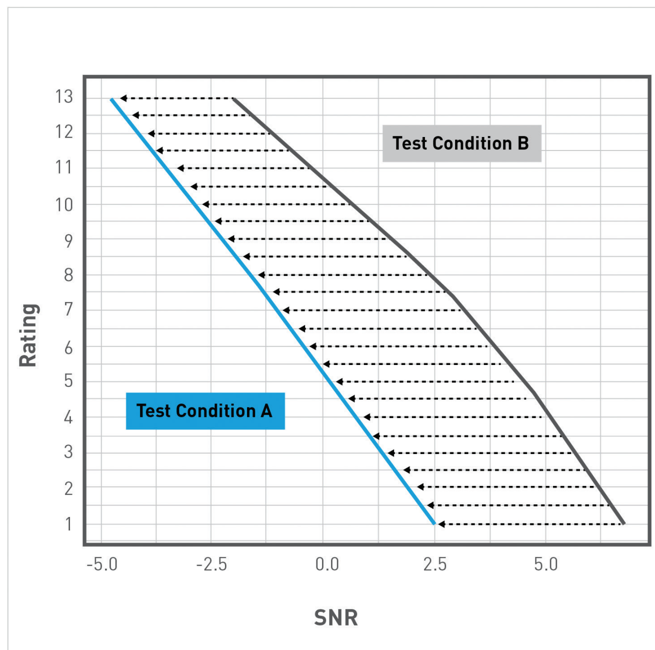
Edge Mode+

Implementing an on-demand environment-specific noise reduction option aims to improve speech intelligibility in a variety of listening situations.

example, the highest listening effort (ratings 9 to 13, *considerable effort* to *extreme effort*) are associated with the most negative (most difficult) SNRs, and the lowest listening effort (ratings 1 to 5, *no effort* to *little effort*) are associated with the most positive (most easy) SNRs.

When comparing ACALES outcomes across listening conditions, inspecting how the curve shifts along the SNR axis for each condition allows us to interpret whether listening effort has improved or worsened with each condition. For example, as shown in Figure 3, if the comparative condition's curve shifts leftward on the SNR axis, then that condition allowed for improved (reduced) listening effort. In other words, the listener's ratings have changed such that listening to speech in more difficult SNRs has become easier (less effortful).

Figure 3.



In this illustrative example, listening effort ratings derived from the ACALES test are plotted against SNR. For both test conditions, the lowest listening effort ratings are associated with the most positive SNRs, while the highest listening effort ratings are associated with the most negative SNRs. The curves derived from the two test conditions differ in their location on the x-axis; test condition A is shifted leftward compared to test condition B, which indicates a listening effort benefit for test condition A over test condition B. For example, for test condition B, a listening effort rating of 8 (between moderate and considerable effort) is made when the SNR is +2.5 dB, whereas for test condition A, a listening effort rating of 1 (no effort) is made when the SNR is +2.5 dB. Thus, while the SNR presented to the participant is identical in both test conditions, the listening effort ratings are different: test condition B elicits greater listening effort than test condition A.

Experimental Results

For statistical analysis, mean SNR benefits were derived from the ACALES outcomes. For each participant, the mean SNR benefit of Edge Mode+ Enhance Speech, as compared to default hearing aid settings, was calculated as:

$$mean\ SNR\ benefit = \frac{\sum_{i=1}^{n}\left(SNR_{Default\ Settings_i} - SNR_{Edge\ Mode+\ Enhance\ Speech_i}\right)}{n}$$

where n was the number of listening effort ratings for the fitted curve, and SNR $default_i$ and SNR $Edge\ Mode+\ Enhance\ Speech_i$ were the SNRs for effort rating score i. A positive mean SNR benefit value indicated the benefit of using Edge Mode+ Enhance Speech over default settings.

Figure 4 shows average mean SNR benefits for Edge Mode+ Enhance Speech over default settings. Overall, compared to default settings, the average mean SNR benefit with Edge Mode+ Enhance Speech was +1.13 dB ($t(19) = 2.08$, $p = 0.05$). This indicated that Edge Mode+ Enhance Speech improved (reduced) listening effort, on average. Note that a difference of approximately +1 dB is associated with an approximate 13% increase in speech understanding on the English Matrix Test.[8]

While we found an overall significant benefit for Edge Mode+ Enhance Speech for listening effort, we observed that individual mean SNR benefits varied across our 20 participants. As an example, in Figure 5, we present results from two participants with similar hearing losses, but who show very different levels of benefit with Edge Mode+ Enhance Speech. Participant #1 experienced an SNR benefit with Edge Mode+ Enhance Speech only in conditions perceived to require the highest listening effort, while Participant #2 experienced SNR benefits with Edge Mode+ Enhance Speech across all levels of listening effort. Thus, as an on-demand feature, Edge Mode+ can likely provide significant benefit for those patients who need additional assistance in noisy situations.

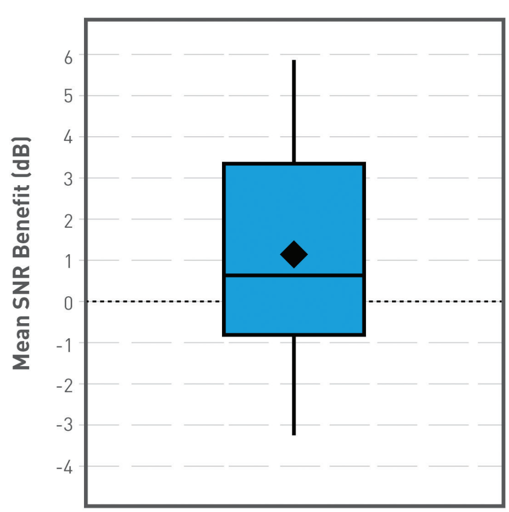


Figure 4.

This boxplot shows participants' mean SNR benefits derived from the ACALES test. Positive data indicate that participants experienced a mean SNR benefit for Edge Mode+ Enhance Speech over default settings, while negative data indicate that participants experienced a mean SNR benefit for default settings over Edge Mode. The diamond symbol indicates the average benefit, and the solid black line indicates the median benefit. Overall, the mean SNR benefit with Edge Mode+ Enhance Speech was +1.13 dB.

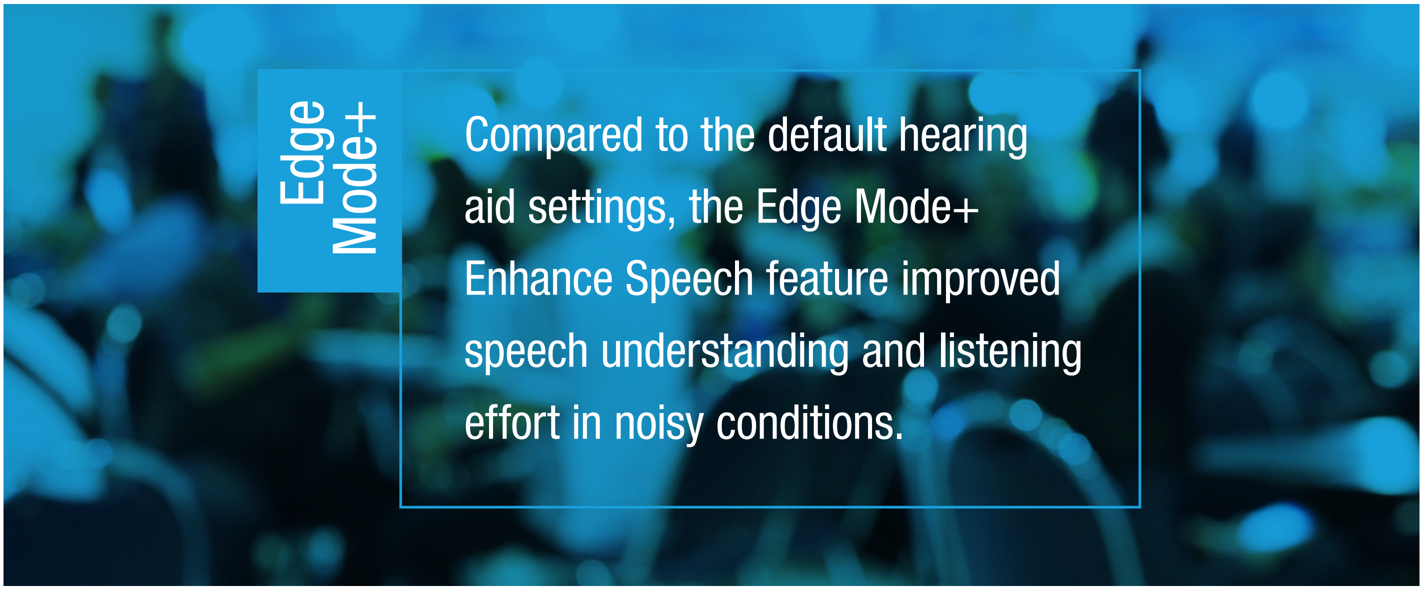
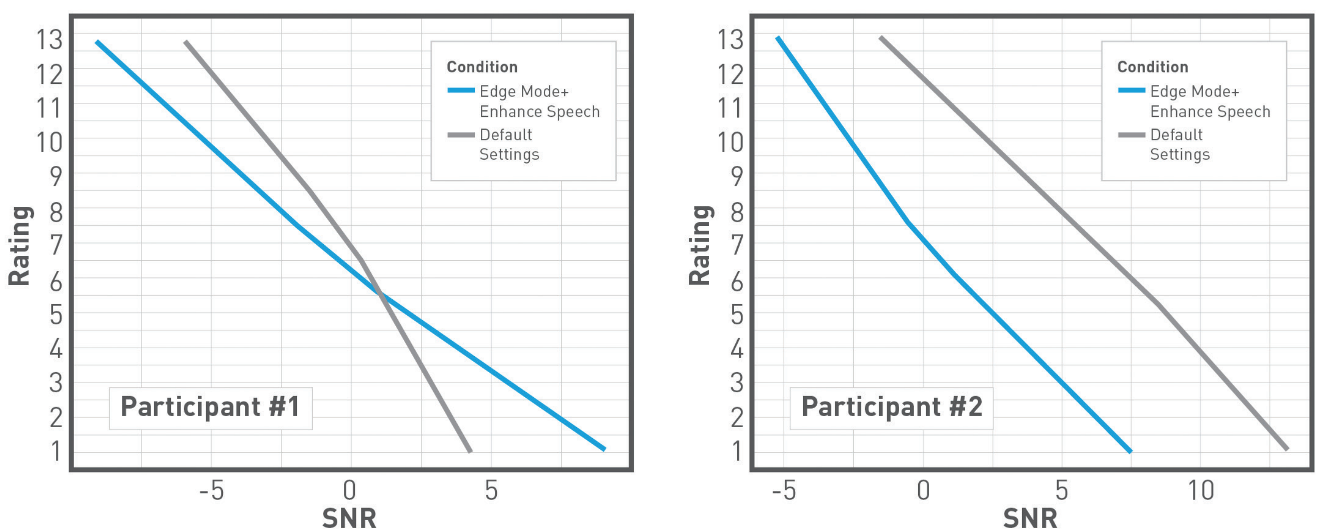


Figure 5.

Participant	Left Threshold (dB HL)				Right Threshold (dB HL)				Word Recognition (%)	
	0.5k	1k	2k	4k	0.5k	1k	2k	4k	Left	Right
#1	50	50	65	65	50	50	60	65	82	68
#2	55	60	70	75	55	70	60	55	84	78



While there was a significant mean SNR benefit for Edge Mode+ Enhance Speech at the group level, individual mean SNR benefits for Edge Mode+ Enhance Speech varied. Despite Participant #1 and Participant #2 having similar hearing losses (see above table), their mean SNR benefits for Edge Mode+ Enhance Speech differed: while Participant #1 showed only a slight benefit with on-demand processing in the highest effort conditions (above left plot), Participant #2 showed a consistently large benefit with on-demand processing across all effort conditions (above right plot). Thus, as an on-demand feature, Edge Mode+ can provide listening effort benefits for those patients who need additional assistance in noisy listening situations.

Conclusion

While the MarkeTrak 2022 survey data indicate that more than 80% of hearing aid owners are satisfied with their devices, hearing aid wearers still encounter difficulties understanding speech in certain noisy environments.[1] Edge Mode+, as an AI-driven, on-demand feature, provides an option for hearing aid users to optimize their hearing aids in situations where they have trouble hearing with the default settings. More importantly, Edge Mode+ in Genesis AI 24 and 20 tier devices provides choices (Enhance Speech and Reduce Noise) that can take the user's listening intent into consideration, which can further tailor the signal processing to meet the wearer's needs.

Results from the present studies showed that compared to the default hearing aid settings, the Edge Mode+ Enhance Speech feature improved speech understanding and listening effort in noisy conditions. These findings support the conclusion that Edge Mode+ can provide additional speech enhancement and noise reduction to help communication in these challenging situations.

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__Jingjing Xu, Ph.D.__ is a research scientist in the department of clinical and audiology research at Starkey. Before joining Starkey in 2016, he was a research assistant professor of audiology at the University of Memphis. He received his master's degree in Engineering Acoustics from the Technical University of Denmark and his Ph.D. in Communication Sciences and Disorders from the University of Memphis. His research interests include acoustics, speech recognition, hearing aid outcome measures, and ecological momentary assessment.

__Brittany N. Jaekel, M.S. Ph.D.__, joined Starkey as a research scientist in 2021. She earned her master's degree in Communication Sciences and Disorders from the University of Wisconsin-Madison and her Ph.D. in Hearing and Speech Sciences from the University of Maryland-College Park. Her research has focused on speech perception outcomes in people with hearing prostheses and the impacts of aging on communication. ■

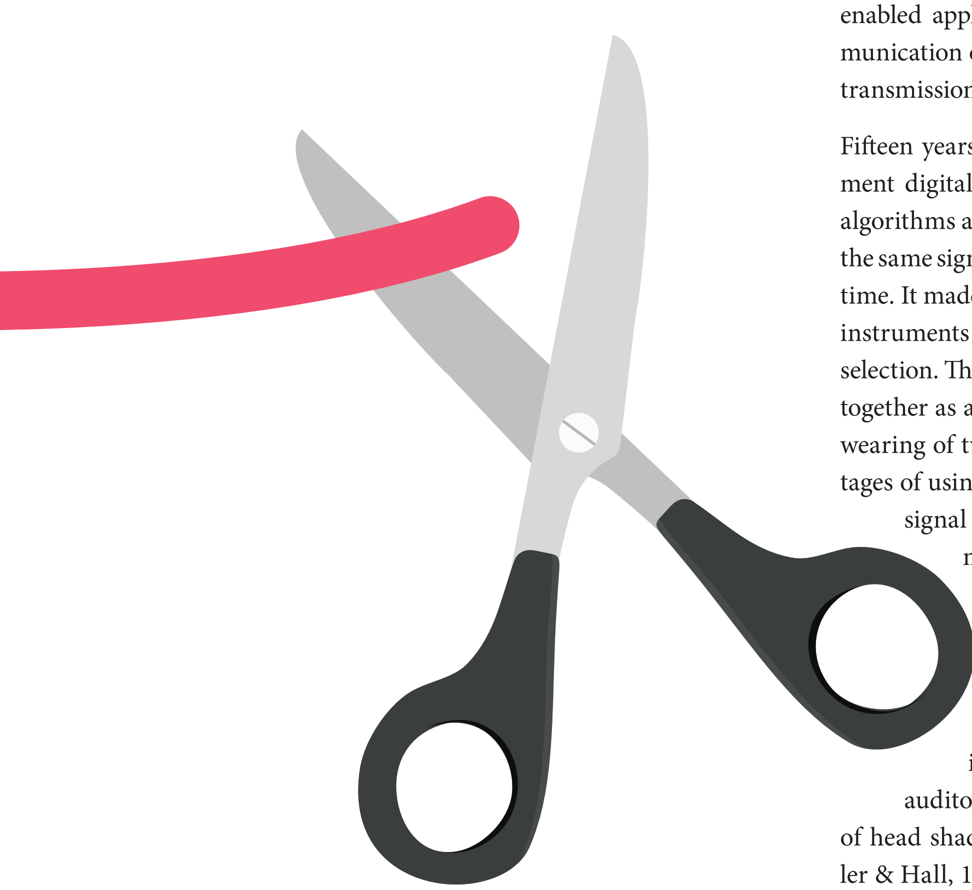
EVOLUTION OF

Wireless Communication Technology IN HEARING AIDS

THE FEATURES AND BENEFITS OF SIGNIA E2E INNOVATIONS

Navid Taghvaei, AuD and Sonie Harris, AuD

Wireless communication between hearing aids is an excellent example of how hearing aids in the digital era, which began in the late 1990's, have evolved over time. As this tutorial demonstrates, with these incremental improvements come added wearer benefit. Although the focus here is on Signia technology, the evolution of wireless technology offered by other hearing aid manufacturers tracks in a similar way; consequently, leading to overall wearer satisfaction increases from about 60% in 1998 to upwards of 85% in 2022, as measured by MarkeTrak surveys.



Hearing aid wearers have not always enjoyed the benefits of wireless technology. In October 2004, nearly 20 years ago, Siemens launched a new product, Acuris™ which was, for the first time, embedded with wireless technology called e2e (ear-to-ear). The first of its kind, e2e technology opened new pathways for future product developments. For the uninitiated, e2e wireless communication between the hearing instruments sends and receives signals during normal operation of the hearing instruments to continually share information about the current listening environment and control settings. The technology can also trigger additional information and data transmission, both through user controls and between the hearing instruments simultaneously.

This e2e wireless technology was the first of its kind to efficiently use electromagnetic transmission and send coded digital information alternating on two frequencies, 114 kHz, and 120 kHz. e2e uses a form of modulation called Frequency Shift Keying (FSK) and with a typical current consumption of 120 μA, the technology is extremely efficient in power consumption. Operating on this narrow frequency band, it assures wireless functionality with virtually no interference. Even though FSK modulation is used in Bluetooth-enabled applications, this form of electromagnetic transmission, also called Near Field Magnetic Induction (NFMI), is not a Bluetooth enabled application. NFMI is well suited for wireless communication over short distances, thus it is ideal for ear-to-ear transmission between two devices that are worn on the head.

Fifteen years ago, e2e wireless synchronized hearing instrument digital processing using activation of noise reduction algorithms and linked hearing instruments so that they reach the same signal processing characteristics at precisely the same time. It made it possible to control both left and right hearing instruments with one control for volume and one for program selection. The two hearing instruments were designed to work together as a single unified system to simplify the fitting and wearing of two hearing instruments. There are many advantages of using this wireless technology: maintaining binaural signal processing, excellent sound quality without signal drop, optimizing the accuracy of signal classification, expanding options on smaller custom instruments, and overall ease of use.

It is well established that there are many benefits to binaural hearing, including improved signal to noise ratio (SNR), better auditory localization, loudness summation, reduction of head shadow effect, and improved sound quality (Mueller & Hall, 1998). Hearing instrument wearers, who use two independent hearing instruments, gain a bilateral advantage; however they do not necessarily enjoy the benefit of binaural hearing (Noble & Byrne, 1991). e2e wireless communication ensures that both instruments analyze, interpret, and react together as a single system, thus empowering hearing instrument wearers to take full advantage of binaural hearing.

The main benefit of binaural hearing is improvement in localization, using interaural time and intensity cues. Independent bilateral hearing aid fittings can easily compromise and mismatch the volume settings on hearing instruments worn by patients, affecting these necessary auditory cues (Hornsby & Ricketts, 2004). Another benefit of consistent gain matching relates to the binaural squelch effect, sometimes referred to as the binaural intelligibility level difference, or the binaural masking level difference (Zurek, 1993). Binaural squelch effect provides an improvement in the SNR. This improvement in binaural fittings can provide an advantage of 2.5 to 3.0 dB for listening in background noise over a unilateral fitting, which demonstrates that individuals with hearing loss also experienced binaural squelch benefits (Ricketts, 2000). As e2e wireless technology helps maintain loudness symmetry, it should also help maximize the wearer's binaural squelch and redundancy (Jerger et al. 1984).

In addition to interaural time and intensity cues, wireless e2e processing synchronizes directional microphones, which has a significant effect on speech intelligibility. The most important aspect of research in this area is the fact that matched directional microphone modes in both hearing instruments significantly increase speech understanding up to 4.5 dB in noise when compared to mismatched microphone settings (Hornsby & Ricketts, 2005; Mackenzie et al. 2005). Wireless e2e technology not only provides significant improvements in "ease of use," but also improves the wearer's overall listening comfort and speech understanding by synchronizing decision-making and signal processing.

WIRELESS CONNECTIVITY

In 2008, e2e wireless 2.0 was introduced in tandem with remote wearer controls. This 2nd generation of e2e technology enabled audio signals from external devices to be streamed wirelessly to the hearing instruments in stereo, with no audible delay. For the first time, hearing aid wearers could watch TV, listen to music, and telephone conversations wirelessly, essentially turning their hearing instruments into personal headsets. In addition to significant audiological advantages, because the microphone could be placed closer to the sound source and transmitted directly to hearing aids considerable distance away, this wireless connection significantly improved the SNR of the listening environment. A wearer benefit that is especially relevant for telephone communication. In a bilateral fitting, the phone signal transmits to both hearing instruments, allowing the wearer to take advantage of binaural redundancy and central integration, which can improve the signal to noise ratio by 2 to 3 dB (Dillon, 2001).

By 2012, e2e wireless 2.0 technology improved further by offering connectivity to several transmitters and audio devices. These wearer benefits of e2e technology corresponded with the rising popularity of smartphones. Hearing aid wearers could take advantage of multiple applications on their favorite gadgets simultaneously. This meant that they could have video calls on their laptop then transition seamlessly back to their smartphones. Wearers could now take turn-by-turn instructions from their favorite navigation app or listen to their favorite songs from their smartphones simultaneously. It was now possible to continue to watch TV and listen at their preferred volume without disturbing others via streaming from their favorite tablets or streaming platforms.

One of the most impressive innovations in the hearing instruments at the time featured automatic learning or "trainable hearing instruments." Signia hearing instruments (Siemens at the time) could automatically learn through the SoundLearning algorithm, ensuring that every time the patient makes an adjustment to loudness or frequency response, both hearing instruments record the specific listening situation. This was done based on the acoustic sensor system, the sound pressure level of the input, and the patients' desired gain in frequency response in synchrony. In a matter of weeks, it was possible for the learning instruments to map out the wearer's' preferences and then automatically adjust to that setting when that given listening situation was detected again.

In 2014, e2e wireless 3.0 enabled a series of new algorithms, which provided signal processing that empowered hearing aid wearers to have better speech recognition in demanding listening environments than people with normal hearing (Kamkar-Parsi, et. al, 2014). This 3rd generation NFMI system could transmit dual-microphone bidirectional audio data from ear to ear, creating a virtual 8-microphone

EVOLUTION OF WIRELESS COMMUNICATION TECHNOLOGY IN HEARING AIDS:

2004 →

Siemens launches Acuris™
e2e technology

2008 →

Second Generation of e2e
Remote wearer controls

2012 →

e2e 2.0 Technology improves
Connectivity to several transmitters and audio devices

2014 →

e2e wireless 3.0
Exceptional speech recognition in demanding environments

2016 →

Signia launches the Primax platform
Listening effort reduced

2017 →

Signia launches the Nx platform
Ultra HD e2e technology

2021 →

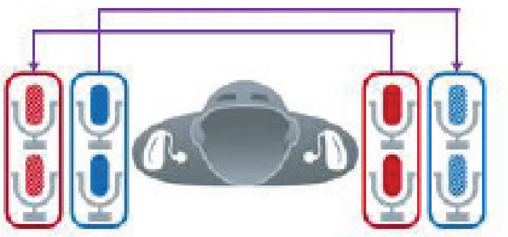
Signia launches the Augmented Xperience (AX) platform
Two independent acoustic snapshots around the wearer

2023 ·····

Signia launches Signia Integrated Xperience platform
Real Time Conversation Enhancement (RTCE)

network (Figure 1). To achieve this sophisticated communication, the effective inter-aural data rate of e2e 3.0 was raised by a factor of 1000 compared to e2e 2.0. The e2e 3.0 achieved this without size or battery drain drawbacks due to the use of a dedicated design for hearing instruments. This included the choice of frequency band, the design of the analog and digital transmission system, as well as the system integration into the hearing instrument.

Figure 1:
E2e 3.0: transmission of audio signals



e2e wireless 3.0 creates a virtual 8 microphone network (2 physical and 2 "virtual" microphones on each side).

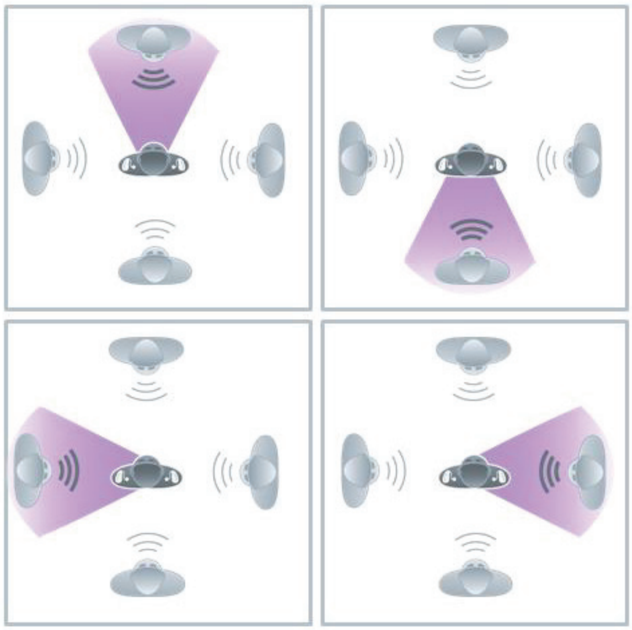
Through the wireless transmission and sharing of audio information between the two hearing instruments with e2e wireless 3.0, it is possible to make calculations involving the wearer's auditory scene that were not previously possible. Particularly, to focus and enhance the hearing instrument output for signals of interest—most commonly target speech—while simultaneously minimizing the output from other spatial orientations where the input is not desirable. In Signia devices, this was accomplished through two different algorithms referred to as Narrow Directionality and Spatial SpeechFocus. With Narrow Directionality, the directional polar pattern has a very narrow focus to the front (e.g., the look-direction of the hearing instrument wearer). The output of the hearing instruments is significantly reduced for all inputs falling outside of the narrow focus (Figure 2), even if they are located right next to the target speech source. This provided a SNR advantage not observed in previous directional instruments. This SNR advantage was easily achieved simply by the wearer looking at the talker of interest, as illustrated in Figure 2.

Figure 2:

Compared with standard monaural directional microphone (gray-shaded area), Narrow Directionality (purple-shaded area) has a narrower focus beam so that sounds outside of what is immediately in front of the wearer can be attenuated.

In contrast, the Spatial SpeechFocus algorithm was designed for the opposite speech-in-noise listening situation—when the listener cannot look directly at the target speech signal. This algorithm detects the location of speech (front, back, or either side) and adjusts the focus of the directional polar pattern to enhance this signal, which provides less output for signals from other spatial orientations (Figure 3). While it is understood that we may not restore optimal binaural processing for older individuals with hearing loss, there are methods to compensate for their diminished capabilities. The algorithms of the b=Binax hearing instruments, using binaural beamforming, were able to provide this compensation very effectively; to the extent that the hearing aid wearer could perform even better than their normal hearing counterparts for some speech-in-noise listening conditions (Powers & Beilin, 2013).

Figure 3:

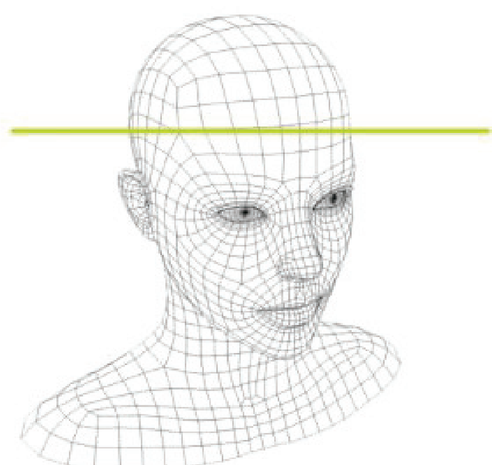


Spatial SpeechFocus offers true directionality towards whichever side speech comes from without compromising spatial and localization cues.

In early 2016, Signia launched the Primax platform. With this new platform and the power of wireless binaural data exchange, clinical studies from three leading hearing aid research centers showed a consistent trend: Primax features significantly reduced listening effort. The number of participants, speech material used, the SNRs applied to establish baseline, and the Primax features examined varied somewhat from site to site, but all sites used the same hearing instruments, objective EEG analysis, and subjective self-assessment judgments of listening effort. Research from one site revealed that speech recognition performance for hearing-impaired listeners (pure-tone average 35-60 dB) using the Primax Narrow Directionality algorithm was equal to that of normal-hearing individuals for the same speech-in-noise task. Overall, the cumulative findings affirmed the desired Primax design goal of optimizing speech understanding while simultaneously reducing listening effort (Littmann, et. al. 2017).

With the introduction of the Nx platform in 2017, Signia was able to harness "Ultra HD e2e" technology to address the "own voice issue" experienced by many hearing aid wearers. As all audiologists know, sound quality is vital for new hearing aid wearers who must adapt to hearing the world via a prosthetic device. Of course, one critical aspect of sound quality is the wearer's own voice. Audiologists often resolve own voice complaints by reducing gain, with the unintended consequence of decreasing speech intelligibility. With the Signia Nx, the "own voice problem" was minimized -because of a novel technology called Own Voice Processing (OVP™). Traditionally, the audiogram is the basis for the hearing aid fittings. With OVP, the wearer's voice is scanned by the hearing aid's microphone system. This process adds a short additional step during the fitting (Figure 4). During the acoustic scan, the wearer simply talks for a few seconds and a three-dimensional acoustic model of the wearer's head and vocal pattern is created using machine learning principles. This model is used to detect if sound originates from the wearer's mouth, or from an external source; a dedicated setting-optimized for naturalness and comfort is then applied when the wearer is talking. By separating the processing of the wearer's voice from external sounds, it is possible to simultaneously achieve comfort and audibility. The benefits of OVP have been consistently proven in several independent clinical studies including own voice quality when the wearer is talking, allowing uncompromised audibility for external sounds, enhanced localization in soft, average, and loud environments without reducing the clinically proven performance of Narrow Directionality, and extended dynamic range preserving the integrity of the amplified signal, even in very loud environments (Froehlich, et. al, 2018).

Figure 4:



During the initial fitting with Signia Nx, the effect of the wearer's individual head shape is acoustically scanned to determine the position of the wearer's mouth. This provides a highly reliable detection which is not influenced by the wearer's vocal effort, emotional state, or general voice quality.

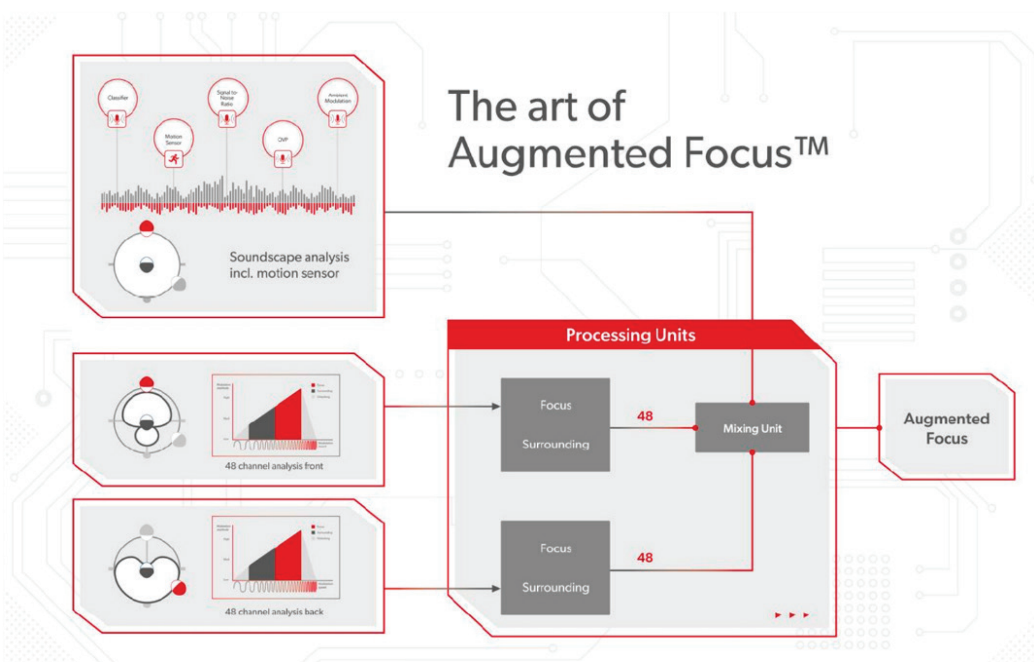
SPLIT PROCESSING

One of the most common complaints of hearing aid wearers is difficulty understanding speech in background noise (Picou, 2020). When determining how to best provide amplification to hearing aid wearers, each manufacturer designs algorithms for frequency shaping and "gain-for-speech" in the wearer's soundscape. These algorithms offer the wearer some combination of directionality, noise reduction and compression – all in an effort to optimize speech intelligibility and listening comfort, while minimizing background noise.

Each manufacturer tackles these challenges in slightly different ways by using different combinations of directional microphone arrays, processed-based (spectral) noise reduction and compression. Some manufacturers use an algorithm designed to preserve speech by using broad focus (more omni-directional) directionality. This approach is often promoted for its natural sound quality; however, it relies on the wearer's top-down auditory processing ability to extract speech in difficult listening situations. In contrast, other manufacturers use an algorithm designed to enhance speech by using narrow focus directionality to provide a better SNR in an effort to increase the gain of speech relative to extraneous noise and reverberation. This approach gives the wearer access to speech and ease of listening in noisy situations, however the overall sound quality can be negatively impacted by the heavy use of directionality and noise reduction. Each approach presents a compromise: Leveraging the wearer's ability to use top-down auditory processing is limited in unfavorable SNR conditions or if the wearer is prone to listening-related fatigue to cognitive decline. On the other hand, using narrow directionality to manage the SNRcan detrimentally affect sound quality as well as the ability to localize.

In 2021, using the latter approach described above, Signia launched the Augmented Xperience (AX) platform which leverages the unique aspects of bilateral beamforming technology to create two independent acoustic snapshots around the wearer. Each acoustic snapshot (one for the frontal hemisphere and one for the rear hemisphere) independently analyzes the wearer's soundscape and applies gain, noise reduction, and compression to the input signals in each of the two snapshots. The front focus processor highlights speech using a more linear compression strategy, effectively providing more contrast for speech coming from the front of the wearer. The rear surround processor uses curvilinear compression to preserve the natural growth of loudness for surrounding sounds to help the wearer feel more aware of their surroundings. The information from both acoustic snapshots is then combined and the signal undergoes a soundscape analysis which employs sensors for SNR, motion, noise floor and own voice detection. This processing strategy is known as split processing and has been branded by Signia as Augmented Focus.

Figure 5: Schematic of the split processing units and advanced acoustic sensors in the Signia Augmented Focus platform.



ENHANCEMENTS MADE POSSIBLE BY SPLIT PROCESSING

In addition to providing improved speech understanding in adverse SNRs, the use of split processing also enables the implementation of certain advanced features.

STREAMING SOUND QUALITY

Devices that use split processing can offer a dedicated signal path for streamed signals, effectively a third dedicated processor, which uses tailors gain and compression for streamed music. This dedicated processing path can further be customized based on the source of the input signal (audio, television streamer or made for iPhone [mFi] Handsfree devices) to optimize the frequency shaping and microphone mix for different listening scenarios.

OWN VOICE PROCESSING 2.0

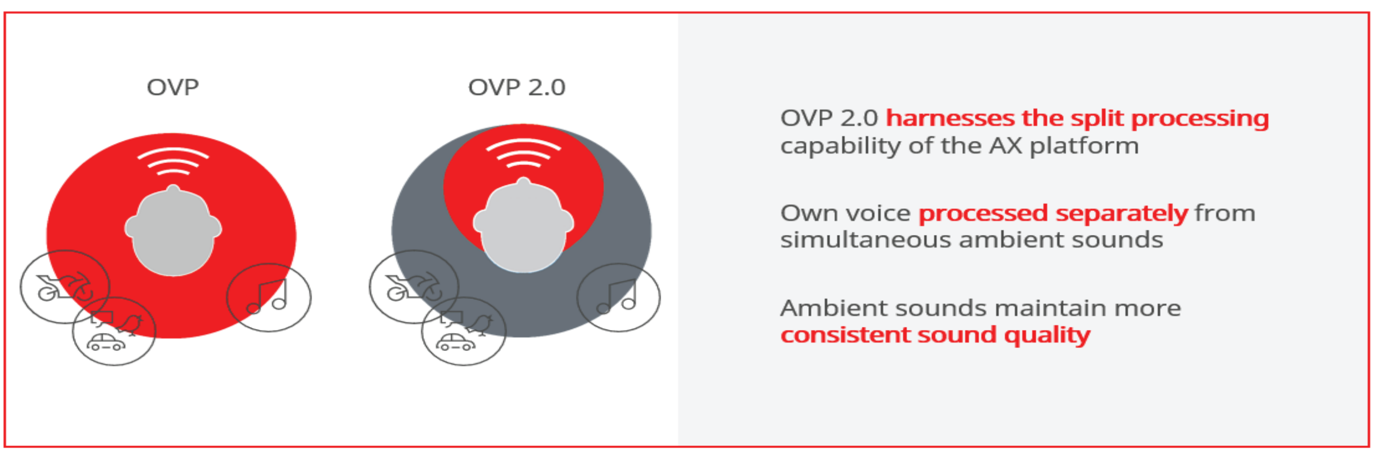
Hearing aid wearers experience their own voice through two routes. The occlusion effect, from energy building up in a closed ear canal, and amplification of the wearer's voice by the hearing aids, which is delivered into the ear canal. The result is an own voice sound quality that is sometimes too loud and uncomfortable. To adjust the fitting for these sound quality complaints, a provider could choose to increase the vent size or decrease gain, however both options compromise audibility for the wearer. This issue affects both new and experienced hearing aid wearers with 56% of experienced wearers, with an open fitting, shown to be dissatisfied with their own voice perception (Hengen, et al, 2020).

Signia introduced Own Voice Processing with the NX platform in 2017, which allowed the provider to calibrate the hearing devices for the wearer's own voice. Once this calibration is completed during the fitting process, the devices can detect the wearer's own voice and apply gain and compression settings to keep the wearer's own voice comfortable. The compression of the wearer's own voice releases rapidly, returning to programmed gain, when the wearer stops talking.

Own Voice Processing 2.0 was further improved using split processing in the Augmented Xperience platform, with the wearer's own voice processed in the front focus processor and ambient sounds processed by the surround processor. This results in consistent sound quality for environmental sounds while providing a more natural sounding own voice quality.

Own Voice Processing is supported by extensive research, showing improvement in own voice satisfaction and preference for OVP (Høydal, 2017; Froelich, et al, 2018, Jensen, et al., 2021). The benefits of Own Voice Processing extend beyond subjective improvements in sound quality. Research has also shown that 78% of participants reported increased communication with Own Voice Processing activated (Powers, et al 2018). This increase in social interaction can have a positive effect on neurological function and mental wellbeing (Friedler, et al., 2015). To further encourage increased social interaction, hearing aid wearers can access "My Conversations" within the Signia smartphone app which looks at how often and how long

Figure 6: Benefits of split processing in Own Voice Processing 2.0



Own Voice Processing is activated, rating the wearer's conversation frequency on a scale of Low, Medium, High, or Very High. This provides a tangible end-user benefit to encourage hearing aid use and social interaction.

REAL TIME CONVERSATION ENHANCEMENT WITH MULTI-STREAM ARCHITECTURE

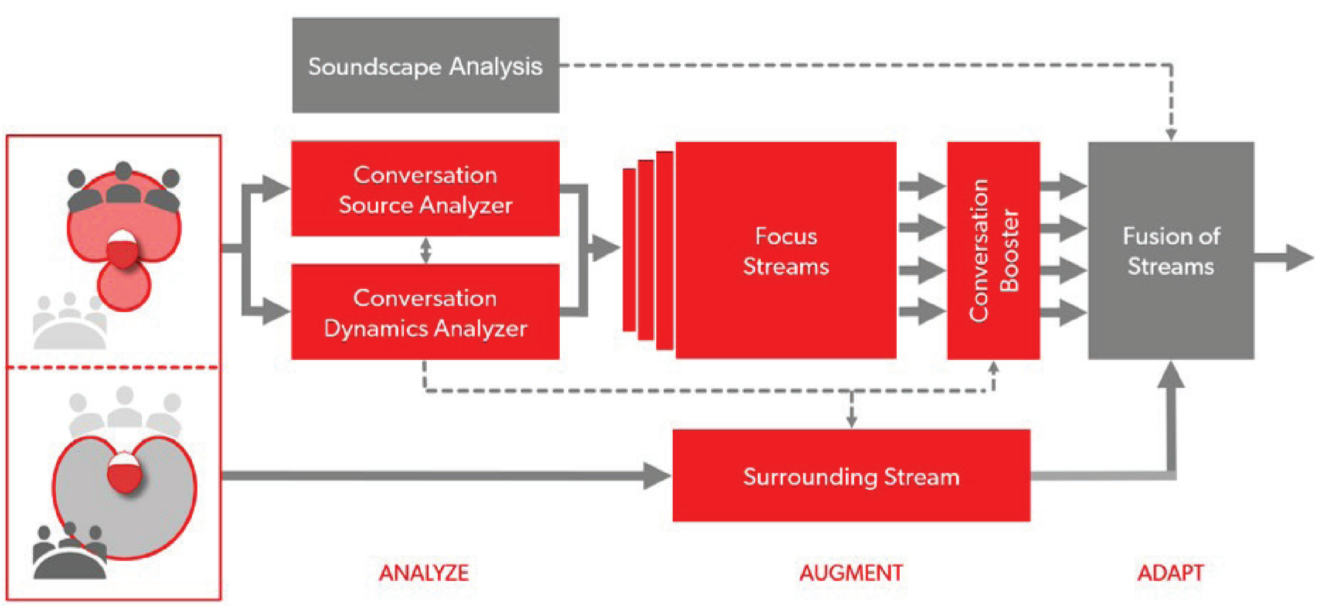
Picou (2022) reports that "conversations with large groups" and "following conversations in the presence of noise" continue to show low percentages of satisfied hearing aid owners. Both situations are difficult because dynamic conversation with multiple conversation partners cannot be isolated to a specific directional polar plot or acoustic snapshot. As people change positions or the hearing aid wearer moves their head, speech becomes harder to follow. Add in any significant background noise and the hearing aid wearer may become frustrated and withdraw from the conversation altogether.

Nicoras et al. (2022) identified several factors related to conversational success, such as "being able to listen easily", "being engaged and accepted", and "perceiving flowing and balanced interaction". These findings indicate that conversation is a dynamic, free-flowing and multifaceted activity. Hearing aid wearers want to be able to hear and contribute actively to group conversations, even when they cannot turn to look at the person who is speaking.

Hearing aids are now being designed to leverage these unique aspects of group conversations. One example of this is the Signia Integrated Xperience platform, which was launched in 2023. The IX platform uses an advanced analysis of the conversational layout of the wearer, called Real Time Conversation Enhancement (RTCE). This analysis is used to pinpoint and enhance multiple speakers in real-time using a three-stage process the attempts to identify speech and increase the gain of it once it has been identified.

Instead of dividing the wearers soundscape into a front and rear hemisphere, where each is processed independently, IX can divide the frontal hemisphere into three acoustic snapshots in addition to one rear snapshot. Speech is identified and gain is increased when speech is present in each of the four acoustic snapshots. This processing strategy represents a novel application of minimal-variance, distortion-less array microphones – technology that all manufacturers use, but that each implement differently. Signia is one of three manufacturers who implement it as part of a second order array, bilateral beamforming system.

Figure 7: Schematic of the Integrated Xperience platform processing with MultiStream architecture and RealTime Conversation Enhancement.



Both benchtop and behavioral studies have been conducted with Signia Integrated Xperience with RealTime Conversation Enhancement to measure the patient benefit of this new processing strategy.

Jensen et al. (2023b) was able to compare the conversational signal-to-noise ratio benefits of Signia IX with RTCE to four premium receiver in canal (RIC) competitor devices using a Kemar mannequin and a simulated conversation scenario with two conversation partners in background noise. In this study, Signia IX with RTCE showed an overall output SNR of 11.8 dB, which was a 4.1 dB improvement over the next closest competitor device. It was also noted that there were benefits for speech coming from the front and the side of the wearer. This SNR improvement for speakers outside of the traditional directional polar plot allows wearers to participate in conversations without always facing the conversation partner.

Jensen et al. (2023a) were also able to conduct a behavioral study which supported the benefits of Signia IX with RTCE. Speech in noise testing was completed using the German Matrix test, the standard Oldenburger Statztest (OLSA; Wagener et al., 1999) and a modified OLSA, which was designed to simulate a realistic group conversation, with multiple speakers in front of the wearer and multiple noise sources behind the wearer. With RealTime Conversation Enhancement turned on, 95% of participants performed better in the modified OLSA test, suggesting that this feature can provide a clear benefit to wearers in group conversations.

As hearing aid technologies evolve, it is important to improve the wearer's ability to participate in dynamic, spontaneous group conversations that keep them connected to the people that matter most. Advancements in wireless binaural technologies have been clinically proven to provide significant benefits to hearing aid wearers. Given that wearer satisfaction has improved more than 25 percentage points over a 20-year span suggests that all hearing aid manufacturers have effectively implemented innovations like near-field magnetic induction wireless technology.

As hearing aid technologies evolve, it is important to improve the wearer's ability to participate in dynamic, spontaneous group conversations that keep them connected to the people that matter most.

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Navid Taghvaei, Au.D. *and* ***Sonie Harris, Au.D.*** *are both Senior Education Specialists for Signia.* ■

CASE STUDY

INTRAOPERATIVE MONITORING Business Plan

Veronica Lane & Ally Seehafer

Intraoperative monitoring (IOM) is performed during surgery to assess a patient's auditory system by testing the nervous system, using evoked potentials to monitor the integrity of the auditory nerve. IOM has been a part of the scope of practice of audiologists for several years. However, few audiologists are actively involved in IOM. Here we present a case study of how an IOM practice could be started and achieve profitability within three years.

DISCUSSION POINT:

Peppered throughout this case study, readers will see these *Discussion Points* boxes. They are designed to spur critical thinking about how the projected figures could change and what those changes would do to annual operating costs, revenue and profit.

In this case study note there are several economic advantages of an IOM practice, including the following:

1. Low overhead. Because an IOM business focuses on operating room procedures, there is no cost associated with maintaining a brick-and-mortar clinic. However, in some IOM businesses the owners might be expected to pay fees associated with using the hospital.
2. Marketing costs are relatively low and typically decrease over time. Because the service is provided to a finite number of surgical teams, located in specific places, once a clientele is established, there is little reason to maintain a large marketing budget.
3. Equipment costs are not astronomically high. Unlike a conventional private practice that needs a booth, audiometer, immittance bridge and probe mic system, there is one large equipment investment: an ABR unit. In some cases, the hospital may have one that can be used, reducing this cost even more.
4. Reimbursement rates are consistent, and the reimbursement process is relatively simple. There are just a handful of codes that are routinely used and reimbursement rates from both Medicare and other third-party administrators have been consistent over many years.
5. The work is steady and rewarding. Audiologists involved in IOM typically work during surgical hours, which are very early in the morning until early afternoon, Monday through Friday, and rarely on weekends. Because IOM audiologists are part of a surgical team, they are at the forefront of many life-altering events, which can lead to a fulfilling career.

While all audiologists might find this case study informative, it is especially geared toward professors and students who are engaged in Audiology Practice Management coursework. Those readers should pay particular attention to how the case study business plan is organized as well as the financial projections and how they may differ in various ways.

Elevator Pitch

We are a team of IOM audiologists who travel throughout hospitals in Illinois, mostly throughout the Chicago area, to serve cochlear implant and acoustic neuroma/facial nerve patients who are receiving surgery. IOM requires precise skills and there is currently a lack of audiologists that solely specialize in this delicate, yet important practice, which can offer peace of mind to patients and surgeons. The presence of IOM specialists has been shown to improve the accuracy and speed of the surgery (Charalampidis, et al 2020).

The Team

We are two licensed audiologists certified by the American Audiology Board of Intraoperative Monitoring (AABIOM) (AABIOM, 2020). We have a combined 20 years of experience in medical audiology. We went through extensive supervised experiences and passed our board certification for intraoperative monitoring. Our team will also include a part-time employee (.5 FTE) to help us schedule appointments and implement marketing strategies. We will hire a tax consultant/accountant for tax season annually to assist us with our finances. By the end of year four, we plan to hire an additional AABIOM certified audiologist in Iowa to expand our business further into the Midwest.

Market Summary

This business will perform intraoperative monitoring services for two types of survey: cochlear implants and acoustic neuromas. Further, any other surgery involving preservation of the Facial nerve deemed necessary by the local hospital's surgical staff will be part of our IOM scope of practice.

This business markets itself to the eight major hospitals of the Chicago, Illinois area (American Cochlear Implant Alliance, n.d.). These hospitals perform many of the state's otolaryngology surgical procedures. The greater Chicago area is a medical destination for the entire state of Illinois as well as some of the surrounding states due to the high prevalence of outstanding medical facilities. Lurie Children's is one of the largest cochlear implant centers for pediatrics and Loyola Medicine is the highest volume center for cochlear implants in the Midwest. Collectively, all eight hospitals report doing hundreds of cochlear implant surgeries since 1991, which demonstrates there is a sizeable market to support this business. Additionally, we believe cochlear implant surgeries, especially in the adult population, are poised to grow because of technological advancements and the recent expanded candidacy requirements, known as the 60-60 criteria (Zwolen et al 2022). These expanded criteria are increasing awareness in and beyond the audiology community of cochlear implant effectiveness for adults with moderately severe to profound hearing loss, who are struggling with traditional hearing aids.

According to the local head surgeons we have spoken to at the local hospitals, the national average for acoustic neuromas (combined with other similar types of neoplasms) on an annual basis is 25 surgeries per site, each lasting an average of five hours. With the increase in access to imaging procedures by patients, and the increased technology for surgical procedures, it has become more commonplace to perform these surgeries as needed. The business will primarily market to hospitals that perform these surgeries and that can significantly improve safety and accuracy with the presence of IOM. Globally, IOM is on the rise and is expected to grow over the coming years (GlobeNewswire, 2023)

Competitive Landscape & Advantage

The state of Illinois does not have any certified AABIOM audiologists. The current strategy for IOM in the state of Illinois is to have medical doctors, who have been trained in neurology, assist in these surgeries. Our business allows medical doctors to focus on their own patients and schedules, especially as many of these professionals do not have a background in otolaryngology specialties. We differentiate ourselves from other IOM services as we are experts in audiology/otology IOM procedures and offer in-person, academically trained specialists instead of in-person techs and virtual specialists. This allows for direct and immediate communication between our audiologists and the surgeons. Being the only certified AABIOM audiologists in the state of Illinois offers us an advantage to set up strong relationships between ourselves and hospitals and surgeons. The process of becoming a certified AABIOM audiologist requires two to three years of additional training and experience, creating a limited field within audiology. In addition, the vast majority of AABIOM certified audiologists work for companies like our own, as it is rare to be hired by a hospital for full time intraoperative monitoring by an audiologist. This shows our competitive advantage in the field and how our competitive advantage will last for at least several years, if not longer.

Financial Goals

We plan to be profitable by the end of Year 2. We believe that to be profitable, we need to conduct 200 intraoperative procedures per year. Generally, we plan to divide the work evenly between the two audiologists, thus conducting 100 appointments per audiologist per year. Given the ramp up time, Year 1 will be below 200 appointments per year.

We will not have office space, greatly reducing projected annual operating costs. Also, as we are only advertising to the eight hospitals that offer these surgeries in the Chicago area, our marketing costs will be low. Our part-time employee will work from home to schedule appointments with hospitals, perform billing and coding functions, and support marketing efforts. Since the audiologists will not be spending 40 hours/week on appointments, they will also assist in marketing the business.

In Year 4, we plan on hiring another IOM audiologist who will conduct IOM appointments in Iowa which will increase our revenue and our reach further into the Midwest. We also plan on increasing the number of appointments all three audiologists will have to further increase profits. This will be achievable since we will have established ourselves in the Chicago community and will have shown our value and necessity during surgeries.

	Year 1	Year 2	Year 3
Revenue	$194,280	$310,920	$333,840
Operating Costs	$245,000	$264,500	$272,000
Profit	-$50,720	$46,420	$61,840

Figure 1. Estimated gross revenue, total operating costs and net profit over a 3-year period.

Go-To-Market Strategy

This business is being exclusively marketed to hospitals where a high volume of head and neck surgeries are conducted. Due to this, marketing strategies will differ from typical private practice and hearing aid marketing strategies. We will focus on marketing to hospital administrators and surgeons using presentations and informational flyers and emails. For our presentations, we will combine them with a catered lunch.

DISCUSSION POINT:

While reading the Go-to-Market Strategy, what are other marketing tactics that could be used? What would be their projected costs?

These presentations will help us introduce ourselves, discuss our business, and present our necessity in appointments. We will discuss our certification and how we are the only AABIOM certified audiologists in the state, which shows our expertise and understanding of the patients. We will also regularly send informational flyers/emails to administrators and surgeons to show them our benefit during appointments. Since we are marketing to eight hospitals, we will cater our marketing to fit the mission statements and practices of each individual hospital. All these hospitals promote high levels of patient care, which aligns with our values. We will also discuss how we will meet all our patients prior to the surgery to talk about our role and answer any questions they may have. Our priority is emphasizing how we are clinicians that offer peace of mind for patients undergoing surgeries of all risk levels.

Another integral part of our marketing strategy will be increasing awareness within the audiology community and the general public about the value of cochlear implants in adults, with severe-to-profound hearing loss who currently wear hearing aids. We believe there is a lack of awareness among audiologists about the relatively new 60-60 CI guidelines. Therefore, we will use part of our marketing budget to host one or two local seminars for audiologists to raise their awareness on the 60-60 criteria. We believe by educating audiologists, this will lead eventually to more CI business for us in later years.

We expect 200 appointments completed during Year 2, which aligns with a typical acoustic neuroma/facial nerve and cochlear implant caseload for eight hospitals. The number of appointments completed will increase after the first year as we further establish our relationships with the hospitals.

The major benefit of having us conduct intraoperative monitoring during appointments is that we can provide input on how the auditory system is being impacted while the surgery is being done. If something happens during the appointment, such as the surgeon clamping the auditory nerve, that will show up on our auditory brainstem response testing and we could alert the surgeon of the issue so that the risk of long-term effects decrease. Our services offer more peace of mind and security for these patients and their loved ones as they are undergoing surgery.

Pricing Structure

(How We Will Bill for Our Services)

We will bill according to the 95940 CPT code which bills in 15 minutes increments. Both Medicaid and private third-party insurance plans reimburse for the surgical procedures in which this CPT code applies. These Illinois hospitals (and Iowa in years 4 and 5) are not heavily impacted by Medicare reimbursement rates, at least within the next three years. However, this region is not devoid of all Medicare services. Therefore, we estimate that 25% of our appointments will be with Medicare rates and 75% of our appointments will be with insurance or private pay rates. The Medicare rate is $33 per every 15 minutes, or $132 per hour. The insurance rate is an estimated $75 per every 15 minutes, or $300 per hour. Acoustic neuroma/facial nerve surgeries, on average, take five hours and cochlear implant surgeries, on average, take two hours. Thus, our IOM time corresponds with these: five billable hours for facial nerve monitoring procedures and two billable hours for IOM monitoring for cochlear implant procedures.

DISCUSSION POINT:

The projected reimbursement rates here could be quite different in other areas of the country. Additionally, the 25%/75% mix of insurance type could vary as well. How would a 50-50 mix of these insurance plans change the revenue and profit projections?

Financial Roadmap

To start our business, we are asking for a $75,000 small business loan from the state of Illinois. This is a special loan granted by the state to qualifying women who want to start a business. A stipulation of this loan is that if it is repaid in full within three years, there is zero interest. Next, we model the annual revenue and expenses we estimate for the first three years of our business to show how we plan to break even and repay this loan by the end of Year 3.

Projected Profit for Year 1:

In year 1, we are expected to lose money as our business gains traction. Our projected loss: -**50,720**

	Estimated # of IO procedures	Estimated Reimbursement from Medicare	Estimated Reimbursement from third party (non-Medicare) payer
Acoustic Neuroma/ Facial Nerve Surgery (avg time = 5 hours)	150	50 @$132/hour = $33,000	100 @$300/hour = $150,000
Cochlear Implant (avg time = 2 hours)	30	20 @$132/hour = $5,280	10@$300/hour = $6000
Total Gross Revenue Year 1			**$194,280**

Table 1. Projected Revenue, Year 1

DISCUSSION POINT:

How would the projected gross revenue at the end of Year 1 change if 150 hours was devoted to cochlear implants and 30 hours were devoted to acoustic neuroma/ facial nerve surgery? How would the projected revenue change if non-Medicare billable hours were 70 and Medicare billable hours were 110?

Expenses Year 1	**Salary + Benefits**
Audiologist 1	$90,000
Audiologist 2	$90,000
Part Time Assistant	$15,000
Accountant (contracted work)	$3,000
Total Costs of Labor	**$198,000**
Equipment	**Start-up Costs**
ABR unit	$20,000
Fax machine + service plans	$1,000
2 Smartphones + service plans	$1,000
	Other costs
Marketing	$18,000
Hospital Credentialing	$2,000
Loan Repayment	$5,000
Total Expenses for Year 1	**$245,000**

Table 2. Projected costs, some of which are associated with initial start-up.

DISCUSSION POINTS:

A $15,000 wage might be too low. Keeping it at $15k could mean working too few hours which limits how much revenue the business can generate. How might doubling the assistant wage/salary help the business generate more revenue?

A $1,000 value might be too low. It is possible that the owners got an incredible deal on phone plans? What happens to operating expenses if this number is tripled?

What other operating expenses might be missing in Table 2? That list includes fleet costs, attorney fees, malpractice insurance. These costs could add an additional $5,000 to these projected costs.

Projected Profit for Year 2:

In year 2, we expect to make a profit of **$46,420.** We plan to reinvest this profit back into the business by purchasing another ABR unit.

	Estimated # of IO procedures	Estimated Reimbursement from Medicare	Estimated Reimbursement from third party (non-Medicare) payer
Acoustic Neuroma/ Facial Nerve Surgery (avg time = 5 hours)	250	100 @$132/hour = $66,000	150 @$300/hour = $225,000
Cochlear Implant (avg time = 2 hours)	50	30 @$132/hour = $7920	20@$300/hour = $12,000
Total Gross Revenue Year 2			**$310,920**

Table 3. Projected revenue for Year 2

Expenses Year 2	Salary + Benefits
Audiologist 1	$90,000
Audiologist 2	$90,000
Part Time Assistant	$15,000
Accountant (contracted work)	$3,000
Total Costs of Labor	**$198,000**
Equipment	**Maintenance**
ABR unit	$5,000
Fax machine + service plans	$500
2 Smartphones + service plans	$1,000
	Other costs
Hospital Credentialing	$2,000
Marketing	$8,000
Loan Repayment	$50,000
Total Expenses for Year 2	**$264,500**

Table 4. Projected Expenses for Year 2

DISCUSSION POINT:

As this business gains traction, it is likely that the assistant will need to work more hours, thus driving up this projected cost by at least $10,000. How would doubling the part-time assistant's wage/salary, effect the projected operating costs and profit? What other ways could the owners keep this cost from increasing?

DISCUSSION POINT:

The adage, "the devil is in the details" holds true as readers carefully sift through these financial projections. Keep in mind, these are projections based on imperfect information. How might your projections differ from the ones in this business plan? How might increases in costs effect annual profit projections?

Projected profit at the end of Year 3: $61,840

Revenue Year 3	Estimated # of IO procedures	Estimated Reimbursement from Medicare	Estimated Reimbursement from third party (non-Medicare) payer
Acoustic Neuroma/ Facial Nerve Surgery (avg time = 5 hours)	270	110 @$132/hour = $72,600	160 @$300/hour = $240,000
Cochlear Implant (avg time = 2 hours)	55	35 @$132/hour = $9240	20@$300/hour = $12,000
Total Gross Revenue Year 3			**$333,840**

Table 5. Projected gross revenue for Year 3

Expenses Year 3	Salary + Benefits
Audiologist 1	$95,000
Audiologist 2	$95,000
Part Time Assistant	$20,000
Accountant (contracted work)	$3,000
Total Costs of Labor	**$213,000**
Equipment	
New ABR unit	$20,000
ABR unit	$5,000 (maintenance)
Fax machine + service plans	$1,000
2 Smartphones + service plans	$1,000
	Other costs
Hospital Credentialing	$2,000
Marketing	$10,000
Loan Repayment	$20,000
Total Expenses for Year 3	**$272,000**

Table 6. Projected expenses for Year 3.

DISCUSSION POINT:

It is possible that these projected costs are too low. To maintain the projected profit at the end of Years 2 and 3, the loan repayment could be lowered, thus extended the terms (years need to repay it). Another option would be to maintain these loan terms and cut substantially into projected profit.

Financial Roadmap Highlights

Over the course of the first three years, we project incremental growth of our business. This is a deliberate strategy, as we plan to share one portable ABR unit between 2 audiologists. Having one unit will reduce operating costs but will force us to be highly efficient in our scheduling, as both IOM audiologists cannot be working at the same time. To improve efficiencies, we will hire a part-time administrative assistant who will plan our schedules. Over the course of the first three years, the IOM audiologists (Ally and Veronica) are job sharing, as only one will be actively monitoring at any given time.

Because we have kept expenses down, we plan to make a profit in Years 2 and 3. This enables us to do these important things at the end of Year 3:

1. Repay our $75,000 loan.
2. Buy a second ABR unit that enables us in subsequent years to be more efficient.
3. Expand our business into Iowa by hiring another audiologist.

DISCUSSION POINT:

Realism counts! Are these Year 2 and Year 3 projections too rosy? What would you do if the business was still losing money and not profitable at the end of Year 3? Would you want to expand this business? If so, what is the downside to expansion?

Risk Analysis

One significant risk is that we won't be able to have a steady flow of appointments since we are being outsourced to various hospitals. Having a higher marketing budget in year one and focusing on a small number of hospitals will help us be able to focus on building a strong reputation with these hospitals and showing surgeons our value during surgeries. Roughly beyond year three, we could have competition as there is a possibility that other audiologists become AABIOM certified within the state. However, we will have built a reputation and relationship with the hospitals which will offer us a competitive advantage.

Summary

We are a team of IOM audiologists in Illinois who provide IOM services for cochlear implant and acoustic neuroma/facial nerve surgeries. As the only AABIOM certified audiologists in the state of Illinois, we strive to provide high quality services to patients and collaborative care for surgeons during complex operations. IOM services are on the rise as patients and surgeons desire improved safety and technology, and a reduction in risks during surgeries. We expect a gradual increase in profit within Years 2 and 3, with a net profit at the end of Year 3 of about $60,000. Since our services are in high demand, we plan on growing our business to expand further into the Midwest, improving our reach and our profits.

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***Veronica Lane & Ally Seehafer** are students in the University of Wisconsin Audiology Consortium, a program offered jointly by the UW–Madison Department of Communication Sciences and Disorders and the UW–Stevens Point School of Communicative Disorders.* ■

Bluetooth Technology Update

For Audiologists

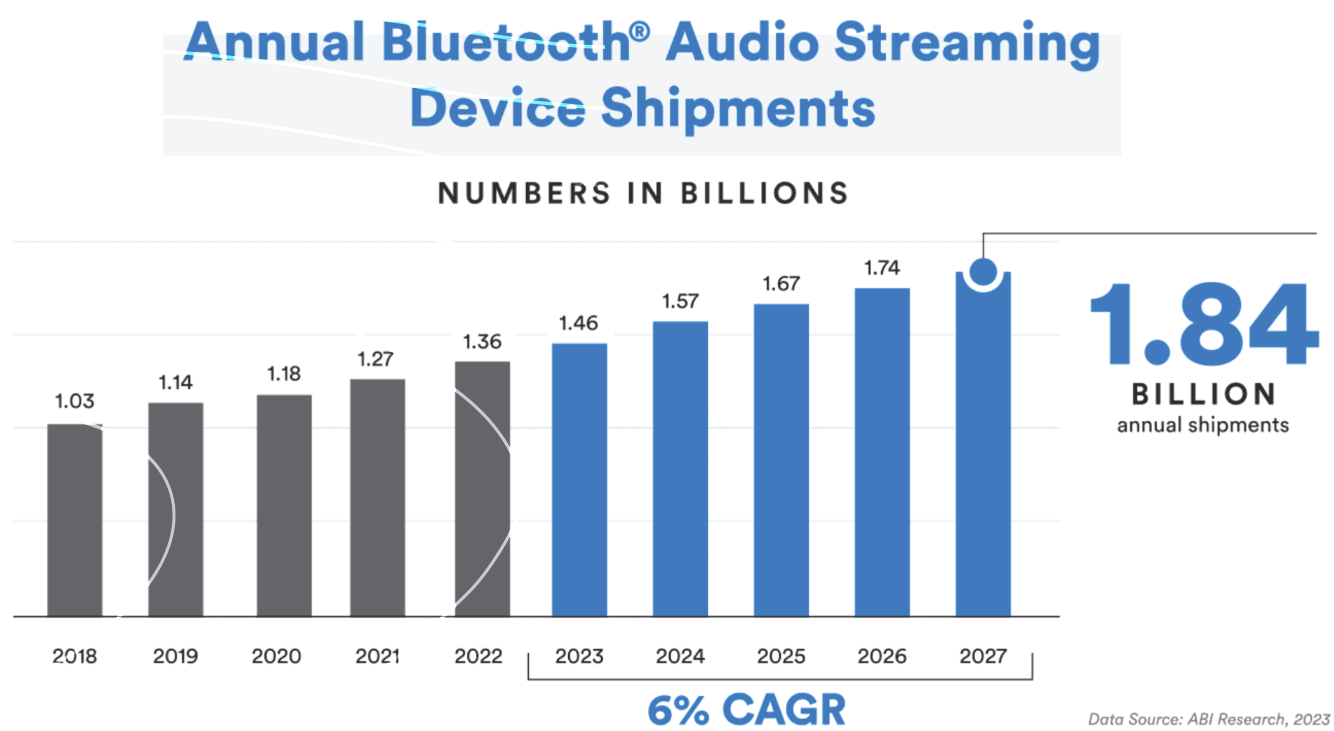
Brian Taylor, Au.D.

Wireless technology, from telecoils to FM systems has been a part of hearing aid dispensing practices for generations. About 20 years ago, with much fanfare, Bluetooth® technology was introduced into hearing aids. Cumbersome and clumsy, the original Bluetooth® wireless streaming system in hearing aids required the use of a separate transmitter worn around the patient's neck.

Starting around 2014, wireless technology in hearing aids changed with the advent of direct Bluetooth® streaming. Today, ten years later, most prescription hearing aids and even a handful of over-the-counter hearing aids, come standard with some type of wireless Bluetooth® streaming capability built directly into them. The purpose of this brief infographic is to highlight the recent Bluetooth® advances around LE Audio and Auracast and what they mean for clinicians.

Let's start with the basics. Bluetooth® is the name of the standardization that covers a wide range of different use types of wireless transmission. Bluetooth® relies on short-range radio frequency, and any device that incorporates the technology can communicate with other Bluetooth-enabled devices as long as they are within the required distance of each other, which is about 30 feet.

It is also important to know that Bluetooth technology is governed by a special interest group called Bluetooth® Special Interest Group (SIG). The Bluetooth® SIG has been working closely with hearing aid manufacturers for more than a decade to bring a universal, wireless hearing aid standard to market. Before we discuss these new standards, let's next examine, more broadly, how Bluetooth® technology works with hearing aids.



Currently the hearing industry has implemented four wireless protocols, all of which are used for both data & audio transmission. An example of data transmission between hearing aids is when one device, say in the left hearing aid, has its digital noise reduction activated which, in turn, automatically activates digital noise reduction in the right hearing aid. In contrast, audio transmission occurs when the amplified sound in one hearing aid is transmitted or shared with the other hearing aid. The prime example of audio transmission is bilateral beamforming in which the two microphones in each hearing aid share or exchange information with each other.

The four wireless protocols are Bluetooth Classic, Apple's Made for iPhone (MFi), Google's Audio Streaming for Hearing Aids (ASHA), and the new Bluetooth Low Energy Audio. Hearing aids and other Bluetooth enabled devices often utilize more than one of these protocols to maximize the advantages while minimizing any disadvantages. Table 1 below shows the various advantages & disadvantages of each wireless protocol.

Table 1. A summary of the advantages and limitations of current wireless technology used in hearing aids.

CLASSIC Bluetooth SIG protocol	Low Energy Audio Bluetooth SIG protocol	MFi Apple proprietary protocol	ASHA Google proprietary protocol
▲ Widely used for audio streaming & headsets ▲ Streams to all Bluetooth devices – MFA ▲ Supports data transfer over long range ▼ High energy consumption (not ideal for small devices) ▼ High latency ▲ High market penetration	▲ Low energy consumption ▲ Direct Audio streaming HA + phone ▲ Improved stability ▲ Great audio quality ▲ Supports broadcast mode ▼ Cannot penetrate H20: unable to use for e2e / MI ▼ Not yet fully developed / available in market ▼ Initial low market penetration due to implementation into mobile phones & electronics	▼▲ Direct phone & audio streaming for Apple devices ▲ Headset mode available	▼▲ Direct phone call streaming for Android phones ▼ Headset mode not available

In 2023, after more than 10 years of collaborative efforts, hearing aid manufacturers and the Bluetooth® SIG unveiled a new generation of Bluetooth®, one that will eventually benefit the lives of millions of hearing aid wearers and their communication partners. Audiologists and persons with hearing loss can look forward to two major breakthroughs in this new generation of Bluetooth wireless transmission: Auracast and LE Audio. Next, we examine the key differences between these two wireless Bluetooth technologies.

LE Audio

Bluetooth® Low Energy (LE) Audio streams audio signals directly between smartphones and hearing aids with excellent stability, audio quality, and low energy consumption. Starting in 2024, when a person acquires an updated smartphone, there is a good chance it will have LE Audio built in. This means hearing aids with LE Audio capability will make direct Bluetooth® streaming simpler, and with improved sound quality, than it is today. Experts believe it will take about five years to see a significant uptake in smartphones that come standard with LE Audio, but that transfer is taking place today, albeit slowly.

Auracast™

Figure 1. The three components of Auracast™ broadcasting.

AURACAST

Auracast™ requires a specific 3-part infrastructure.

Auracast Transmitter: TV, laptop, tablet. PA system

Auracast Assistant: BLE Audio compatible smart phone or smart watch

Auracast Receivers: headphones or hearing aids

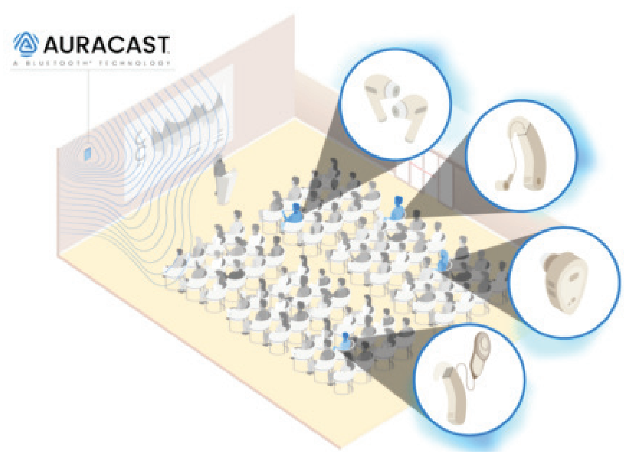
An added bonus is that the Bluetooth® LE Audio protocol can support a broadcast mode, which is called Auracast™. Although Bluetooth® LE Audio and Auracast™ protocols are linked together, the technical hardware requirements are not the same. You can have a device that has Bluetooth® LE Audio but does not have Auracast™ capabilities. Figure 1 is a summary of the various components of Auracast.™

Auracast™ is capable of broadcasting streaming audio from one device (TV/laptop) to multiple devices (earbuds + hearing aids) enabling the audio signal to be broadcasted to many users simultaneously. The way Auracast™ works is akin to how public Wi-Fi connects with your smartphone today. When you walk into, say, an airport or restaurant, your smartphone is prompted to open the Wi-Fi on your smartphone. Once you see the prompt for the local Wi-Fi, you usually next enter a password and begin using the internet connection. Essentially, the same sequence of events occurs with Auracast™ broadcasting. If your smartphone is Auracast™-enabled LE Audio, with a password, you will have the ability to wirelessly connect to any Auracast™ transmitter.

The primary use case for Auracast™ is predicted to be for spaces where public address (PA) systems and hearing loops systems currently exist. Additional use cases of Auracast™ are anticipated to be silent TVs as seen in airports, restaurants, and other public spaces where multiple end users can stream the audio from that television to their own personal devices as well as one-to-one assistive listening at public service counters or reception desks. The latter use case is an example of "shared audio" in which one person can share the audio from their laptop or smartphone with another person's earbuds or hearing aids.

How Auracast™ Broadcast Audio Works

With Auracast™ broadcast audio, an unlimited number of in-range Auracast™ receivers will be able to join an Auracast™ broadcast from a nearby Auracast™ transmitter.



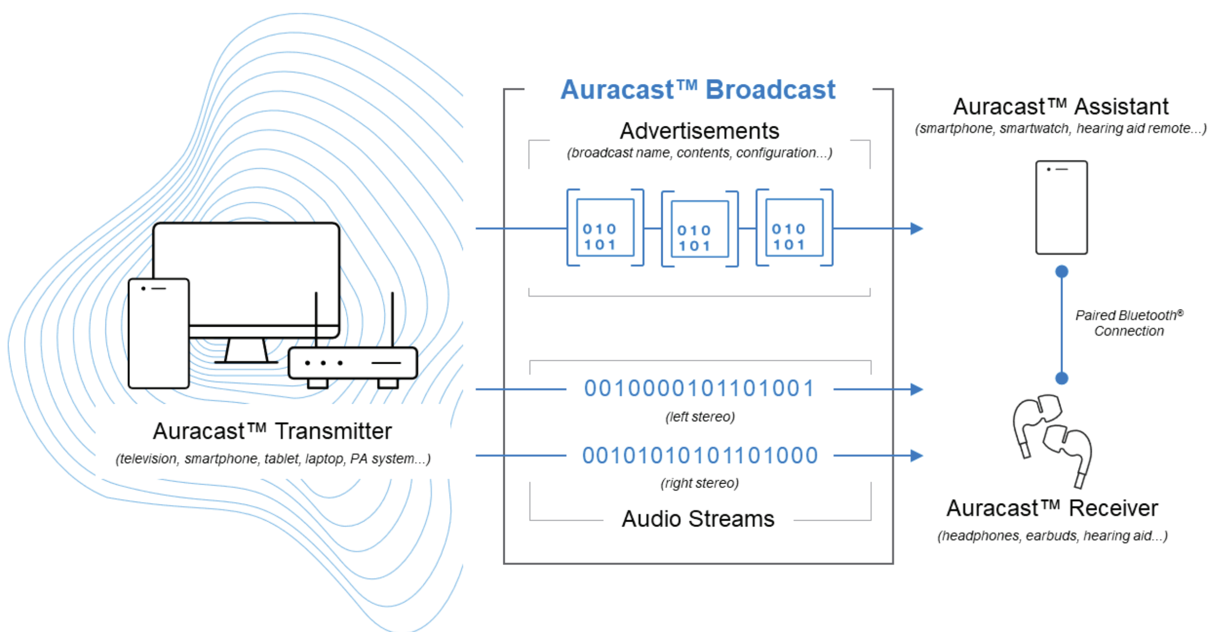
Connecting to an Auracast™ broadcast audio stream is not the same as a standard pairing between two Bluetooth® devices. With an Auracast™ broadcast audio stream, a transmitter advertises the availability and information details of the stream. Any Auracast™ receiver or assistant can listen for that broadcast and join based on the user's request. At the heart of a broadcast, the transmitter does not know what types or how many devices are listening to the Auracast™ broadcast audio stream. This allows for one transmitter to broadcast to an unlimited number of receivers within range. Some broadcasts may be encrypted and require additional input by the user, depending on the implementation.

A smartphone is not required to listen to an Auracast™ broadcast audio stream. This of course is one of the significant benefits of Auracast™ for hearing aid wearers. Once joined, the receiver listens to a direct audio stream from the transmitter. The smartphone is not involved in the listening process. That said, there are two common methods for finding and joining an Auracast™ broadcast audio stream – with and without an assistant (e.g., smartphone or smartwatch).

Joining With an Assistant

In either instance, it starts with a transmitter advertising the availability of an Auracast™ broadcast audio stream. With an assistant, such as a smartphone, the assistant scans for available broadcasts, providing an interface for the user to choose which broadcast to join. Once the broadcast is selected by the user, the assistant directs the receiver to join that broadcast directly. The assistant (smartphone) is then no longer involved in the listening transaction. This method is similar to the method used for discovering a Wi-Fi access point and will likely be the most common method for used to find and join broadcast streams in public spaces. Figure 2 below is a schematic showing how joining with an assistant works.

Figure 2. Joining with an assistant

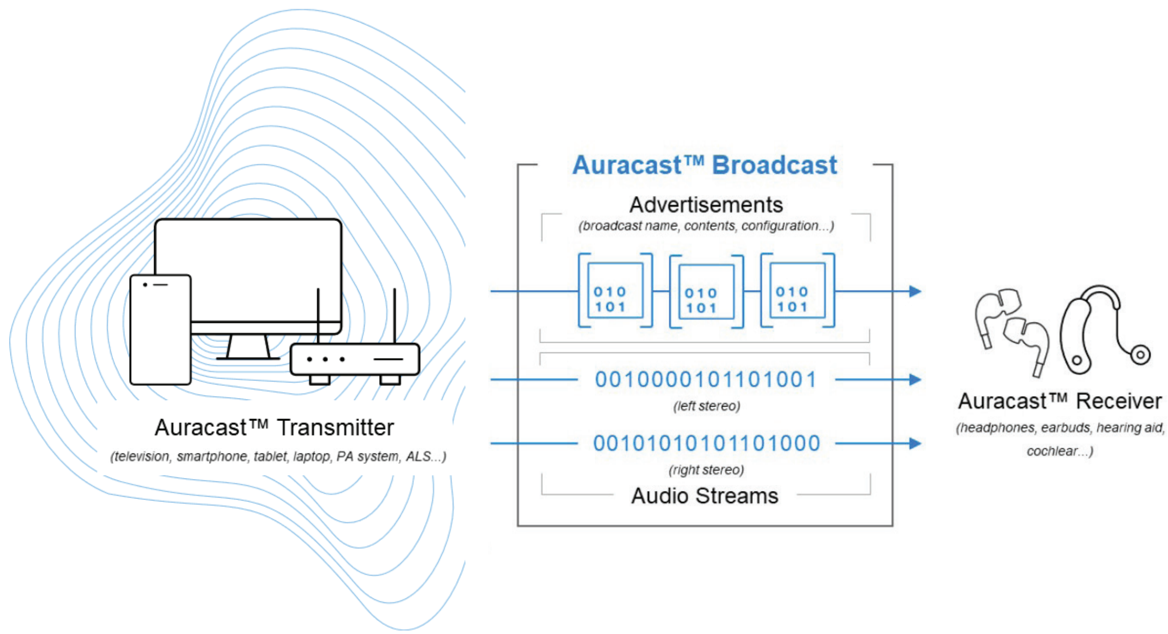


Source: https://www.bluetooth.com/auracast/how-it-works/

Joining Without an Assistant

Without an assistant, the process for finding and joining a broadcast stream is similar. The difference is the receiver, which is built into the hearing aids, scans for an available broadcast and provides the mechanism on the device (button, switch, etc.) to join the broadcast stream. This method, shown in Figure 4, may not be ideal for devices that are size or resource constrained or when multiple streams are available.

Figure 3. Joining without an assistant



Source: https://www.bluetooth.com/auracast/how-it-works/

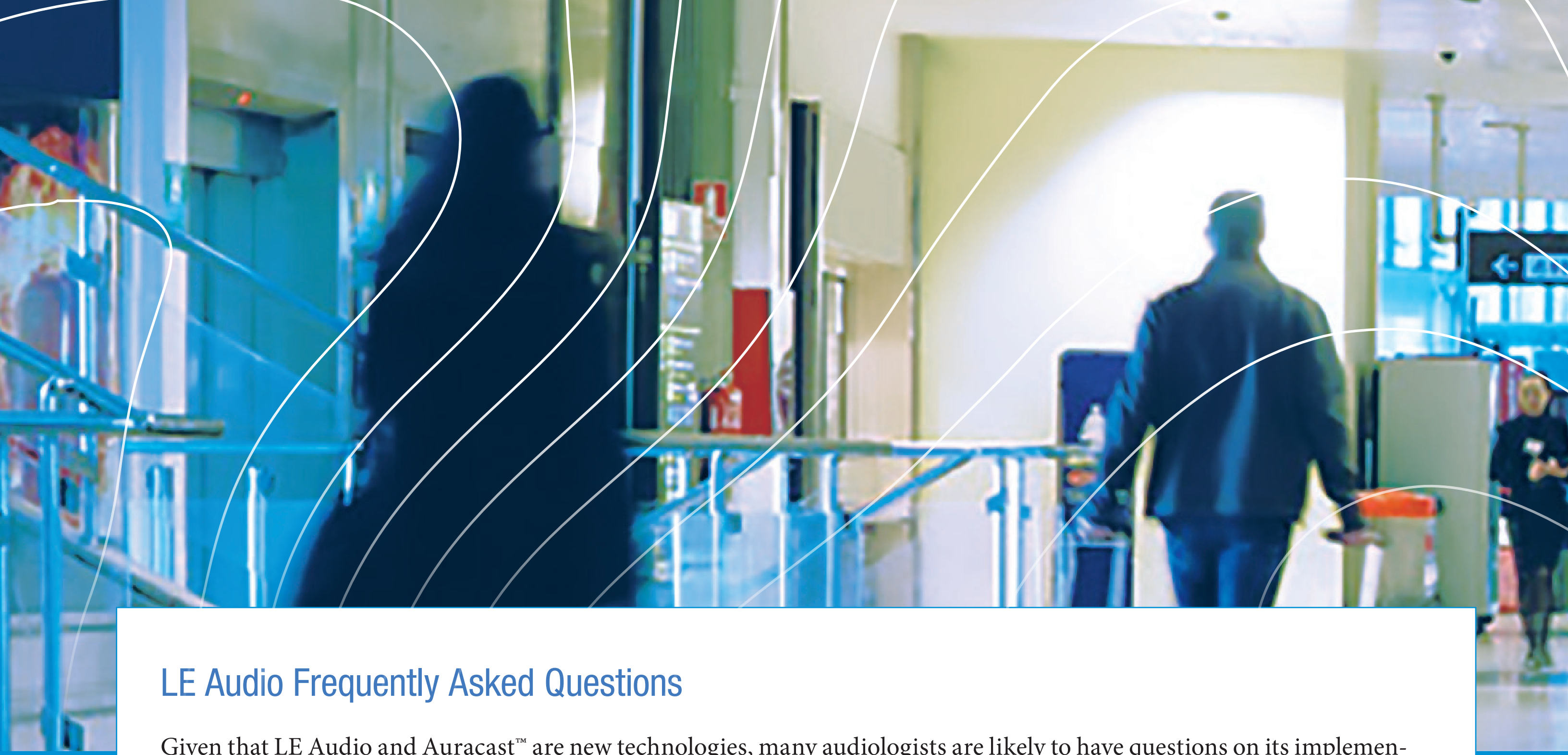
Deployment of Auracast™ has just begun and is still in its infancy, with ongoing discussions in the standardization group about the user interface and optimal setup. Auracast™ needs time to penetrate the market due to the required 3-part infrastructure of a transmitter (TV/laptop), BLE Audio compatible smartphone, and BLE Audio receivers (hearing aids/headphones), as outlined in Figure 1.

Experts believe Auracast™ availability will grow slowly through 2024 and 2025, and then spread to more general use around 2030. In public places, this use case is largely covered by induction loop systems today. Further, experts think the current assistive listening systems such as loops systems will remain in use until at least 2030, while new installations of group assistive listening systems through 2030 and beyond are likely to be Auracast™ installations.

It will take time for Bluetooth LE Audio to be fully integrated into the market. Consumer electronics (e.g., earbuds) and hearing aid manufacturers will continue to use dual-mode Bluetooth protocols to ensure end users can use existing infrastructure while the new Bluetooth LE Audio protocol is adopted.

Auracast™ needs time to mature into a stable, reliable, and user-friendly technology that can be easily adopted by end-users including hearing aid wearers. Currently all major hearing aid manufacturers continue to support both Made for iPhone and ASHA protocols to enable data and audio streaming between hearing aids and smartphones.

Auracast™ is in its infancy, thus clinicians should not anticipate broad general use of Auracast™ especially in public spaces until at least 2030. As hearing aid manufacturers get closer to releasing Auracast™ enabled devices, clinicians should inquire about any updates with their industry partners. As of January 2024, Resound is the only manufacturer with LE Audio capability, but others anticipate its launch within the next year or two. For additional information, go to Bluetooth.com.



LE Audio Frequently Asked Questions

Given that LE Audio and Auracast™ are new technologies, many audiologists are likely to have questions on its implementation and use. For that reason, here are some commonly frequently asked questions.

1. How should audiologists talk about LE Audio and Auracast™ with hearing aid wearers in 2024?

   Individuals who purchase hearing aids in 2024 should be advised that LE Audio wireless streaming in on the way, but that in order to use it, you'll need other new consumer electronic devices that have the Auracast transmitter and assistant built in. For example, you could purchase hearing aids today with LE Audio capability, but without at least the transmitter, the LE Audio feature on the hearing aid cannot be activated.

2. Should audiologists actively promote that many hearing aids purchased in 2024 already have LE Audio or will have firmware upgrades enabling use of LE Audio and Auracast™?

   Like the response to the first question, hearing aid purchasers in 2024 should know that LE Audio is available. However, since the transmitters and assistants are just beginning to roll out, other types of wireless streaming that have been around several years (see Table 1) should, at least for the next several months, remain the priority for most wearers. In some cases, hearing aid wearers who happen to be early adaptors of new consumer electronic devices might appreciate that some devices *right now* have LE Audio in them. This gives them a leg up on incorporating Auracast™ into their daily lives.

3. What should audiologists anticipate from hearing aid manufacturers in 2024 as LE Audio begins to roll out?

   It's a safe bet that all manufacturers of prescription hearing aids have LE Audio capability in their product launch pipeline for 2024 or 2025. As of January 2024, GN is the only manufacturer that has LE Audio capability built into its latest model. Others are planning to add it in 2024 with a simple firmware update on some existing models. It is best to communicate directly with your manufacturing partner because launch plans can change quickly.

4. Once Auracast™ and LE Audio gain traction, how much will audiologists be called upon to help or counsel patients on how to successfully use it?

   Over the next few years, as these technologies grow in popularity, it is a sure bet that audiologists will be called upon to troubleshoot and counsel hearing aid wearers on its use. Unlike current forms of wireless transmission, LE Audio does tend to be simpler to use, but given the demographics of hearing aid wearers, audiologist will always be called upon to provide hands-on assistance with any type of new wireless system.

Now is a good time to get familiar with the basics of LE Audio. You can do this by going to www.bluetooth.com/auracast. At this link you will get feature/benefit overviews and links to other resources. Additionally, if you have an audiology assistant or technician in your practice, encourage that person to be the "local expert" on LE Audio.

Finally, now is a great time to start screening the digital literacy of all prospective hearing aid wearers. The 2-question version of the Mobile Device Proficiency Questionnaire is a validated approach to assessing the individual's proficiency at handling a smartphone, which is a cornerstone of LE Audio use. Here are the two questions and the possible answers to each question.

A. "How would you rate your skill level with a smartphone?"

- ☐ Never used one
- ☐ Beginner
- ☐ Competent

B. "How confident are you using a smartphone?"

- ☐ Not confident at all
- ☐ I usually need help
- ☐ It depends on the task
- ☐ I am confident in my ability to use a smartphone

If the prospective hearing aid wearer answers that they are competent and confident (bottom response to each question), that is a strong indication the individual can readily use LE Audio without assistance. Any other response to either question suggests the wearer will need some extra instruction or should perhaps avoid technologies that require the use of a smartphone.

The author would like to thank Chuck Sabin of the Bluetooth SIG for his valuable insights as well as granting permission to use the infographics.

***Brian Taylor** is the editor of Audiology Practices and can be reached at brian.taylor.aud@gmail.com* ■

HAVE YOU HEARD?

In Loving Memory: Brian P. Doty

It is with deep sorrow that we announce our beloved colleague, Brian Doty, died on December 27, 2023, at age 55. Brian began his service to the Academy of Doctors of Audiology (ADA) in 2008 where he served for the past 15 years as ADA's Director of Education.

Throughout his tenure, Brian contributed to the design and implementation of educational programs serving thousands of audiologists and improving outcomes for the patients they serve. Brian will be deeply missed, and especially by the audiologists who worked with him on the AuDacity Conference Planning Committee over the years.

Brian is survived by his children Matthew and Campbell Doty, and his sisters Gina and Renee Doty. Family and friends are invited to attend a visitation on Saturday, February 3, 2024, beginning at 10:00 a.m. Eastern Time at St. Mark's Catholic Church in Richmond, Kentucky, followed by a funeral mass at 12:00 p.m. Brian's complete obituary and information about his memorial service can be found at the following link: www.orpfh.com/obituary/brian-doty.

Exemplary Audiologists Recognized at AuDacity 2023

ADA President, Dr. Dawn Heiman, presented **Sarah Curtis, Au.D.**, with the Leo Doerfler Award to commemorate the outstanding clinical services that she has provided in her community throughout her career.

"Dr. Curtis is a most deserving recipient who exemplifies outstanding clinical services and the very best in patient care," said Dr. Heiman. "Over the course of her career, she has consistently demonstrated outstanding efforts to meet patients where they are, and to deliver the highest standard of clinical care for every patient, even when they cannot afford to pay for care."

Dr. Heiman presented **Erica Person, Au.D.**, the Joel Wernick Award, which recognizes an outstanding educational contribution within the profession of audiology or the field of hearing science.

"Dr. Person is widely recognized for her expertise in the areas of unbundling," noted Dr. Heiman. She is a generous teacher who is always willing to share her knowledge with colleagues in formal and informal venues.

Dr. Person is humble and always willing to lean into new opportunities to educate and inform. Audiology is lucky to have such an excellent educational leader!"

Dr. Heiman presented **Sam Vaught, Au.D.** with the Craig W. Johnson Audiology Advocate Award, which was established to honor the memory and accomplishments of Craig W. Johnson and to recognize an individual who has made significant contributions to the profession of audiology through federal and/or state advocacy.

"Dr. Vaught is a tireless advocate for the Medicare Audiology Access Improvement Act, and has worked diligently to advance the legislation over many Congresses, said Dr. Heiman. "He goes out of his way to engage other audiologists and patients in advocacy efforts and, as a member of the ADA Advocacy Steering Committee, he is always willing to volunteer to do whatever it takes to accomplish ADA's advocacy goals."

Dr. Heiman presented **D'Anne Rudden, Au.D.** with the President's Award to recognize her long-standing accomplishments and dedication to ADA and its mission. "Dr. Rudden has contributed so much to ADA and to the profession of audiology," stated Dr. Heiman. "She is a global philanthropist who seeks out opportunities to help people hear around the world and in her own community. She has dedicated her time and talent to advance ADA's advocacy efforts nationally and in Colorado. Dr. Rudden also seeks out opportunities to help disseminate important information to the audiology community through her Hearing Journal podcast."

ICYMI Representatives Gus Bilirakis and Matt Cartwright Introduce the Medicare Audiology Access Improvement Act of 2023 in the U.S. House of Representatives

In November 2023, Representative Gus Bilirakis (R-FL-12) and Matt Cartwright (D-PA-8), introduced the Medicare Audiology Access Improvement Act of 2023, H.R. 6445, in the U.S. House of Representatives. The legislation will make overdue technical improvements to Medicare statutes to remove red tape, better deploy audiologists within the Medicare system, and streamline access to audiologic care for beneficiaries.

"Medicare reimbursement policies should be patient-centered and maximize patient choice whenever possible," said Congressman Bilirakis. "Updating these policies to allow licensed audiologists to fully participate in Medicare will bring greater parity and provide seniors with improved access to hearing health and balance care."

The Medicare Audiology Access Improvement Act will make the following important updates to Medicare statutes:

- Completely eliminate the pre-treatment order requirement for Medicare Part B coverage so that beneficiaries can go directly to the audiologist for hearing and balance concerns.
- Authorize CMS to reimburse audiologists for the Medicare-covered diagnostic *and* treatment services that they are licensed to provide.
- Reclassify audiologists as practitioners under the Medicare statute. This will ensure that beneficiaries have continued access to audiology services via telehealth.

"We applaud Representative Bilirakis and Representative Cartwright for championing the Medicare Audiology Access Improvement Act to reduce treatment delays and out of pocket costs for Medicare beneficiaries seeking hearing and balance services that will improve their health, safety, and well-being," said Dawn Heiman, Au.D., President of the Academy of Doctors of Audiology.

> "This landmark legislation aligns Medicare Part B policies with evidence-based practices to optimize clinical outcomes, to promote Medicare system efficiencies, and to deploy scarce healthcare workforce resources most judiciously."
>
> DAWN HEIMAN, Au.D.

ADA 2024 Audiology Reimbursement Update Webinar and Slides Now Available On Demand

If you were unable to attend the live ADA 2024 Audiology Reimbursement Update webinar, featuring Dr. Kim Cavitt, you may view the full session and slides on-demand. Simply scan the QR code below (note you must be logged into the ADA website to access the webinar and slides).

Upon attending the webinar, attendees will be able to do the following:

1. List the new CPT codes for 2024 and define their appropriate use.
2. Differentiate the uses of advanced beneficiary notice, good faith estimate, notice on non-coverage, insurance waiver and upgrade waiver in an audiology practice.
3. Determine potential covered services, out of pocket costs, and hearing aid coverage for different types of Medicare.

Meet the Presenter: Kim Cavitt, AuD was a clinical audiologist and preceptor at The Ohio State University and Northwestern University and has served as an Adjunct Lecturer at Northwestern and Western Michigan Universities. Since 2001, Dr. Cavitt has operated her own Audiology consulting firm, Audiology Resources, Inc. Audiology Resources, Inc. provides comprehensive operational, compliance and reimbursement consulting services to hearing healthcare providers. She is a Past President of the Academy of Doctors of Audiology (ADA), serves as the Chair of the State of Illinois Speech Pathology and Audiology Licensure Board and serves on committees through ADA.

Sights from AuDacity 2023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DIFFERENTIATION THROUGH A 21ST CENTURY AUDIOLOGIC EVALUATION MODEL

There is a great deal of talk about the value of provider driven, audiologic evaluation and its superiority to evaluation delivered by other means (i.e. computerized, self-assessment, or online) or by other providers (i.e. hearing aid dispensers or technicians). There is no doubt that, when delivered to the research evidence, audiologic evaluation performed by an audiologist is the gold standard of hearing care. Study after study illustrates this.

The issues I continue to have and try to bring to the forefront is: Does every patient, in every situation, require inconsistently delivered, gold standard evaluation to treat their hearing loss and communication difficulties? If yes, are the majority of audiologists in the US consistently providing this "gold standard" care? The data still does not illustrate that a majority of audiologists do.

To get to the heart of this, let's break down the most common audiologic evaluations: the audiogram.

Here is the history of the components of the current audiogram:

Pure-tone audiometry
DEVELOPED IN
1937-1943
(Bekesy and Bunch)

Speech Audiometry
DEVELOPED IN
1943
(Carhart)

Speech Recognition I NU-6
DEVELOPED IN
1952[i] | 1966[ii]
[i] (CID-W22; Hirsch)
[ii] (Carhart and Tillman)

Audiologists are almost entirely using these evaluation techniques, from over a half century ago, to evaluate hearing loss and fit today's hearing technology. My question is: Why? Why have we not evolved our model?

As a profession, we voice frustration about disruptive competitors and scope creep by less trained hearing care professionals yet still do not combat this by doing things differently. We don't provide and document the minimally medically necessary services to diagnose the patient's otologic condition and/or hearing loss and create and implement a comprehensive treatment and rehabilitation plan. For example, people talk about the research outcomes of ACHIEVE yet avoid the standard of care that was provided in the project to reach those outcomes. It is like we all completely ignored the method section.

Continued on page 54

What can a 21st century audiologic evaluation look like?

Unless required by your state hearing aid dispensing law or a health plan payer policy, audiologists need to begin to ask themselves: What does the patient in front of me right now need to determine their otologic and audiologic function and status and create a comprehensive treatment plan that meets their individual hearing and communication needs? Why I am I doing what I am doing with and for this patient?

In my opinion, the *minimum* test battery for a new adult patient, again unless dictated by the state law or payer policies, should include:

- A standardized inventory/questionnaire of communication difficulties, such as the COSI, HHI, IOI, or SAC.
- Pure-tone, air conduction audiometry.
- Pure-tone, bone conduction audiometry or a Consumer Ear Risk Disease Assessment.
- Speech in noise testing.
- Patient/family interview regarding the patient's lifestyle, cosmetic desires, the psychological, medical, educational, emotional, social, and/or vocational impact of chief complaint and any financial limitations.

The rest of the common test battery not listed above should be provided as medically necessary for the specific, individual patient. ■

THIS 21st century approach to patient care is research evidence based, patient centered, efficient, and cost effective. This is the type of evaluation and care plan that is not offered by direct to consumer or online retailers, big box stores, or hearing aid dispensers.

THIS IS AUDIOLOGY!

EDITOR'S MESSAGE

Continued from page 5

In the paper they demonstrate that HFPTA and dB SNR loss as measured by the Quick SIN can predict patients who have good or excellent word recognition in quiet. Specifically, they show sensitivity, specificity and area under the curve (AUC) data for various combinations of SNR loss and HFPTA criteria at predicting word recognition in quiet scores with an 88% and 76% cut-off. Their data can be used to create clinical recommendations on using the Quick SIN as the default test of speech perception as well as when word recognition in quiet testing should be completed. One clinical application of their analysis, for example, would be to only perform word recognition testing in quiet when the HFPTA is > 40 dB HL and the Quick SIN score is > to 7 dB SNR. Patients with lower scores compared to the above criteria would have a better than a 99% chance of a word recognition score between 88 and 100%. Thus, if a patient meets this HFPTA/Quick SIN criteria, there is no reason to take the time to complete word recognition in quiet testing. Patients who have scores worse than the above criteria would warrant further testing with words in quiet.

When using the Quick SIN, here are a few "must-do" considerations:

- During routine hearing assessments, using earphones, test each ear at a "Loud but Okay" intensity level (70-75 dB HL or higher). Like word recognition testing in quiet, this ensure that audibility is likely to be optimized.
- Only use the ten lists on the test that are equivalent: 1, 2, 3, 5, 6, 8, 9, 10, 11, and 12
- It is best to gather separate ear information, therefore the are times when the non-test ear must be masked. Select appropriate masking (speech noise) for the non-test ear: 30 dB below presentation level is usually satisfactory unless bilateral conductive loss is present.
- In accordance with the preliminary guidelines cited above, the primary use of speech in noise testing is for diagnostic purposes, however, because the results of the Quick SIN are so relatable to most patients, it's also an ideal way to discuss real world challenges associated with hearing loss and how much hearing aids can help improve performance in background noise.
- If you're looking for more details on how to add the Quick SIN to your hearing aid selection, fitting and follow-up approach, scan the QR code to check out Research Quick Takes Volume 6 that I co-wrote with Gus Mueller that is now posted at AudiologyOnline. You can even get a few CEUs by reading the article or watching the video. ■

Scan the QR code to read Research Quick Takes Volume 6

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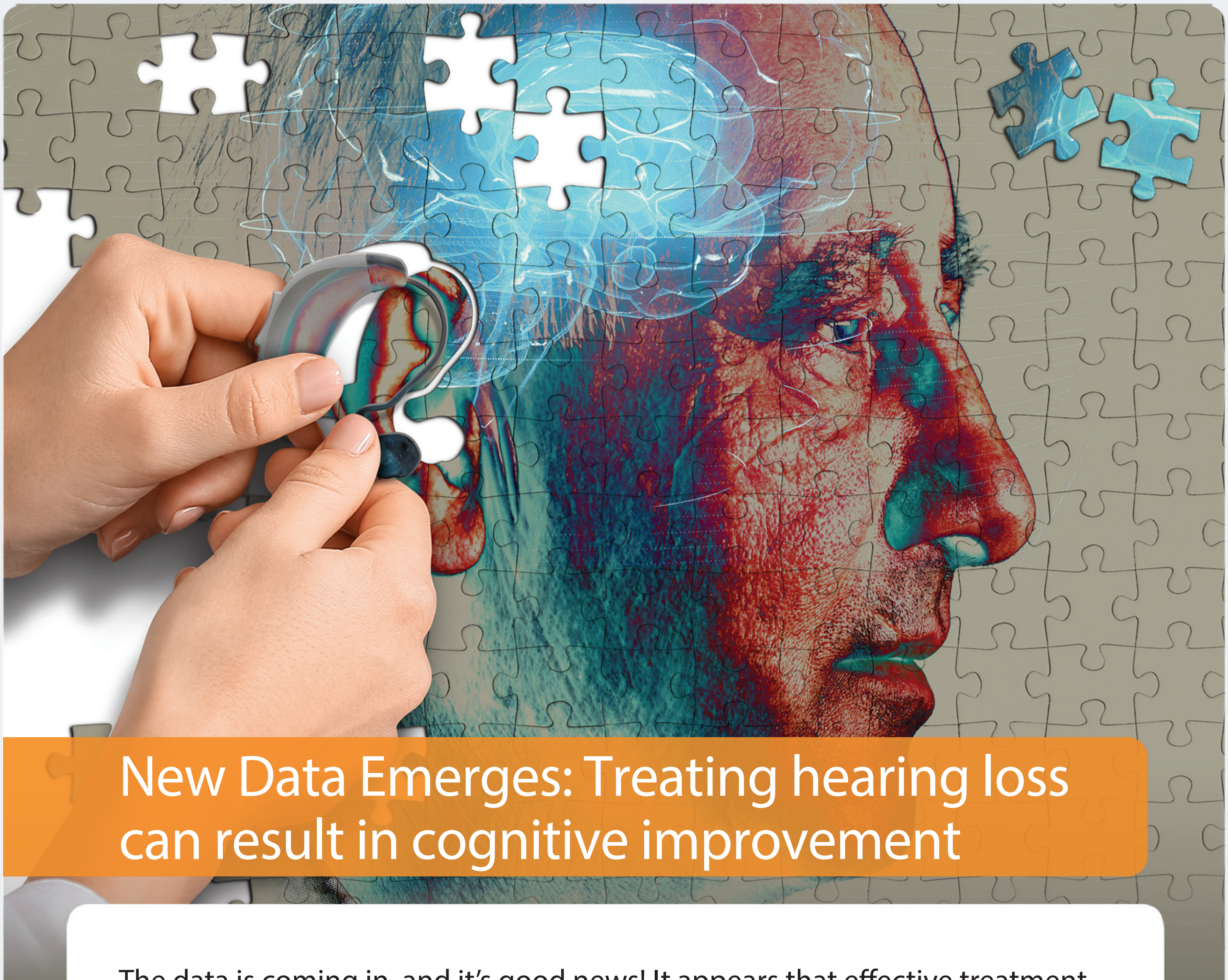

New Data Emerges: Treating hearing loss can result in cognitive improvement

The data is coming in, and it's good news! It appears that effective treatment of hearing loss can not only slow or prevent cognitive decline – it may even result in recovery.

This new brief, sponsored by Hamilton® CapTel®, explores the emerging data and research on how different hearing assistive technologies can have a positive impact on cognitive health and the role cognitive screening tests can play.

Get the brief now at
HamiltonCapTel.com/ADA823

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1024 Capital Center Drive, Suite 205
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The purpose of the **ADA Student Academy of Doctors of Audiology (SADA)** is to serve the varied needs and concerns of student and emerging graduated members of ADA. SADA members have access to exclusive student resources, ADA's mentoring program, eligibility to participate in the Student Business Plan competition at the annual AuDacity Conference, and can help set the direction of ADA student initiatives.

Get involved today! Visit audiologist.org/sada for more information.