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**June 2, 2016 at 12 PM ET**
**Managing tinnitus in pediatric patients, can we apply adult strategies?**
Presented by Catherine Palmer, Ph.D.

Pediatric patients may present with bothersome or disabling tinnitus. The prevalence, impact, and common causes will be reviewed as well as management strategies. Management strategies will be discussed in the context of the adult evidence base and protocols and how these may (or may not) be applied to a pediatric population. Several cases will be discussed in order to highlight the challenges of managing tinnitus in a variety of pediatric patients.

**June 15, 2016 at 12 PM ET**
**Holistic approach to tinnitus management**
Presented by Christopher Spankovich, Au.D., Ph.D., M.P.H.

In this lecture we will discuss approaches to tinnitus management with emphasis on sound based therapy using amplification as a delivery platform. The lecture will provide step-by-step recommendations for clinical application.

**June 27, 2016 at 12 PM ET**
**Driving a Hearing Aid on Highway 80**
Presented by Yu-Hsiang Wu, MD, Ph.D.

It is important to know whether new interventions, such as hearing aid technologies or cochlear implants, actually do help people with hearing impairment than older interventions. Measuring the intervention benefits – or the outcomes – is not as straightforward because many factors, such as the acoustic characteristics of listening environments, can affect the outcomes. In this talk, a series of studies will be presented to illustrate the effect of hearing aid directional microphones and digital noise reduction on speech understanding and listening effort in a laboratory setting and in an automobile. The use of dual-task paradigms to measure listening effort will also be discussed.

**July 8, 2016 at 12 PM ET**
**Speech-in-noise testing for selection and fitting of hearing aids: Worth the effort?**
Presented by H. Gustav Mueller, Ph.D.

Hearing aid fitting protocols must be efficient, and some have questioned if there is value in including speech-in-noise testing. In this course, we'll review evidence showing that speech-in-noise testing can be helpful in guiding the selection and adjustment of special features, selection of accessories, and most importantly, patient counseling. We'll also discuss what specific speech tests easily can be implemented into a busy schedule.

**July 26, 2016 at 12 PM ET**
**Impact of auditory access on speech and language development**
Presented by Mary Pyseldine, Au.D.

Recent results from the Outcomes of Children with Hearing Loss (OCHL) study indicate that factors such as age at hearing aid fitting, speech intelligibility index and amount and duration of hearing aid use – contribute to speech and language development for children who are hard of hearing. Longitudinal trends in audibility and hearing aid use show some children to be at risk for speech and language delays, while others are also at risk for speech and language delays. Auditory access profiles for individual children will be discussed relative to speech and language outcomes and recommendations for audiological amplification management.

Hearing Systems
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# Speech-in-noise testing for selection and fitting of hearing aids: Worth the effort?

H. Gustav Mueller, PhD

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**Course Objectives**

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1. List several speech-in-noise tests that can be used in the clinic.
2. Describe how to score and interpret several speech-in-noise tests
3. Describe how to use the results of speech-in-noise tests for patient counseling

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**Introducing Dr. Mueller**

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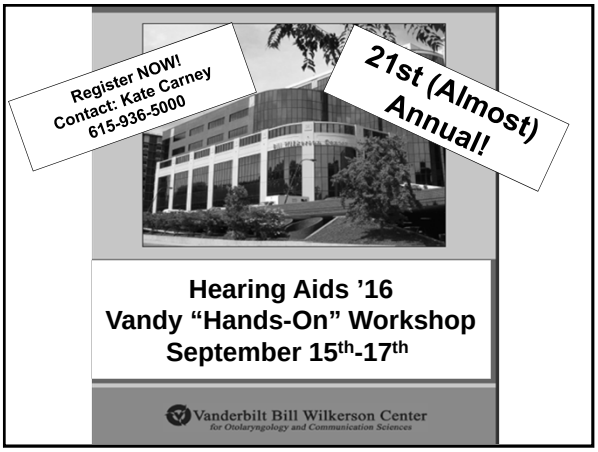
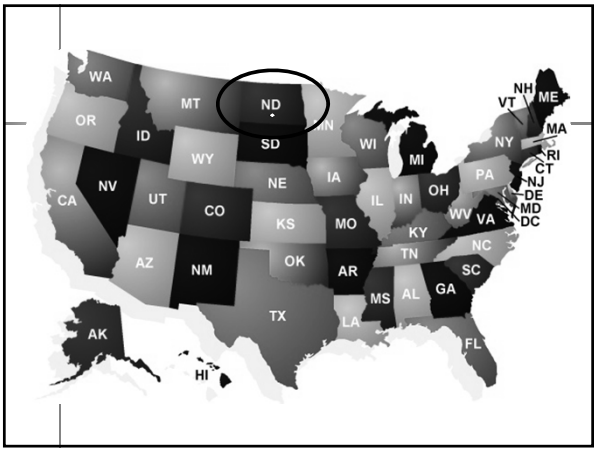
Speech-in-noise testing for selection and fitting of hearing aids:
Worth the effort?


H. Gustav Mueller, PhD
Professor, Vanderbilt University, Nashville, TN.
Consultant, Sivantos Group
Contributing Editor, *AudiologyOnline*

Where Gus hangs out when he is in Nashville



Coming to you today from a beautiful North Dakota Island

Let's start things off with a comparison to our friends in optometry . . .

You walk into their office with a complaint of trouble seeing things at a distance. What do they do?

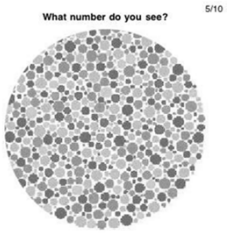
Have you read the Snellen Eye Chart at distance of 20 feet.

What if your main problem is reading magazines and newspapers?

They have you read different size print at arms length.

## Trouble differentiating colors?

They conduct a standardized color differentiation test



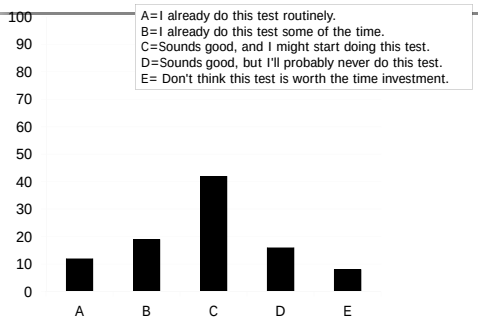

## So now let's jump to the profession of audiology . . .

The typical new potential hearing aid candidate walks in the door with the complaint of understanding speech in background noise.

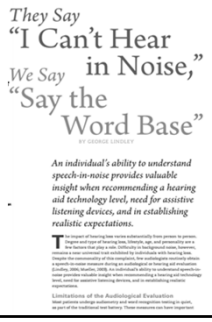
*What does the average audiologist do?*

**Assess speech understanding in quiet!**

## Survey regarding use of QuickSIN (n=>100 audiologists who are routinely fitting hearing aids)



Article from *Audiology Today* (July/Aug), 2015
Written by George Lindley


They Say
"I Can't Hear in Noise,"
We Say
"Say the Word Base"
BY GEORGE LINDLEY

*An individual's ability to understand speech-in-noise provides valuable insight when recommending a hearing aid technology level, need for assistive listening devices, and in establishing realistic expectations.*

The impact of hearing loss varies substantially from person to person. Degree and type of hearing loss, lifestyle, age, and personality are a few factors that influence the impact of hearing loss. Speech-in-noise remains a most universal trait exhibited by individuals with hearing loss. Despite the ubiquitousness of this complaint, few audiologists routinely obtain a speech-in-noise measure during an audiological or hearing aid evaluation. (Lindley, 2004; Mueller, 2009). An individual's ability to understand speech-in-noise provides valuable insight when recommending a hearing aid technology level, need for assistive listening devices, and in establishing realistic expectations.

Limitations of the Audiological Evaluation

Most patients undergo audiometry and word recognition testing in quiet, as part of the traditional test battery. These measures can have important

Lindley suggested that the QuickSin be given to all patients—three different presentation methods were suggested:

- Unaided at conversational level (estimate of how they are doing in the real world)
- Unaided at loud level (maximize audibility; how good they possibly could do)
- Aided at average speech level (note: Walden and Walden found 1.7 dB benefit for aided versus loud unaided)

## Lindley's clinical study:

- Tested 48 patients who were being considered for hearing aid fittings.
- Used the "aided" testing approach:
  - 41%: Normal or near normal
  - 33%: Mild

Regression analysis using age, word recognition score and degree of hearing loss found that these variables only accounted for 54.5% of the variance of QuickSin score

## Lindley concludes that the QuickSin can be used for:

- Patient counseling
- Level of technology
- Need for assistive devices

## Letter to the Editor (Audiology Today) from John Tecca (Nov-Dec , 2015 issue)


LETTER TO THE EDITOR

They Say "I Can't Hear in Noise," We Say "Say the Word Base"

## Points made by Tecca:

- The QuickSIN may not be representative of everyday function, and may not predict real world satisfaction with hearing aids.
- Testing with hearing aids (that were not fitted precisely) isn't a good idea.
- Many other factors go into the decision of what technology should be fitted and recommended.

Not do speech-in-noise testing? All just didn't seem right in the Universe


Letter to the Editor (Audiology Today) from George Lindley (Nov-Dec , 2015 issue)


LETTER TO THE EDITOR

Dear Audiology Today,
I would like to thank Dr. Tecca for his insightful comments regarding the recent article, "They Say I Can't Hear Well, We Say Buy Aids." I appreciate the opportunity to address several of Dr. Tecca's points.

Dr. Tecca expressed concern regarding my proposed use of SIN results in the hearing aid selection process. My proposal was put forward as a lack of research validating the relationship between speech-in-noise (SIN) performance and subjective outcome measures. I agree there is little empirical data to support the use of SIN measures in audiology. Dr. Tecca further stated, "Clinical decisions must often be made for use of new technology before there is conclusive evidence. Clinical decisions should stimulate investigation, not be perpetuated as best practices."

Given the lack of evidence for much of what we do, I believe caution should instead take "Treat the potential benefit of conducting research. I strongly disagree with the concept, measurement of SIN functioning would appear to be a just and fair way to determine the degree of variability in speech-in-noise understanding, both aided and unaided. Given the lack of evidence base, there is excellent face validity for conducting SIN testing. There is no evidence that it is harmful to avoid the used and it potential use approach. No, there is not a perfect relationship between SIN performance and outcomes. The same can be said for real-ear measures. Matching a prescription perfectly may yield a great outcome for one patient, while a different outcome for another is not needed. This does not mean the measure or the prescription is wrong, it just means that each patient is different. We do not know all there is to know, and we need to be flexible. Clinical judgment and facilitate can have clinical judgment.

I proposed that listening fatigue is a major issue for many HA users. It is some task with in Patient it has a severe SIN deficit added valuable information that allows the audiologist to make better recommendations for hearing aid selection. Dr. Tecca, several points in his letter, Dr. Tecca appeared to imply that I make individual hearing aid selection decisions on the SIN results. This is certainly not the message I intended to convey. Rather, I proposed the SIN results be considered as one of many factors.

Dr. Tecca addressed several issues regarding the proposed SIN protocol. He expressed concern regarding the use of ideal hearing aids. Never using the manufacturer's suggestion, but a "Flat" response is a fair and valid concern and is my experience. "Flat-10" audibility varies significantly from manufacturer to manufacturer. As part of our hearing aid fitting protocol, all hearing aids are pre-fitted to "Flat-10" audibility and are verified when real-ear measures are first conducted. This allows us to be in the ballpark and to quickly verify the chosen potential device meets in advance. As a result of the numerous real-ear measures, we have found manufacturers provide equivalent sufficient audibility at default settings and can those when selecting the pre-fitting SIN measures. Thin-pinn hearing aids do provide equivalent audibility although this is typically much less than manufacturer-related variability. Dr. Tecca's other issues raised should have been described in greater detail.

Regarding the concern expressed by Dr. Tecca was the presentation of the speech and noise from 0 degrees azimuth. Dr. Tecca stated that the impact of directionality in the hearing aids. He further described the difficulty of simulating real-world conditions in the clinic. On this point, I agree. Simulation is difficult, if not impossible, to simulate dynamic real-world listening conditions. I agree with Dr. Tecca that the goal in conducting SIN measures is to see how the patient performs in a specific listening condition. Hearing, it is the size of the deficit that I find to be a useful piece of data that is then included in the counseling and decision-making process.

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## Points made by Lindley:

- The purpose of the testing is to see how the patient does compared to those with normal hearing—it is not intended to predict real-world performance.
- Much of what is considered "Best Practice" is only supported by minimal research evidence.

I tend to side with Lindley, and the work of Richard Wilson helped persuade me:

- Wilson developed the words-in-noise (WIN) test back in the early 2000s.
- The test material is the NU#6 words (female talker).
- The background noise is multitalker babble.
- Five words at 7 different babble levels (0 dB to +24 dB; 4 dB increments)

## General interpretation guidelines for the WIN:

- Normal: </= 6 dB
- Mild: 6.8 to 10.0
- Moderate: 10.8 to 14.8
- Severe: 15.6 to 19.6
- Profound: >20 dB

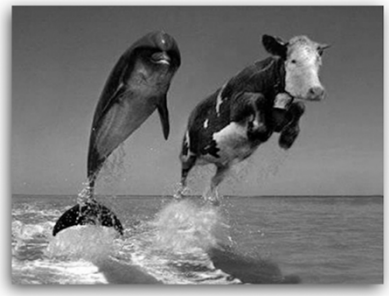
Note: Research by Wilson found the WIN and QuickSIN to result in similar scores

Wilson's (2011) large (n=3,430) comparison study of WIN to NU#6:

- Approximately 70% of the patients had NU#6 performance in quiet that were good or excellent, but only 6.9 of these very same patients had normal WIN scores.
- Of the total, only 222 (6%) had normal performance for the WIN; 218 (98.5%) of these

These data clearly show that if you were to only do one or the other of these two tests, you would do the WIN, as it is highly predictive (98.5%) of the NU#6 score.

Speech in quiet vs. speech in noise: While the task is similar, we are looking at two different things . . .



Six reasons why you might want to conduct speech-in-noise testing with your patients . . .

- Reason #1: To address the patient's complaints. It is very likely that problems understanding speech in background noise are the primary reason why the patient is seeking assistance. Conducting this testing conveys to the patient that you understand, and are interested in learning about his or her problem.

Six reasons why you might want to conduct speech-in-noise testing with your patients . . .

- Reason #2: To select the best technology. The results of these tests can impact your selection of the fitting arrangement (e.g., unilateral versus bilateral versus BiCROS), the hearing aid style, and/or the need for special features such as remote microphones.

## Six reasons why you might want to conduct speech-in-noise testing with your patients . . .

- Reason #3: To establish a baseline. The information collected during this testing can be used as a baseline for measuring aided benefit—use to demonstrate to patients that hearing aids indeed do work in background noise.

## Six reasons why you might want to conduct speech-in-noise testing with your patients . . .

- Reason #4: To monitor performance over time. A patient's ability to understand in background noise may become significantly poorer without an associated change in hearing thresholds or speech understanding in quiet.

## Six reasons why you might want to conduct speech-in-noise testing with your patients . . .

- Reason #5: To assist with counseling. How does the patient's score compare with individuals with normal hearing, or other individuals with the same degree of hearing loss? The results of speech-in-noise testing will assist in identifying real-world situations where the patient may or may not do well.

## Six reasons why you might want to conduct speech-in-noise testing with your patients . . .

- Reason #6: To help a patient make a decision. Many times, a patient may be on the fence regarding the use of hearing aids and maybe has heard that hearing aids do not work. An aided versus unaided speech demo during the initial visit provides an example of potential benefit, and often provides that shot in the arm to encourage the patient to move forward.

## And a Bonus Reason!

- MarkeTrak VIII revealed that when speech testing was conducted as part of the hearing aid fitting, both patient satisfaction and patient loyalty improved.

## So . . . Are you convinced it's a good idea to start using at least one speech-in-noise test with your hearing aid fittings?

But which one do you use?

## The easiest decision is what *NOT* to do . . .


## Some things to consider when selecting a speech-in-noise test for routine clinical use:

- Well-researched
- Reliable
- Good at separating normal from abnormal
- Can be used with a wide range of patients
- Easy to administer and score
- Minimal time investment

## Five reasonable choices:

<u>Adaptive SNRs</u>

- Hearing In Noise Test (HINT)
- Quick Speech In Noise (QuickSIN)
- Bamford-Kowal-Bench Sentences In Noise (BKB-SIN)—Best for kids!
- Words In Noise (WIN)

<u>Fixed SNR</u>

- Connected Speech Test (CST)

## Selecting a speech in noise test: Words or sentences?

Advantages of sentences (Wilson and McArdle, 2008):

- Better face validity; similar to what the patient experiences in everyday listening.
- Probably better approximation of how a person understands conversational speech; monosyllables have a lack of lexical, semantic, and syntactic redundancies.

## Selecting a speech in noise test: Words or sentences?

Advantages of single words (Wilson and McArdle, 2008):

- The syntactic and semantic structures of sentence-length stimuli can influence performance.
  - e.g. from HINT: The fire was very ____.
- Sentences involve more complex cognitive skills; more working memory effort is required. These demands could differentially affect older versus younger patients.

## Selecting a speech in noise test: What background noise to use?

- Speech-shaped noise.
  - Used with the HINT
- Multitalker babble.
  - Used with the CST and the WIN
- Four-talker babble.
  - Used with the QuickSIN and the BKB-SIN

## Selecting a speech in noise test: Adaptive or fixed SNR?

Advantages of adaptive (Mueller et al, 2014):

- Eliminate floor and ceiling effects (i.e., scoring nearly all correct or all incorrect), a common problem when a fixed SNR is used.
- The 50% correct point for most patients can be obtained more reliably and efficiently than a lengthy word list.
- Better able to determine significant differences between patients or between the right and left ears of the same patient.

## Selecting a speech in noise test: Adaptive or fixed SNR?

Advantages of fixed SNR (Mueller et al, 2014):

- Able to simulate different SNR listening conditions.
- Easier to explain the results to the patient and to third parties.
- Easier for the patient to understand their performance, or aided improvement.
- Administration and scoring is easier than for an adaptive speech test.

## And . . . After you select the test, you need to decide on a presentation level:

- Choice #1: High level to maximize audibility (70-75 HL; at patient's "loud, but okay" loudness level).
- Choice #2: Level of average speech (~50 dB HL)
- Choice #3: Level corresponding to patient complaint (e.g., patient who has trouble with soft speech—40 dB HL)

For today—let's pick the QuickSIN for some examples of clinical use



## The QuickSIN: A reasonable choice for clinicians

- Recorded with 6 different S/N ratios
- Six sentences/list; only one sentence at each level (yes it is quick!)
- Female talker with four competing talkers (yes there is informational masking)
- Recommended presentation level: 70-75 HL, or "Loud, But Okay" loudness rating
- Very easy to administer (use two lists)
- Fairly easy to score

## The QuickSIN: A sample list of six scored sentences

| List 1 | | Score |
|---|---|---|
| 1. A white silk jacket goes with any shoes. | S/N 25 | 5 |
| 2. The child crawled into the dense grass. | S/N 20 | 5 |
| 3. Footprints showed the path he took up the beach. | S/N 15 | 4 |
| 4. A vast near the edge brought in fresh air. | S/N 10 | 3 |
| 5. It is a band of steel three inches wide. | S/N 5 | 2 |
| 6. The weight of the package was seen on the high scale. | S/N 0 | 0 |
| 25.5 - TOTAL = 6.5 SNR Loss | TOTAL | 19 |

## Suggested interpretation of QuickSin SNR Loss findings:

- 0-3 dB: Normal or near-normal
- 4-7 dB: Mild
- 8-15 dB: Moderate
- >15 dB: Severe

Note: The QuickSIN is scored as SNR-Loss, not SRT-50. That is, the average performance for normal (2 dB SNR) is subtracted from the SRT-50 to calculate SNR-Loss (deviation from normal hearing).

## The QuickSIN: Critical difference values are available


| Lists per Condition | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 95% C.D. ±, in dB | 3.9 | 2.7 | 2.2 | 1.9 | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 |
| 90% C.D. ±, in dB | 3.2 | 2.2 | 1.8 | 1.6 | 1.4 | 1.3 | 1.2 | 1.1 | 1.1 |
| 80% C.D. ±, in dB | 2.5 | 1.8 | 1.5 | 1.3 | 1.1 | 1.0 | 1.0 | 0.9 | 0.8 |

Note: Research by McArdle and Wilson (2006) revealed that Lists 4, 5,13 and 16 were not within critical range for people with hearing loss

## Clinical use of speech-in-noise test findings:

- Patient (a young woman) says she is really struggling to understand at work; exhausted at the end of the day.
- Her pure-tone thresholds are no worse than 15 dB at any frequency, and she scored 100% on the Ten Hardest NU#6 word list.
- Her QuickSIN scores are 5 dB for the right ear, and 6 dB for the left.

## Clinical use of speech-in-noise test findings:

- Patient with bilateral high-frequency loss really wants CIC products, although you know that he will do much better in background noise using bilateral beamforming mini-BTEs.
- QuickSIN scores are 2 dB for right ear and 1.5 dB for the left.

## Clinical use of speech-in-noise test findings:

- Patient insists that she will only wear one hearing aid (for now at least).
- Hearing loss is symmetrical, and word recognition is 84-88% in both ears
- QuickSIN scores are 6 dB for right ear and 12 dB for the left.

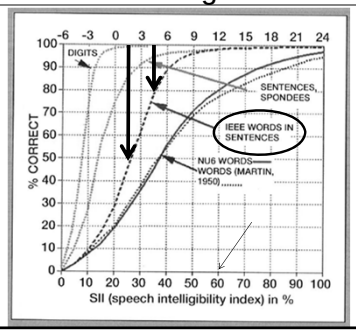
## Clinical use of speech-in-noise test findings:

- Patient fitted bilaterally—new hearing aid user. Main complaint is understanding in background noise.
- Hearing thresholds symmetrical (40 dB downward-sloping to 70 dB) and word recognition is 88% bilaterally.
- QuickSIN score is 6 dB for the right and 11 dB for the left.
- On follow-up, he says he does better at parties when he is only using his right hearing aid—not both.

## Clinical use of speech-in-noise test findings:

- Patient is anxious to obtain hearing aids as he is having trouble understanding dinner at his two favorite restaurants. This is item #1 on his COSI.
- You've been to those restaurants and know that the SNR is about +8 dB (using your handy cell phone app).
- His QuickSIN scores are 7 dB for both ears.

## This chart is for normal hearing, but the relationship applies for people with hearing loss




## Clinical use of speech-in-noise test findings:

- Patient is anxious to obtain hearing aids as he is having trouble understanding dinner at his two favorite restaurants. This is item #1 on his COSI.
- You've been to those restaurants and know that the SNR is about +5 dB (using your handy cell phone app).
- His QuickSIN scores are 12 dB for the right and 14 dB for the left ear.

## Clinical use of speech-in-noise test findings:

- Patient (80-year-old male), using bilateral amplification, says he thinks his right hearing aid isn't working right. Mentions he did have mild stroke about 6-months ago.
- Comparing test results to when he was fitted two years ago: Hearing levels have not changed significantly, nor has word recognition (~80% in both ears).
- QuickSIN scores went from 6 dB to 7 dB for left ear, 6 dB to 12 dB for right ear.

## Clinical use of speech-in-noise test findings:

- Patient just purchased hearing aids a week ago. Specifically was interested in doing better in background noise. Back today saying that the hearing aids do not provide any improvement in background noise—seriously thinking of returning them.
- Pre-fitting QuickSIN scores were 8 dB for right ear and 9 dB for the left.

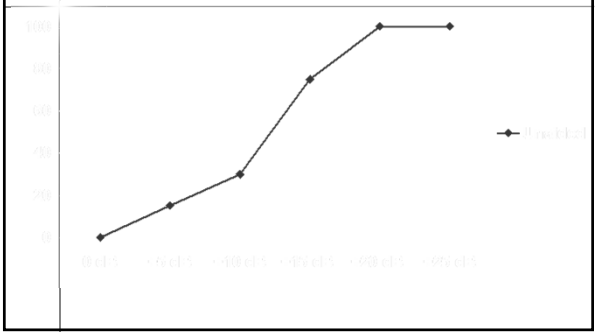
## Two possible approaches:

- Conduct soundfield aided bilateral QuickSIN at average-speech level (e.g., 62-65 dB SPL or roughly 50 dB HL)
  - This should help convince YOU that all is well if patient performs at pre-fitting level (should do even slightly better)
- Conduct soundfield aided bilateral QuickSIN at soft-speech level (e.g., 50-55 dB SPL or roughly 40 dB HL)
  - This should help convince THE PATIENT that hearing aids really do work in background noise.

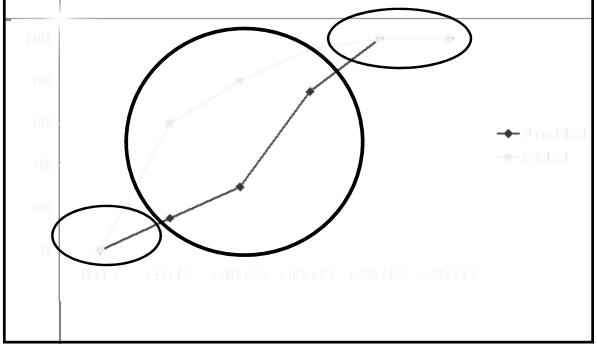
## It is often helpful to provide patients with a “shot in the arm” regarding speech understanding in noise

- Present the QuickSIN in the soundfield
- Conduct testing bilaterally (unaided and aided)
- Use a presentation level of 55 dB SPL
- Can be conducted in sound booth, or through remote speakers, or using probe mic speakers
- Use average of two lists and score for each SNR independently

## Best for patient counseling: QuickSIN results plotted on SNR chart for unaided in soundfield (presentation level 55 dB SPL)

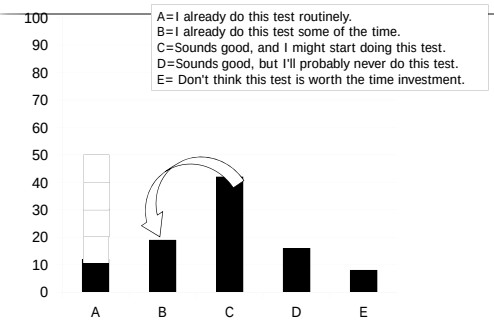


## QuickSIN results plotted on SNR chart for aided and unaided

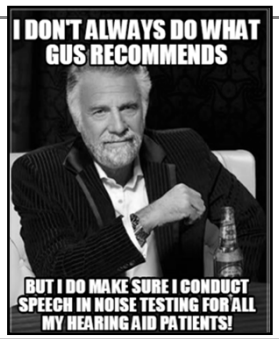


# Time?

Survey regarding use of QuickSIN (n=>100 audiologists who are routinely fitting hearing aids)




And finally, a personal endorsement . . .



Speech-in-noise testing for selection and fitting of hearing aids:
Worth the effort?


Vanderbilt

H. Gustav Mueller, PhD
Professor, Vanderbilt University, Nashville, TN.
Consultant, Sivantos Group
Contributing Editor, *AudiologyOnline*

**Thank you Dr. Mueller!**

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June 2, 2016 at 12 PM ET
**Managing tinnitus in pediatric patients, can we apply adult strategies?**
Presented by Catherine Palmer, Ph.D.

Pediatric patients may present with bothersome or debilitating tinnitus for a number of reasons. Common causes will be reviewed as well as management strategies. Management strategies will be discussed in the context of the adult evidence base and protocols and how these may (or may not) be applied to a pediatric population. Several case studies will be presented to illustrate the challenges of managing tinnitus in a variety of pediatric patients.

June 15, 2016 at 12 PM ET
**Holistic approach to tinnitus management**
Presented by Christopher Spankovich, Au.D., Ph.D., M.P.H.

In this lecture we will discuss approaches to tinnitus management with emphasis on sound based therapy using amplification as a delivery platform. The lecture will provide step by step recommendations for clinical application.

June 27, 2016 at 12 PM ET
**Driving a Hearing Aid on Highway 80**
Presented by Yu-Hsiang Wu, MD, Ph.D.

It is important to know whether new interventions, such as hearing aid technologies or cognitive training, actually benefit adult listeners with hearing impairment than older interventions. Measuring the intervention benefits – or the outcomes – is not as straightforward because many factors, such as the acoustic characteristics of listening environments, can affect the outcomes. In this talk, a series of studies will be presented to illustrate the effect of hearing aid directional processing on speech-in-noise performance and listening effort in a laboratory setting and in an automobile. The use of dual-task paradigms to measure listening effort will also be discussed.

July 6, 2016 at 12 PM ET
**Speech-in-noise testing for selection and fitting of hearing aids: Worth the effort?**
Presented by H. Gustav Mueller, Ph.D.

Hearing aid fitting protocols must be efficient, and some have questioned if there is value in including speech-in-noise testing. In this course, we'll review evidence showing the value of SIN testing for hearing aid fitting, including the selection and adjustment of special features, selection of accessories, and most importantly, patient counseling. We'll also discuss what specific speech tests easily can be implemented into a busy schedule.

July 26, 2016 at 12 PM ET
**Impact of auditory access on speech and language development**
Presented by Mary Sweetow, Au.D.

Recent results from the Outcomes of Children with Hearing Loss (OCHL) study indicate that auditory access - aided audibility levels (i.e., speech intelligibility index) and amount and duration of hearing aid use - are critical factors in speech and language development for children who are hard of hearing. Longitudinal trends in audibility and hearing aid use show some children to be at risk for speech and language delays, thus also at risk for reduced auditory access, thus increase profiles for intervention. Results will be discussed relative to speech and language outcomes and recommendations for audiological/amplification management.

Hearing Systems
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