Hearing Needs Assessment - How to pick the correct hearing aid?

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Agenda

Introduction
Background
Speech in Noise Measures
Questionnaires
Dexterity Measures
Summary & Questions
Case #1

**Right ear**

**Audiogram (dB HL)**

- AC
- BC
- UCL

**Left ear**

- AC
- BC
- UCL
Case#2

Right ear

Audiogram (dB HL)

Left ear

- AC
- BC
- UCL
Don’t Judge a Book by it’s Cover

Other Pieces to the Puzzle

Case History
Otoscopy
Bone conduction thresholds
Speech reception thresholds
Word recognition scores
Immittance
MCLs & UCLs
The Challenge...

In less than an hour need to determine:

- monaural versus binaural
- device style
- earmold configuration
- level of technology
- variables such as vision, aging effects, physical function, cognitive ability, HA expectations, level of motivation, life-style issues, education and support system
The Audiogram

- only determines thresholds; softest sound an ear can detect at each tested frequency

- does not show how ear performs in real world
Completing the puzzle

- Speech in noise measures
- Questionnaires
- Assessment of dexterity
Speech in Noise Measures

The most common complaint from patients with hearing loss is the ability to understand speech in the presence of background noise (Carhart & Tillman, 1970)

Rarely assessed during routine audiologic evaluations
Speech in Noise Measures

Unable to interpret results and how to incorporate into counseling

Tests have lacked the amount of normative data available for the word recognition materials used in quiet (Wilson & McArdle, 2005)
HINT

Hearing in Noise Test (HINT)

– Sentences
– Speech spectrum as noise source
– Utilizes a psychophysical procedure in which the speech-spectrum noise is held constant while the signal is varied to find the 50% correct point

– Scoring
  \[ \frac{\text{# of words correct}}{\text{total words}}\times 100\% \]

(Nilsson et al, 1994)
Sample sentences

1. (A/The) boy fell from (a/the) window
2. (A/The) wife helped her husband.
3. Big dogs can be dangerous.
4. Her shoes (are/were) very dirty.
5. (A/The) player lost (a/the) shoe.
6. Somebody stole the money.
7. (A/The) fire (is/was) very hot.
8. She’s drinking from her own cup.
9. (A/The) picture came from (a/the) book.
10. (A/The) car (is/was) going too fast.
Words in Noise Test (WIN)

- NU-6 words
- Multitalker babble
- The SNRs range from 24 to 0 dB in 4 dB increments.
- There are 35 words per list and 5 of the words are presented at each of the 7 different SNRs. Test stopped when 10 words missed in a row
- Scored in terms of signal-to-noise ratio at the 50% point (Wilson and Burks, 2005)
Quick SIN

Quick Speech in Noise Test

– Sentences
– Multitalker babble
– 6 sentences per list with speech and noise presented together at prerecorded SNRs.
– Descending paradigm that starts at 25 dB SNR and decreases in 5 dB increments to 0 dB SNR

(Killion et al, 2004)
QuickSIN

1. The lake sparkled in the red hot sun.      S/N 25
2. Tend the sheep while the dog wanders.    S/N 20
3. Take two shares as a fair profit.         S/N 15
4. North winds bring colds and fevers.       S/N 10
5. A sash of gold silk will trim her dress.  S/N 5
6. Fake stones shine but cost little.        S/N 0

TOTAL
BKB-SIN
Bamford-Kowal-Bench Speech-in-Noise Test (BKB-SIN)

- Sentences
- Multitalker babble
- The sentences are shorter and simpler (first grade language level) and there is one sentence at each of the following SNRs: 21, 18, 15, 9, 6, 3, 0, -3, and -6 dB.
### BKB-SIN™ Test

#### List Pair 1

<table>
<thead>
<tr>
<th>List 1A</th>
<th>Key Words</th>
<th># Correct</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. They are looking at the clock.</td>
<td>4</td>
<td></td>
<td>+21 dB</td>
</tr>
<tr>
<td>2. The car engine is running.</td>
<td>3</td>
<td></td>
<td>+18 dB</td>
</tr>
<tr>
<td>3. Children like strawberries.</td>
<td>3</td>
<td></td>
<td>+15 dB</td>
</tr>
<tr>
<td>4. They are buying some bread.</td>
<td>3</td>
<td></td>
<td>+9 dB</td>
</tr>
<tr>
<td>5. The green tomato are small.</td>
<td>3</td>
<td></td>
<td>0 dB</td>
</tr>
<tr>
<td>6. He played with his train.</td>
<td>3</td>
<td></td>
<td>+6 dB</td>
</tr>
<tr>
<td>7. The bag fell to the ground.</td>
<td>3</td>
<td></td>
<td>+3 dB</td>
</tr>
<tr>
<td>8. The boy did a handstand.</td>
<td>3</td>
<td></td>
<td>0 dB</td>
</tr>
<tr>
<td>9. The water boiled quickly.</td>
<td>3</td>
<td></td>
<td>-3 dB</td>
</tr>
<tr>
<td>10. The man is painting a sign.</td>
<td>3</td>
<td></td>
<td>-6 dB</td>
</tr>
</tbody>
</table>

Total Key Words Correct: 30

SNR = 50 - (# Correct) = dB

#### List Pair 2

<table>
<thead>
<tr>
<th>List 2A</th>
<th>Key Words</th>
<th># Correct</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The cat is sitting on the bed.</td>
<td>4</td>
<td></td>
<td>+21 dB</td>
</tr>
<tr>
<td>2. They had a lovely day.</td>
<td>3</td>
<td></td>
<td>+18 dB</td>
</tr>
<tr>
<td>3. The thin dog was hungry.</td>
<td>3</td>
<td></td>
<td>+15 dB</td>
</tr>
<tr>
<td>4. They are watching the train.</td>
<td>3</td>
<td></td>
<td>+12 dB</td>
</tr>
<tr>
<td>5. The dog played with a stick.</td>
<td>3</td>
<td></td>
<td>+9 dB</td>
</tr>
<tr>
<td>6. The farmer keeps a bull.</td>
<td>3</td>
<td></td>
<td>+6 dB</td>
</tr>
<tr>
<td>7. The lady wore a coat.</td>
<td>3</td>
<td></td>
<td>+3 dB</td>
</tr>
<tr>
<td>8. The boy is running away.</td>
<td>3</td>
<td></td>
<td>0 dB</td>
</tr>
<tr>
<td>9. The room is getting cold.</td>
<td>3</td>
<td></td>
<td>-3 dB</td>
</tr>
<tr>
<td>10. The wife helped her husband.</td>
<td>3</td>
<td></td>
<td>-6 dB</td>
</tr>
</tbody>
</table>

Total Key Words Correct: 30

SNR = 50 - (# Correct) = dB

#### List 1B

<table>
<thead>
<tr>
<th>List 1B</th>
<th>Key Words</th>
<th># Correct</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The dog made an angry noise.</td>
<td>4</td>
<td></td>
<td>+21 dB</td>
</tr>
<tr>
<td>2. They followed the path.</td>
<td>3</td>
<td></td>
<td>+18 dB</td>
</tr>
<tr>
<td>3. Someone is crossing the road.</td>
<td>3</td>
<td></td>
<td>+15 dB</td>
</tr>
<tr>
<td>4. The mailman brought a letter.</td>
<td>3</td>
<td></td>
<td>+12 dB</td>
</tr>
<tr>
<td>5. The milk was by the front door.</td>
<td>3</td>
<td></td>
<td>+9 dB</td>
</tr>
<tr>
<td>6. The candy shop was empty.</td>
<td>3</td>
<td></td>
<td>+6 dB</td>
</tr>
<tr>
<td>7. The lady stayed for lunch.</td>
<td>3</td>
<td></td>
<td>+3 dB</td>
</tr>
<tr>
<td>8. The policeman knows the way.</td>
<td>3</td>
<td></td>
<td>0 dB</td>
</tr>
<tr>
<td>9. The little girl was happy.</td>
<td>3</td>
<td></td>
<td>3 dB</td>
</tr>
<tr>
<td>10. They are coming for Christmas.</td>
<td>3</td>
<td></td>
<td>-6 dB</td>
</tr>
</tbody>
</table>

Total Key Words Correct: 30

SNR = 50 - (# Correct) = dB

#### List 2B

<table>
<thead>
<tr>
<th>List 2B</th>
<th>Key Words</th>
<th># Correct</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The lady went to the store.</td>
<td>4</td>
<td></td>
<td>+21 dB</td>
</tr>
<tr>
<td>2. A tree fell on the house.</td>
<td>3</td>
<td></td>
<td>+18 dB</td>
</tr>
<tr>
<td>3. The fruit came in a box.</td>
<td>3</td>
<td></td>
<td>+15 dB</td>
</tr>
<tr>
<td>4. The husband brought some flowers.</td>
<td>3</td>
<td></td>
<td>+12 dB</td>
</tr>
<tr>
<td>5. A man told the police.</td>
<td>3</td>
<td></td>
<td>+9 dB</td>
</tr>
<tr>
<td>6. Potatoes grow in the ground.</td>
<td>3</td>
<td></td>
<td>+6 dB</td>
</tr>
<tr>
<td>7. The big dog was dangerous.</td>
<td>3</td>
<td></td>
<td>+3 dB</td>
</tr>
<tr>
<td>8. The strawberry jam was sweet.</td>
<td>3</td>
<td></td>
<td>0 dB</td>
</tr>
<tr>
<td>9. The boy has black hair / tie.</td>
<td>3</td>
<td></td>
<td>3 dB</td>
</tr>
<tr>
<td>10. The mother heard the baby.</td>
<td>3</td>
<td></td>
<td>-6 dB</td>
</tr>
</tbody>
</table>

Total Key Words Correct: 30

SNR = 50 - (# Correct) = dB

Average SNR = 50, Lists 1A and 1B = dB

Average SNR = 50, Lists 2A and 2B = dB
Scoring

0-3 dB Normal/near normal
  – May hear better than normals hear in noise

3-7 dB Mild SNR loss
  – May hear almost as well as normals hear in noise

7-15 dB Moderate SNR loss
  – Consider directional microphones

>15 dB Severe SNR loss/Maximum SNR improvement is needed.
  – Consider FM system
Comparing Tests

QuickSIN or WIN

– Prefer sentences or words
– WIN could use same word list for both quiet and noise
– BKB-SIN and HINT for children and those with more significant hearing losses (cochlear implant candidates)

(Wilson & McArdle, 2007)
Benefits of Speech in Noise

- Offers insight to the most appropriate amplification (directional microphones, FM systems, etc.)

- Assists in counseling patients as far realistic expectations.
UWO Plurals Test

Test the perception of high frequency speech sounds

Specific to the English language

Measures the listener’s ability to detect word final consonant eg. /s/ and /z/
Compare performance

It can be used to evaluate performance in different testing conditions:

- compare hearing instrument features on versus off
- compare hearing aids
- Aided versus unaided conditions
- compare settings (pre versus post fine tuning of SoundRecover)
The tools

Audio CD

10 picture list books or slideshow

Scoring sheet

Critical difference table
Steps to administer

1. Instruct the listener
   “You will hear a woman’s voice saying some words. Point to the picture that matches the word that you hear. Listen carefully and give it a guess if you are not sure.”

2. Present 2 word lists (freefield)

3. Child points to picture that corresponds to what they heard (closed set)

4. Repeat step 1 & 2 in the comparative test condition (ie. aided versus unaided)
Scoring – when are the two scores significantly different?

Example:
Test condition A 54% Test condition B 71%
Find the lower of the two scores on the critical difference table
Match with the correct column (30 or 60 item presentation)
30 item presentation – not significant (71 < 75)
60 item presentation – significant (71 > 69)
Motivation = Success

- Impairment - the hearing impairment at the level of the organ or structure (the auditory system)

- Activity limitations and participation restrictions are viewed from the perspectives of the person and society.
Questionnaires

Screening Version of Hearing Handicap Inventory for the Elderly (HHIE-S) (Ventry & Weinstein, 1982)

Client Orientated Scale of Improvement (COSI) (Dillon, James & Ginis, 1997)

Abbreviated Profile of Hearing Aid Benefit (APHAB) (Cox & Alexander, 1995)

Characteristics of Amplification Tool (COAT) (Newman & Sandridge, 2006)
A 10 item self-assessment questionnaire designed to quantify the emotional and social effects of self-perceived hearing impairment
Hearing Handicap Inventory for the Elderly

Screening Version of the Hearing Handicap Inventory for the Elderly (HHIE-S)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>YES (4 pts)</th>
<th>SOMETIMES (2 pts)</th>
<th>NO (0 pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does a hearing problem cause you to feel embarrassed when you meet new people?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a hearing problem cause you to feel frustrated when talking to members of your family?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have difficulty hearing when someone speaks in a whisper?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you feel handicapped by a hearing problem?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a hearing problem cause you to attend religious services less often than you would like?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a hearing problem cause you to have arguments with family members?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a hearing problem cause you difficulty when listening to TV or radio?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you feel that any difficulty with your hearing limits or hampers your personal or social life?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RAW SCORE _______ (sum of the points assigned each of the items)

INTERPRETING THE RAW SCORE

0 to 8 = 13% probability of hearing impairment (no handicap/no referral)
10 to 24 = 50% probability of hearing impairment (mild-moderate handicap/refer)
26 to 40 = 84% probability of hearing impairment (severe handicap/refer)

HHIE-S

0 to 8 = 13% probability of hearing impairment (no handicap/no referral)

10 to 24 = 50% probability of hearing impairment (mild-moderate handicap/refer)

26 to 40 = 84% probability of hearing impairment (severe handicap/refer)
COSI

- Open-ended approach to problem identification
- The patient and clinician work together
- Identify up to five situations the patient feels are most impacted by the hearing loss
- Situations are prioritized and become the outcome goals of the intervention strategy
**iCOSI**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
<th>Select Sound Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Speech in Party Noise</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Moderate Classical Music</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Television, Radio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Undefined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Undefined</td>
</tr>
</tbody>
</table>

**Client**

- Personal Data
- Audiogram
- Needs Assessment

**Instruments**

- Pre-Fitting
- Fitting
- End Fitting

**Insight**

**Notes:**
APHAB

- 24-item self-assessment inventory
- Patient reports the amount of trouble they are having with communication or noises in various everyday situations.
- Scores for 4 subscales: Ease of Communication (EC), Reverberation (RV), Background Noise (BN), and Aversiveness (AV).
- Used pre and post treatment
<table>
<thead>
<tr>
<th></th>
<th>Without Hearing Aids</th>
<th>With Hearing Aids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>2.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>3.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>4.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>5.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>6.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>7.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>8.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>9.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
<tr>
<td>10.</td>
<td>A B C D E F G</td>
<td>A B C D E F G</td>
</tr>
</tbody>
</table>

A = Always (99%)
B = Almost Always (87%)
C = Generally (75%)
D = Half-the-time (50%)
E = Occasionally (25%)
F = Seldom (12%)
G = Never (1%)
COAT

- 9-item instrument

- Identifies important audiological and non-audiological issues prior to hearing aid fitting
Our goal is to maximize your ability to hear so that you can more easily communicate with others. In order to reach this goal, it is important that we understand your communication needs, your personal preferences, and your expectations. By having a better understanding of your needs, we can use our expertise to recommend the hearing aids that are most appropriate for you. By working together we will find the best solution for you.

Please complete the following questions. Be as honest as possible. Be as precise as possible. Thank you.

1. Please list the top three situations where you would most like to hear better. Be as specific as possible.

2. How important is it for you to hear better? Mark an X on the line.
   
   Not Very Important ________________________________ Very Important

3. How motivated are you to wear and use hearing aids? Mark an X on the line.
   
   Not Very Motivated ________________________________ Very Motivated

4. How well do you think hearing aids will improve your hearing? Mark an X on the line.
   
   I expect them to:
   
   Not be helpful ________________________________ Greatly improve my hearing

5. What is your most important consideration regarding hearing aids? Rank order the following factors with 1 as the most important and 4 as the least important. Place an X on the line if the item has no importance to you at all.
   
   — Hearing aid size and the ability of others not to see the hearing aids
   — Improved ability to hear and understand speech
   — Improved ability to understand speech in noisy situations (e.g., restaurants, parties)
   — Cost of the hearing aids

6. Do you prefer hearing aids that: (check one)
   
   — are totally automatic so that you do not have to make any adjustments to them.
   — allow you to adjust the volume and change the listening programs as you see fit.
   — have no preference

7. Look at the pictures of the hearing aids. Please place an X on the picture or pictures of the style you would NOT be willing to use. Your audiologist will discuss with you if your choice is appropriate for you — given your hearing loss and physical shape of your ear.

8. How confident do you feel that you will be successful in using hearing aids.
   
   Not Very Confident ________________________________ Very Confident

9. There is a wide range in hearing aid prices. The cost of hearing aids depends on a variety of factors including the sophistication of the circuitry (e.g., higher-level technology is more expensive than the more basic hearing aids) and size/style (e.g., the CIC hearing aids are more expensive than the BTE (intraural). The price ranges listed below are for two hearing aids. Please check the cost category that represents the maximum amount you are willing to spend.

   Please understand that you are not locked into that price range. It is just very helpful for us to know your budget so that we can provide you with the most appropriate hearing aids.

   — Basic digital hearing aids: Cost is between $XXXX to $XXXX
   — Basic Plan hearing aids: Cost is between $XXXX to $XXXX
   — Mid-level digital hearing aids: Cost is between $XXXX to $XXXX
   — Premium digital hearing aids: Cost is between $XXXX to $XXXX

Thank you for answering the questions.
Your responses will assist us in providing you with the best hearing healthcare.
Dexterity Screening

Pegboard Test

– Evaluates fine motor coordination and finger dexterity.
– Consists of a block with nine holes into which the subject has to place accompanying pegs.
Pegboard Test
Informal testing

Have your patient…

– Open battery door
– Peel off battery tab
– Insert battery into hearing aid and close door
Conclusion

Need to consider all aspects of the patient including:

- Formal and informal tests
- Speech in noise testing
- Assessments of communication difficulty
TIME Saver Tips

Give patient questionnaire while in waiting room

Add an additional 5 minutes to diagnostic battery for speech in noise testing

Complete informal test of dexterity
Once all information is gathered...

Can make appropriate style choice-
ITE, BTE, RIC

Can decide on technology level-
Premium, Advanced, Economy, Basic
Test Availability

HINT-Bio-logic Systems Corp
WIN- Send an email to Dr. Richard H. Wilson, richard.wilson2@va.gov
QuickSIN/BKB-SIN –www.etymotic.com
HHIE-S
http://www.desertsounds.net/Hearing_Handicap_Inventory_for_the_Elderly_Screening_Form.htm
COSI
APHAB
COAT


www.audiologyonline.com/articles/article_detail.asp?article_id=154


