Evidence-based Decision Making for Selecting & Fitting Hearing Aids

Presenter:
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Learning Objectives

1. Implement Type 2 thinking into your decision making process
2. Address common clinical questions with Type 2 thinking
   • Speech-in-Noise Testing
   • Hearing Aids and Dementia
   • Selecting the Right Level of Hearing Aid Technology
1st important point

• Taking the time to obtain one additional piece of information about the patient can be the difference between success and failure
1\textsuperscript{st} Important Point

• Use Type 2 thinking in the decision-making process with patients
  – Set you apart as the expert
  – A key component of patient-centered care
Remember when...
Type 2 Thinking

- Methodical
- Careful
- Intellectual
- Rationale
- Deliberate
- Logical
- Slow
Confident Clinicians....

Have moved from conscious incompetence to unconscious competence
Type 1 Thinking

- Hard wired
- Reflexive
- Swift judgments
- Task-oriented
- Relies on pattern recognition
- Fast
“The Lizard Brain”

• Habits take over
• Mental shortcuts based on:
  – Experiences with similar patients
  – Emotional polarization toward the patient
  – Cognitive biases:
    • Anchoring
    • Search sacrificing
    • Premature closure
    • Unpacking principle
    • Context errors
Type 1 (fast, reflexive) Processes
- Pattern Recognition
- Executive override
- Dysrationalia Override

Type 2 (slow, analytic) Processes
- Pattern Recognition
- Education
- Training
- Critical thinking
- Logical competence
- Rationality
- Feedback
- Intellectual ability

Hard wiring
Ambient conditions/Context
Task characteristics
Age and Experience
Affective state
Gender
Personality

Patient Presentation

Pattern Processor

RECOGNIZED

NOT RECOGNIZED

Calibration

Treatment Plan
Executive Override

- To reduce errors in judgment, experienced clinicians must find ways to use Type 2 thinking through a calibration process:
  - Clinical guidelines
  - Checklists
  - Feedback from others
  - Evidence-based decision making
A Common Blind Spot

Right Ear:
- SRT: 15dB
- WRS @55dB: 36%

Left Ear:
- SRT: 20dB
- WRS @60dB: 44%
A Common Blind Spot

Right Ear:
- SRT: 15dB
- WRS @55dB: 36%
- WRS@75dB: 84%

Left Ear:
- SRT: 20dB
- WRS @60dB: 44%
- WRS@80dB: 88%
Why avoid blind spots?
2nd Important Point

• Type 2 thinking contributes to one of the most critical aspects of patient-centered care:

• The informed decision – provides the benefits and harms of a treatment plan in the context of individual variation

• Cannot balance benefits and harms of the individual without critical thinking of thorough information you’ve gathered
Benefits vs. Harms

Clinical Judgments
Balancing Benefit & Harm

• Benefits:
  – Real world improvements in functionality
  – Quality of life
  – Value ($$)

• Harms:
  – Physical
  – Emotional
  – Financial
Scenario
Information Gathered

• 50 year old male
• Catastrophic insurance
• Non-localized, periodic chest pain
• Healthy lifestyle (non-smoking, active, etc)
• Negative family history of heart disease
Would you rather see a physician ..... 

• The physician in the habit of using Type 1 thinking

– or –

• One who relies on Type thinking?
Another Scenario
• Your 88 year old patent who you have fitted with 3 pairs of hearing aids over the past 20 years insists he try the new OTC product he read about in the NY Times.

• How do you convince him that may be the wrong course of action?
The Trusted Healthcare Professional

EBP

PCC
The Trusted Healthcare Professional

- Technical Communication
- Humanistic Communication
Technical Communication

- Results of the hearing test
- Acoustical & physical limitations
- Appropriate type or style of technology
- “Science”
Evidence-Based Decision Making (EBP)

1. What is it?
2. How does it work?
3. Why is it important?
Using EBP, a little like....

Going to the gym
If you want to keep it real simple, you can learn more about EBP by watching “The Myth Busters” on TV.
The Scientific Method

**Lab Evidence:**
- conduct an experiment in controlled or simulated conditions

**Real World Evidence:**
- observe and record actual events, use EBP guidelines – The Gold Standard
What is it?

A way to make clinical decisions using current best evidence. Does our recommendation work under real world conditions?
Why EBP

• Healthcare knowledge changes over time
• Individual professionals are prone to biases and errors when they rely too much on experience or intuition
• Patients have access to an abundance of information – both good and bad – someone has to sort it out
• Part of informed decision process
Key Points About EBP

• There is a process to evaluating research and applying it to the person in front of you
• Researchers look at many more patients (subjects) than any one professional
• When you take research findings into consideration before deciding on how to interpret a test or recommend a hearing aid feature, you are using EBP
Step 1: Generate a Focused Question

Is Digital Noise Reduction (as implemented in digital hearing aids) effective in real world listening situations in an adult population?
Step 2: Go to Pub Med and conduct key word searches

Digital noise reduction +
Hearing aids = 46 +

A. Benefit = 10
B. Satisfaction = 5
C. Clinical Effectiveness = 2
D. Usage = 0
E. Real World = 2
The objective and subjective evaluation of multichannel expansion in wide dynamic range compression hearing instruments.

PMID: 17344545 [PubMed - indexed for MEDLINE]

Amplification with digital noise reduction and the perception of annoying and aversive sounds.

PMID: 16959733 [PubMed - indexed for MEDLINE]

The effects of expansion on the objective and subjective performance of hearing instrument users.

PMID: 15807049 [PubMed - indexed for MEDLINE]

Comparison of three procedures for initial fitting of compression hearing aids. III. Inexperienced versus experienced users.
Step 3: Narrow the Search

1. Carefully read all the abstracts (15)
2. Eliminate all those that pertain to children, and implement DNR in analog hearing aids (e.g., ASP)
3. Those that make the cut (9) carefully read the entire article
4. Eliminate all those that didn’t use actual hearing aids, or were conducted in lab conditions only (5)
Step 4: Grade the Evidence

• Pay attention to:
  – Number of subjects
  – Blinding of subjects
  – Blinding of authors
  – Study design (randomized or non-randomized)

• Grade the evidence based on the study design
Study Design

**Randomized**
Subjects are assigned to one of two groups (treatment and control) using a specific randomization method

**Non-Randomized**
A study that does not use a control group
Levels of Evidence

- Level 1a: Meta-analysis of well-designed randomized control trials
- Level 1b: Well-designed randomized control trials
- Level 2a: Well-designed controlled study without randomization
- Level 2b: Well-designed quasi-experimental study
- Level 3: Well-designed non-experimental study (case studies)
- Level 4: Expert opinion or consensus statement
Step 5:
Make a Recommendation Based on Your Reading of the Evidence

DNR does not improve speech intelligibility in noise.
Did you know?

• Review articles and expert opinion are “good enough” forms of EBP
  – Gus Mueller’s 20Q
  – Courses & Talks by Independent Researchers at State meetings, AO, etc.
A Final Key Point

• Usually the evidence won’t tell you what to do, but it can tip the scale by helping you weigh the benefits and harms of any given recommendation, test or treatment
Clinical Scenarios

• Hearing Aid Selection & Counseling
Blind Spot?

- Right Ear:
  - WRS at 75dB = 88%

- Left Ear:
  - WRS @ 80dB = 84%
Blind Spot?

- **Right Ear:**
  - WRS at 75dB = 88%
  - SNR loss = 10dB

- **Left Ear:**
  - WRS @ 80dB = 84%
  - SNR loss = 12dB
Question

- Is it worth spending 5 to 10 minutes of clinical time with a patient to conduct speech in noise testing during the pre-fitting evaluation?
Optometry
Visual Acuity

Snellen Eye Chart

<table>
<thead>
<tr>
<th>Number</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20/200</td>
</tr>
<tr>
<td>2</td>
<td>20/100</td>
</tr>
<tr>
<td>3</td>
<td>20/70</td>
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<tr>
<td>4</td>
<td>20/50</td>
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<td>20/40</td>
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<td>6</td>
<td>20/30</td>
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<td>20/25</td>
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<td>20/20</td>
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<tr>
<td>9</td>
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<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>
Colorblindness
Presbyopia

This is a visual test to see whether or not you are suffering from presbyopia (age-induced far-sightedness). As we advance down the screen, the text is getting smaller and smaller, but a person with proper eye-sight should have no trouble at all reading even the smallest print in this image. Admittedly, you might need to lean in towards the screen some, but there’s nothing wrong with that. In fact, the real test of presbyopia is that even as you bring text closer to your eye to read, you are no longer able to focus on it properly. It will seem fuzzy and may even jitter and dance as you struggle unsuccessfully to bring it into focus. Are you having any difficulty yet? If you are, then you are mostly likely far too old and feeble to function in this MTV generation world. So, get out of the way, Grampa.

How did you do? Are you old? Or just gullible?
Hearing Care Professionals

• No matter the patient complaint, 80% of professionals use the same battery of tests:
  – Air conduction thresholds
  – SRT
  – WRS in quiet at MCL
  – Bone conduction thresholds
Why we do speech intelligibility testing
Auditory Pathways

- Ascend via the lateral meniscus tract on ipsilateral side to the **inferior colliculus** in the midbrain.
- Fourth order neurons travel to the **medial geniculate nucleus (MGN)** in the thalamus.
- Terminate in the **primary auditory cortex** in the temporal lobe.
- Tonotopic organization maintained from cochlear nuclei to auditory cortex.
The Performance-Intensity Function

In this case, so the score can improve significantly.
The Limitations of the Audiogram

Increasing test level or high fq. gain engages more cochlear regions, which can contribute in this case. So the score can improve significantly.

Increasing test level or high fq gain engages more cochlear regions, but some cannot contribute.

So the score will not improve significantly.
“I already do speech testing in quiet, why take the time to do a speech in noise test?”
5 Reasons to do speech intelligibility-in-noise tests

1. Addresses most common complaint
2. Provides insight into most appropriate amplification strategy
3. Used to counsel patient about realistic expectations
4. Monitor aided performance over time
5. To help patients make decisions
Wilson and McArdle, JRRD, 2005. N = 387

"Bad is Bad"
Wilson and McArdle, JRRD, 2005. N = 387

“Good may be bad”
Choices of speech intelligibility in noise tests

Fixed Tests:
- An entire word or sentence list is given at the same, fixed SNR level
- Advantage: easy to conduct, easy to score & talk about (% correct)
- Limitation: too easy or too hard
- Example: Connected Speech Test
Choices of speech intelligibility in noise tests

Variable Tests:
• The SNR varies within the test
• Advantage: Find the SNR level where communication breaks down (50% correct mark)
• Disadvantage: Not typically scored as a % correct
• Examples: WIN, HINT
Quick SIN and BKB-SIN Test

Etymotic Research, Killion et al.
Conducting the Quick SIN (Standard Unaided Approach)

- Under earphones
- Test each ear separately
- Loud MCL (70-75db HL)
- Don’t use lists 4,4,13 and 16
The QuickSIN:
A sample scoring of a list of six sentences

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

1. A white silk jacket goes with any shoes.  
S/N 25  
Score 5

2. The child crawled into the dense grass.  
S/N 20  
Score 5

3. Footprints showed the path he took up the beach.  
S/N 15  
Score 4

4. A vent near the edge brought in fresh air.  
S/N 10  
Score 3

5. It is a band of steel three inches wide.  
S/N 5  
Score 2

6. The weight of the package was seen on the high scale.  
S/N 0  
Score 0

25.5 - TOTAL = 6.5 SNR Loss  
TOTAL 19
If annoyance is a priority.....
Acceptable Noise Level Test

1. Obtain MCL with speech
2. Introduce background noise (BNL)
3. Instruct patient to tell you when noise can longer be “put up with”
4. MCL – BNL = ANL score
5. ANL less than 7 dB = full time user (Nabelek, et al 2006)
uHEAR app
Average ANLs for different groups

(Nabelek et al, 2006)

• Full-time users (n=69) 7.7
• Part-time users (n=69) 13.5
• Non-users (n=53) 14.4
ANL as a predictor of hearing aid use or success

- More than 40 peer reviewed studies
- Results tended to suggest that the ANL was not a valid predictor of either use or success
Another study

• Wu et al IJA 2016
• Does ANL predict hearing aid use or success at 3 months and 12 months post-fitting?
Study Design

• N= 132
• Mean age 72
• 103 new users, 29 experienced users
• 67 bilaterally fitted
• Outcome measured with IOI-HA and Hearing Aid Usage Questionnaire (full, part or non user)
INTERNATIONAL OUTCOME INVENTORY FOR HEARING AIDS (IOI-HA)

1. Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?
   
   none  less than 1 hour a day  1 to 4 hours a day  4 to 8 hours a day  more than 8 hours a day
   □     □                     □          □                          □                  □

2. Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in those situations?
   
   helped not at all  helped slightly  helped moderately  helped quite a lot  helped very much
   □     □                      □         □                   □                   □

3. Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?
   
   very much difficulty  quite a lot of difficulty  moderate difficulty  slight difficulty  no difficulty
   □     □                      □         □                   □                   □

4. Considering everything, do you think your present hearing aid(s) is worth the trouble?
   
   not at all worth it  slightly worth it  moderately worth it  quite a lot worth it  very much worth it
   □     □                      □         □                   □                   □

5. Over the past two weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?
   
   affected very much  affected quite a lot  affected moderately  affected slightly  affected not at all
   □     □                      □         □                   □                   □

6. Over the past two weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?
   
   bothered very much  bothered quite a lot  bothered moderately  bothered slightly  bothered not at all
   □     □                      □         □                   □                   □

7. Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?
   
   worse  no change  slightly better  quite a lot better  very much better
   □     □                      □         □                   □                   □

8. How much hearing difficulty do you have when you are not wearing a hearing aid?
   
   severe  moderately-severe  moderate  mild  none
   □     □                      □         □                   □                   □
## Results

<table>
<thead>
<tr>
<th>IOI-HA</th>
<th>Outcome / Success Rate</th>
<th>ANL Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>27.3  63.1%</td>
<td>9.8</td>
</tr>
<tr>
<td>12 months</td>
<td>28.1  73.1%</td>
<td>10.1</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Hearing aid success</th>
<th>ANL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA Use</td>
<td>Full/Part/Non-user</td>
<td>Success / Unsuccess</td>
</tr>
<tr>
<td>3 months</td>
<td>99/28/4</td>
<td>75.6</td>
</tr>
<tr>
<td>12 months</td>
<td>94/23/11</td>
<td>73.4</td>
</tr>
</tbody>
</table>
What the Results Mean

• For first time users, if the ANL score is 10 or higher there is 65% chance the person will be an successful user
Benefit vs. Harm

Benefits
• Set precise expectations
• Address chief complaint
• Establish baseline for aided benefit
• Help with counseling
• Monitor performance over time
• Help patient make a decision
• Time = Trust

Harms
• Make the patient tired
• Take up too much time
Hearing Aid Use and Cognitive Decline
As Hearing Loss Increases, So Does Your Dementia Risk

Many of the symptoms associated with early Alzheimer's disease are the same as those associated with hearing loss. In fact, among those over 60, hearing loss accounted for over one-third of the risk of developing dementia and Alzheimer's.

Brain and Hearing

How We Hear

Sound travels into the ear and stimulates small hair cells

Vibration of the hair cells trigger electrical impulses to travel along nerves to the brain stem

Brain Activity & Hearing Are Related

- The temporal cortex, occipital cortex, posterior parietal cortex and brain stem all play a role in...
HL: Scope of the problem

In US
- 30 million people with HL
- 12.7% of those age > 12 years

Overwhelmingly, aging most important risk factor
- 3% among adults 20-29 years
- 45% in 70-74 years
- 80% in 85+ years

Noise exposure an important contributor
- Occupational, esp. military
- Recreational ♫
Associated conditions:
- Social isolation, depression
- Falls, hospitalizations, increased death rate
- Accelerated cognitive decline
  - vs. cognitive impairment

Note of caution: association & causation
Important Point

There is a range of cognitive function in the elderly.
There is a range of cognitive function in the elderly.

**Normal Aging:**
Perform tasks more slowly, slower reaction times compared to younger person.

**Mild Cognitive Impairment:**
Subjective memory complaint, borderline low score on test of dementia.

**Dementia:**
Deficits on multiple domains of cognitive function, diagnosed by physician.
What is dementia?

• A progressive global impairment in thinking, understanding, learning and remembering

• **Per DSM-V, diagnosis is a three-step process:**
  • Patient (or family member) must report significant cognitive decline
  • Patient must score significantly low on test of dementia
  • A complete medical work up to rule out depression and delirium

• **Involves some combination of cognitive deficits in the following areas:**
  - Language ability, fine-motor skills, memory, executive function (planning, organizing, sequencing, abstracting thinking)
1. Depression

2. **Delirium** — acute onset, often medication related

3. **Dementia** — progressive in nature

Medical evaluation is needed to rule out treatable conditions of depression and delirium.
Worldwide Incidence (# of new cases per year):
- 35.6 mil in 2012
- 60 mil in 2030
- 114 mil in 2050

Prevalence of dementia doubles every 5 years after the age of 60:
- ~5% of individuals 65 and over have dementia
- 40% to 50% of individuals 85 and over have dementia
- 25% to 45% of community dwelling elders over 85 have dementia
- Over 50% of elders aged 85 and older in nursing homes
• 60% to 70% of dementia cases are due to Alzheimer’s disease

• 30% to 40% stem from other causes:
  - Vascular diseases (e.g., stroke)
  - Parkinson’s disease
  - Lewy body dementia
Mild Cognitive Impairment (MCI)
MCI

• 5 times more likely than dementia
• 20% to 40% of adults 65 and older have MCI
• Higher incidence in people with cardiovascular problems and diabetes
• Cognitive training & medication may slow down MCI
What is the role of the HCP?

To screen or not to screen for dementia?
Screening for Cognitive Decline

• Mini-Mental States Exam (MMSE) is most common

• Scored on a 30 point scale:
  – 27-30: normal cognition function
  – 20-26: mild cognitive function
  – 10-19: dementia
  – 10 or less: severe dementia

• Requires the perception of auditory language to complete

• Not as sensitive for detection of MCI
1. Orientation
5 ( ) What is the (year) (season) (date) (day) (month)?
5 ( ) Where are we (state) (country) (town) (hospital) (floor)?

2. Registration
3 ( ) Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trials ________

3. Attention and Calculation
5 ( ) Serial 7’s. 1 point for each correct answer. Stop after 5 answers. Alternatively spell “world” backward.

4. Recall
3 ( ) Ask for the 3 objects repeated above. Give 1 point for each correct answer.

5. Language
2 ( ) Name a pencil and watch.
1 ( ) Repeat the following “No ifs, ands, or buts”
3 ( ) Follow a 3-stage command: “Take a paper in your hand, fold it in half, and put it on the floor.”
1 ( ) Read and obey the following: CLOSE YOUR EYES
1 ( ) Write a sentence.
1 ( ) Copy the design show
Screening for Cognitive Decline

- Montreal Cognitive Assessment (MoCA)
- 30 point scale:
  - 26-30: normal
  - 19-25: MCI
  - 18 or less: Dementia
- More sensitive for identifying MCI or early Alzheimer’s
MONTREAL COGNITIVE ASSESSMENT (MOCA)
Version 7.1 Original Version

VISUOSPATIAL / EXECUTIVE

Copy cube

Draw CLOCK (Ten past eleven) (3 points)

NAMING

Contour Numbers Hands

MEMORY
Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

1st trial

2nd trial

Subject has to repeat them in the forward order

Subject has to repeat them in the backward order

ATTENTION
Read list of digits (1 digit/sec.).

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors


Serial 7 subtraction starting at 100

FACE VELVET CHURCH DAISY RED

No points

LANGUAGE
Repeat: I only know that John is the one to help today. [ ]

The cat always hid under the couch when dogs were in the room. [ ]

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words)

ABSTRACTION
Similarity between e.g. banana - orange - fruit [ ] train - bicycle [ ] watch - ruler

DELAYED RECALL
Has to recall words with no cue

Category cue

Multiple choice cue

Optional

ORIENTATION

Date Month Year Day Place City

Points for UNCUED recall only

© Z.Nasreddine MD www.mocatest.org

Administered by:

Total

Normal ≥ 26 / 30

Add 1 point if ≤ 12 yr edu
Screening for Cognitive Decline

- **Mini-Cog** ([www.mini-cog.com](http://www.mini-cog.com)) ([https://consultgeri.org/try-this/general-assessment/issue-3.1](https://consultgeri.org/try-this/general-assessment/issue-3.1))
  - Give 3 words from list & recall the words (3 pts)
  - Draw Clock Test (DCT) (2 pts)

- **2-minutes to complete**

- **Score:**
  - 0 Positive for cognitive impairment
  - 1-2 + Abnormal CDT then positive for cognitive impairment
  - 1-2 + Normal CDT then negative for cognitive impairment
  - 3 Negative screen for dementia (no need to score CDT)
To screen or not to screen?

- By virtue of your test process, you are indirectly measuring executive function
- If you’ve corrected for hearing loss and the patient cannot answer case history questions and complete the standard test battery
- Red flags for referral for cognitive evaluation
Blind Spot?

- Right Ear:
  - WRS at 75dB = 88%
  - SNR loss = 10dB

- Left Ear:
  - WRS @ 80dB = 84%
  - SNR loss = 12dB
Blind Spot?

- Right Ear:
  - WRS at 75dB = 88%
  - SNR loss = 10dB
  - MiniCog: 0

- Left Ear:
  - WRS @ 80dB = 84%
  - SNR loss = 12dB
  - MiniCog: 0
Dementia/Alzheimer Patients

Focus on Alternative Approaches:

- Enjoyment of music
- Watching TV
- Relaxation (sound therapy)

Involve:

- Family
- Caretaker
- Staff at long term care facility
Music and TV

Xtunity

HyperSound
Neck-band Amplifiers
Considerations outside your clinic

Network with physicians/nurses:

- Physicians need to be aware of hearing status of patients before a cognitive test is administered.
- Encourage physicians/nurses who administer these tests to use PSAPs/Pocketalker/Apps during evaluation to improve audibility.
- Educate about link between hearing loss and cognitive decline: “All adults over the age of 55 should have their hearing screened every 1-2 years.”
Will hearing aids improve this?

- **Right Ear:**
  - WRS at 75dB = 88%
  - SNR loss = 10dB
  - MiniCog: 0

- **Left Ear:**
  - WRS @ 80dB = 84%
  - SNR loss = 12dB
  - MiniCog: 0
Let’s go to the research

- 3 recent studies that examined the relationship between hearing aid use and cognitive ability over a long period of time
Study #1

- Deal et al 2015 Am J Epidemiology
- 253 adults followed over a 20 year period
- Mod-Sev HL=85, Mild HL=95, No HL=73
- 51/85 with Mod-Sev HL Wore Hearing Aids
- Three cognitive tests administered at 1, 5 and 20 year interval
What they found

• Non-hearing aid users had higher incidence of depression, hypertension & diabetes
• Degree of hearing loss was associated with magnitude of cognitive decline
• Hearing aid use showed a positive effect on just 1 of the 3 cognitive tests over the 20 year follow-up
Study #2

• 3,670 individuals over a 25-year period
• Self-reported hearing loss into 3 categories: normal, moderate or major
• Divided into 3 groups: normal hearing, non-hearing aid users (with HL) and hearing aid users
• Hearing aid users had the highest (best) MMSE scores, non-hearing aid users had the lowest MMSE score
What they found

- Study did not compare cognitive decline in HA users directly to non-HA users or report the characteristics of HA use
- No difference among the two groups with hearing loss
Study #3

- **4,541 individuals between ages of 48 and 92 living in Beaver Dam, Wisconsin and followed for 11 years**
- Of this group, **666 has moderate HF loss (or worse)**
- **666 participants were divided into 2 categories: new hearing aid user, non-user group at baseline**
What they found

• Hearing aid use had no significant impact on cognitive function at the end of the 11 year period
• Hearing aid users had better scores than non-users on measures of physical health
What these studies mean

1. No evidence to suggest hearing aids slow down cognitive decline
2. Hearing aids do seem to improve psychosocial behaviors and activity levels for individuals with hearing loss
3. Hearing aid wearers are likely to be more socially active, indirectly hearing aid may help minimize day-to-day consequences of dementia and improve quality of life
4. Hearing aids (along with diet, exercise and social engagement) are an important part of staying as active and healthy as possible as people age
Face-to-face with 85 y/o patient with MCI

- Based on the research, what can you say about hearing aid use and cognitive decline?
Benefit vs. Harm

Benefits (Pros)
• Keep you active & engaged with others
• Improve quality of life
• Enjoy music, family gatherings

Harms (Cons)
• Can’t say that hearing aids improve cognitive function
Face-to-face with active & healthy 60 year with mild hearing loss
Benefit vs. Harm

Benefits (Pros)
• Hearing aid use may slow decline of hearing loss
• Indirectly this may slow onset of cognitive decline

Harms (Cons)
Mislead patient into thinking hearing aids will prevent dementia
Choosing the “Right” Level of Technology
Recent Studies

- Cox, Johnson, Xu, Gerontology, Aug 2014 (n=25)
- Cox, Johnson, Xu, Ear and Hearing, P-A-P, 2016 (n=45)
- New & experienced users with mild to moderate HL
- Blinded month long trials
- Outcomes measured:
  - Speech understanding
  - Standardized questionnaires
  - Diary entries/interviews
Table 1: Differences, as described by manufacturers A and B, between basic and premium features in the four research hearing aids.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Hearing aids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>premium A</td>
</tr>
<tr>
<td>1 Number of compression channels</td>
<td>16</td>
</tr>
<tr>
<td>2 Directional microphone</td>
<td>automatic</td>
</tr>
<tr>
<td></td>
<td>multi-channel</td>
</tr>
<tr>
<td>3 Environmental adaptation</td>
<td>more</td>
</tr>
<tr>
<td>4 Binaural data streaming</td>
<td>yes</td>
</tr>
<tr>
<td>5 Automatic learning of preferred volume</td>
<td>yes</td>
</tr>
<tr>
<td>6 Noise reduction</td>
<td>7 steps</td>
</tr>
<tr>
<td>7 Wind reduction</td>
<td>yes</td>
</tr>
<tr>
<td>8 Reverberation cancellation</td>
<td>no</td>
</tr>
<tr>
<td>9 Impulse noise suppression</td>
<td>3 steps</td>
</tr>
<tr>
<td>10 Digital pinna</td>
<td>yes</td>
</tr>
</tbody>
</table>

Only features that differed between basic and premium models are included. Features 1–4 are designed to improve speech understanding for the premium model compared to the basic model.
Fig. 2. Mean speech understanding in noise in each condition tested in the laboratory. Data are for listening unaided and with two basic-feature and two premium-feature hearing aids. Error bars show 1 SD.
Fig. 3. Mean speech understanding in daily life situations reported on the APHAB questionnaire for unaided listening and listening with two basic-feature and two premium-feature hearing aids. Error bars show 1 SD.
Fig. 5. Change in hearing-related quality of life when using each hearing aid in daily life. The size of each bubble is proportional to the number of participants who gave that score. The score with the downward arrow was -5, corresponding to ‘A good deal worse’.
U of Iowa Study

- Wu et al submitted for publication
- 50 + adult subjects
- Premium vs. basic technology
- Features on vs. Features off
- Lab and Real World Measures ("Ecological Momentary Assessment")
- Features “on” in either premium or basic lead to best real outcomes
Implications of this Research

• Cost of devices does not seem to drive outcomes
• More technology is not necessarily better for patient or cost-effective for third party payers
• There are some individuals (maybe complex cases) that do benefit from premium technology – how do we identify them?
Benefit vs. Harm

Benefits
- “Standard” technology is effective for most patients
- Those that can’t afford premium aren’t necessarily giving up anything

Harms
- Overpaid for hearing aids
Technology & Service Options

Basic
$2200

Standard
$3600

Premium
$6000

Non Custom*
$700

Advanced
$4800

*Additional Fee for unlocking non-custom device
Conclusions

• Discuss benefits and harms based on evidence
• Use Type 2 decision tools to avoid blind spots
General Checklist

- Obtain medical and communication history
- Complete a comprehensive test battery, including speech testing at multiple levels and SNRs
- Pause to reflect – is my judgment being biased in anyway?
- Embark on a treatment plan – discuss pros and cons of all options
Questions

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