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What's New About Getting Old? The Implications of Normal Aging for Audiologists and Hearing Aid Manufacturers

Brian Taylor

Acknowledgement



What's New About Getting Older?

*with Kathy Pichora-Fuller, PhD, Aud(C),
RAUD, FCAHS*

I invite Canadian audiologists to join me in resolving to make 2024 the year to move hearing care into a new era of integrated person-centered, inter-professional primary care. Together we can help older adults to function better by working towards communication accessibility.

Disclosures

BRIAN TAYLOR, AuD

Senior Director, Audiology, Signia

Editor, Audiology Practices (ADA)

Editor-at-Large, HHTM blog

Adjunct Instructor, University of Wisconsin



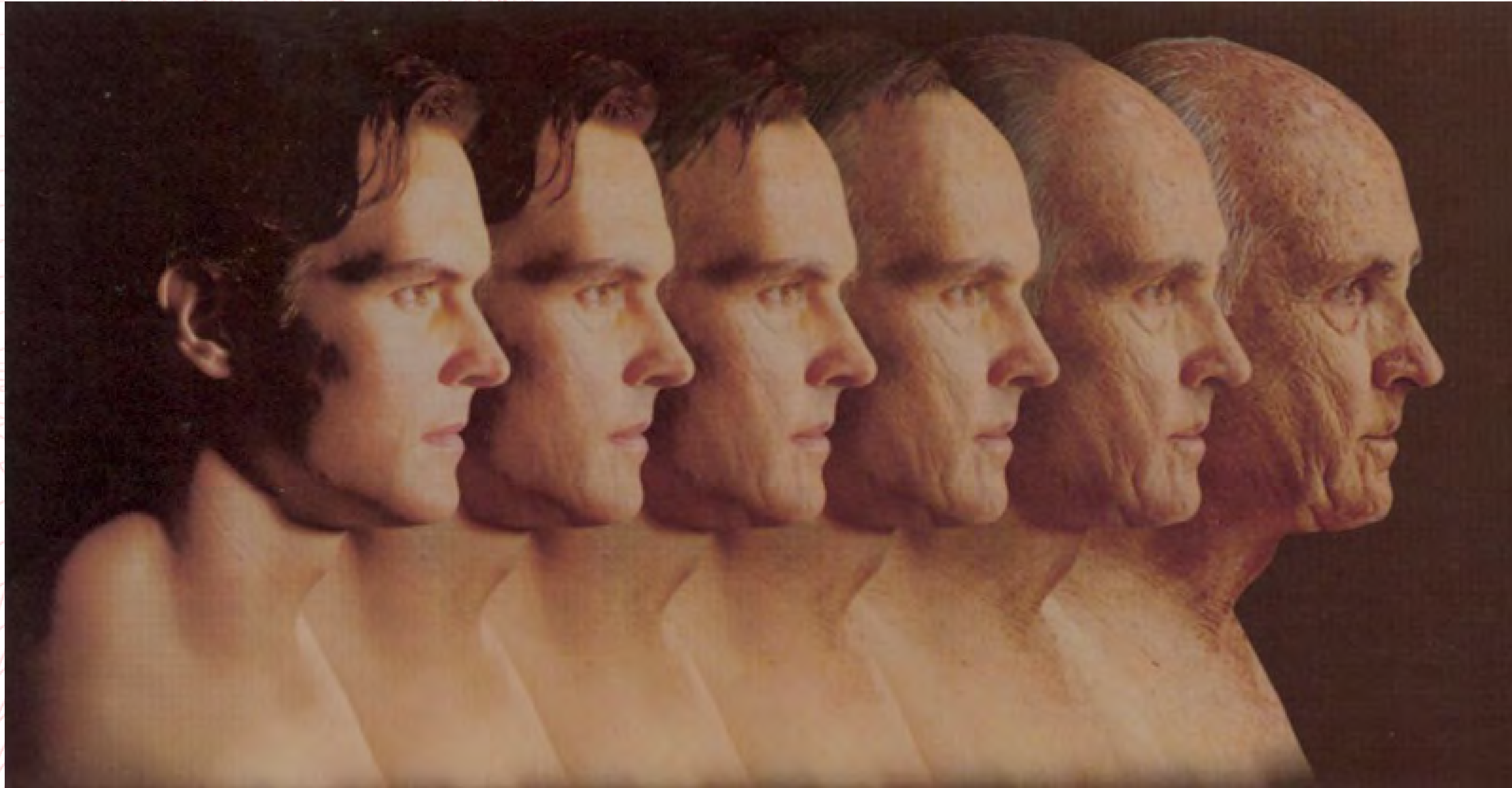
Learner Outcomes

- 1) After this course, participants will be able to define the physical changes in the auditory system related to normal aging.
- 2) After this course, participants will be able to describe technical solutions to improve group conversations.
- 3) After this course, participants will be able to implement four clinical tools to better assess the individual's aging auditory system.

Key Questions

1. What is normal aging and how might it differ from cognitive decline and dementia?
2. How does normal aging affect the auditory system, and how we can account for those changes?
3. How does normal aging affect communication in demanding listening situations?
4. How might normal aging affect how we fit and program hearing aids?
5. How can we ensure “normal aging” is “successful aging?”

What happens to the auditory system as we age?



The Lived Experience of Hearing Loss

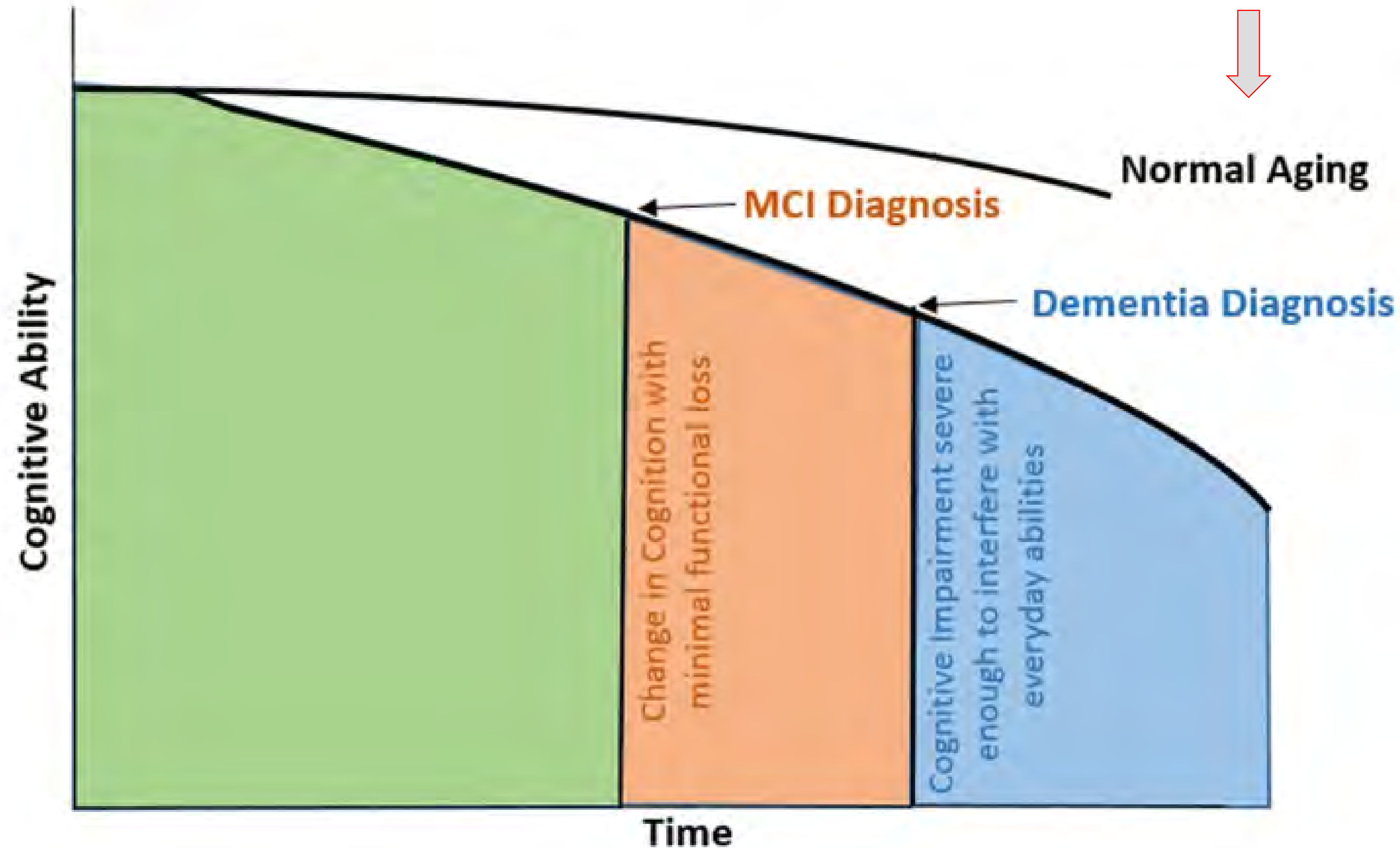


Key point #1: We typically assess just a small part of this lived experience

Key point #2: We are well equipped to assess in a more holistic manner

Most individuals seen in the clinic experience normal aging

87% of adults in US



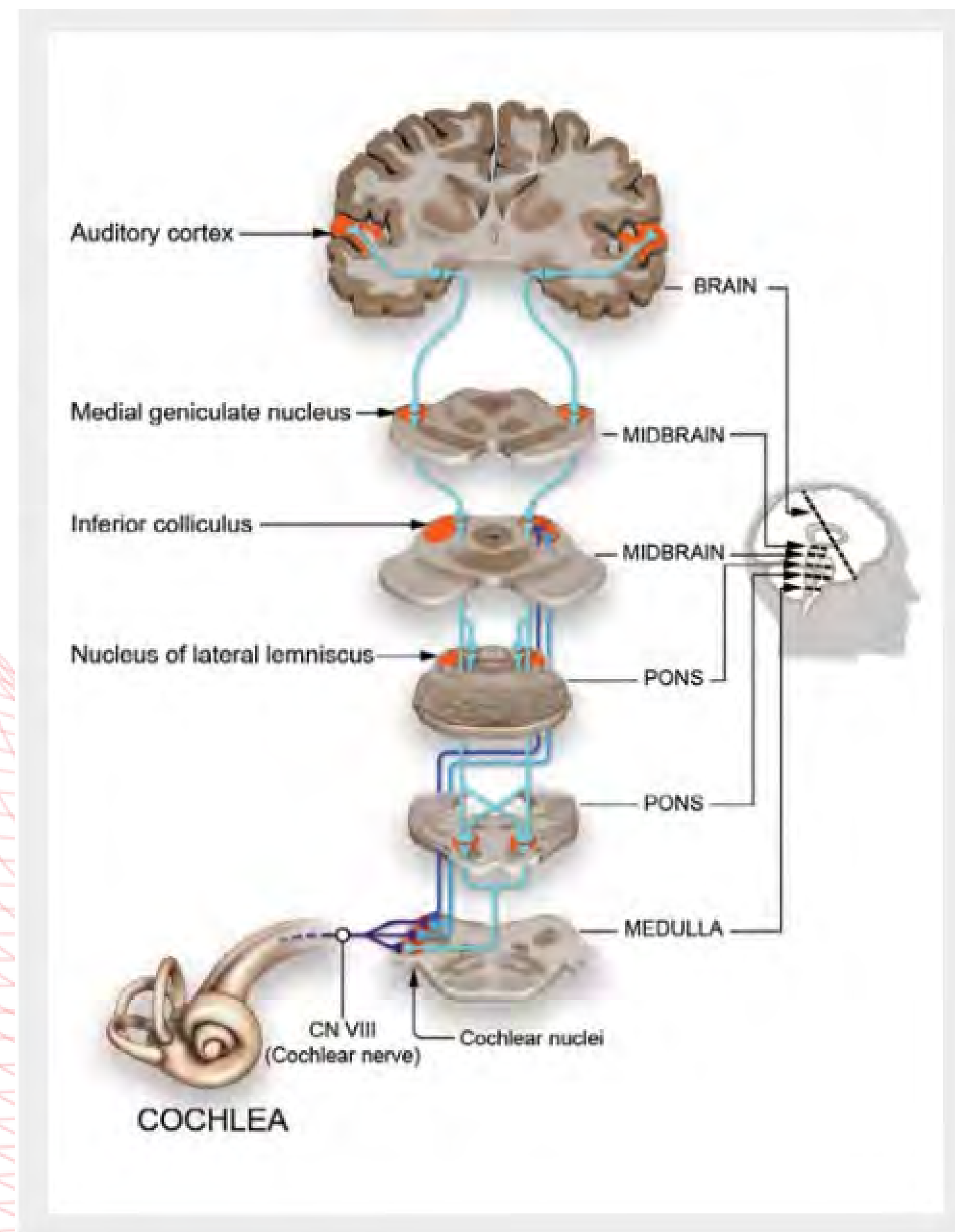
Source: Powell, D. S., Oh, E. S., Lin, F. R., & Deal, J. A. (2021). Hearing Impairment and Cognition in an Aging World. *Journal of the Association for Research in Otolaryngology : JARO*, 22(4), 387–403.

Normal Aging and its Effects on the Auditory System

- How does normal aging affect the auditory system?

Normal Aging and Auditory Processing Pathways

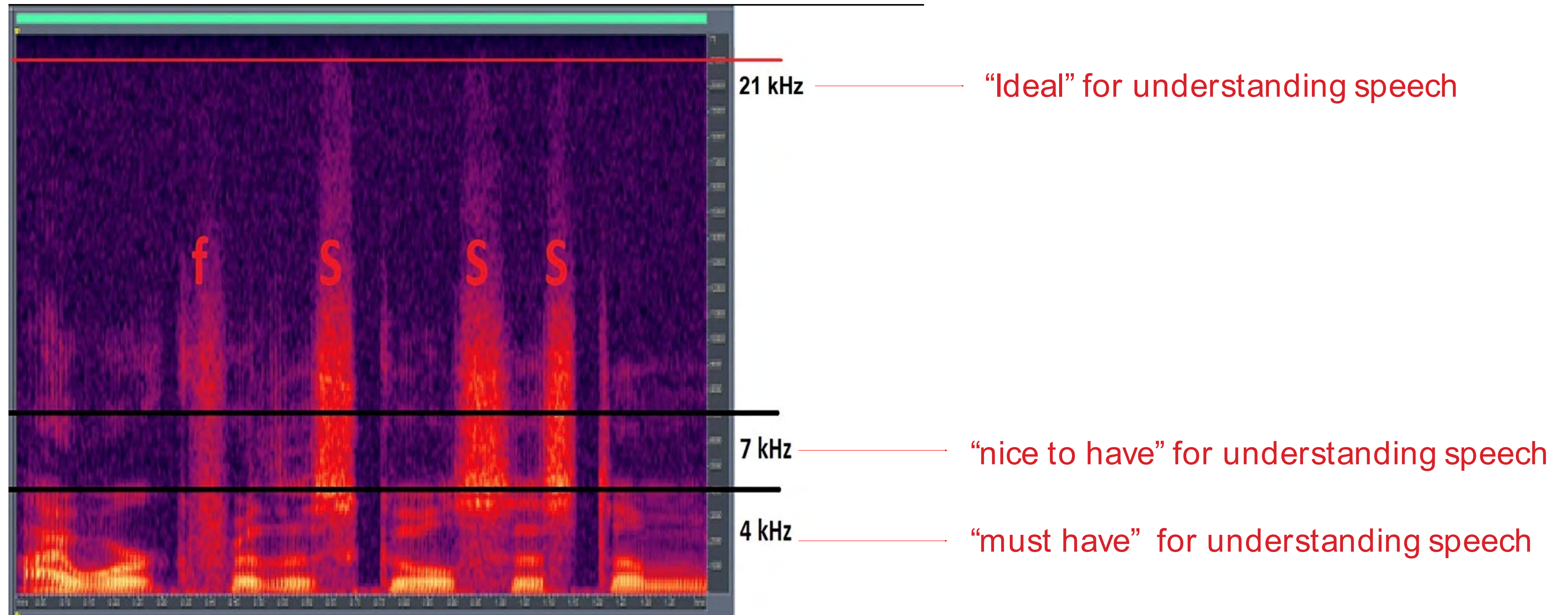
Sound enters the auditory system in the cochlea before proceeding up a complicated set of subcortical nuclei leading to the primary auditory cortex.



Why do People Struggle in Conversational Situations as They Age?

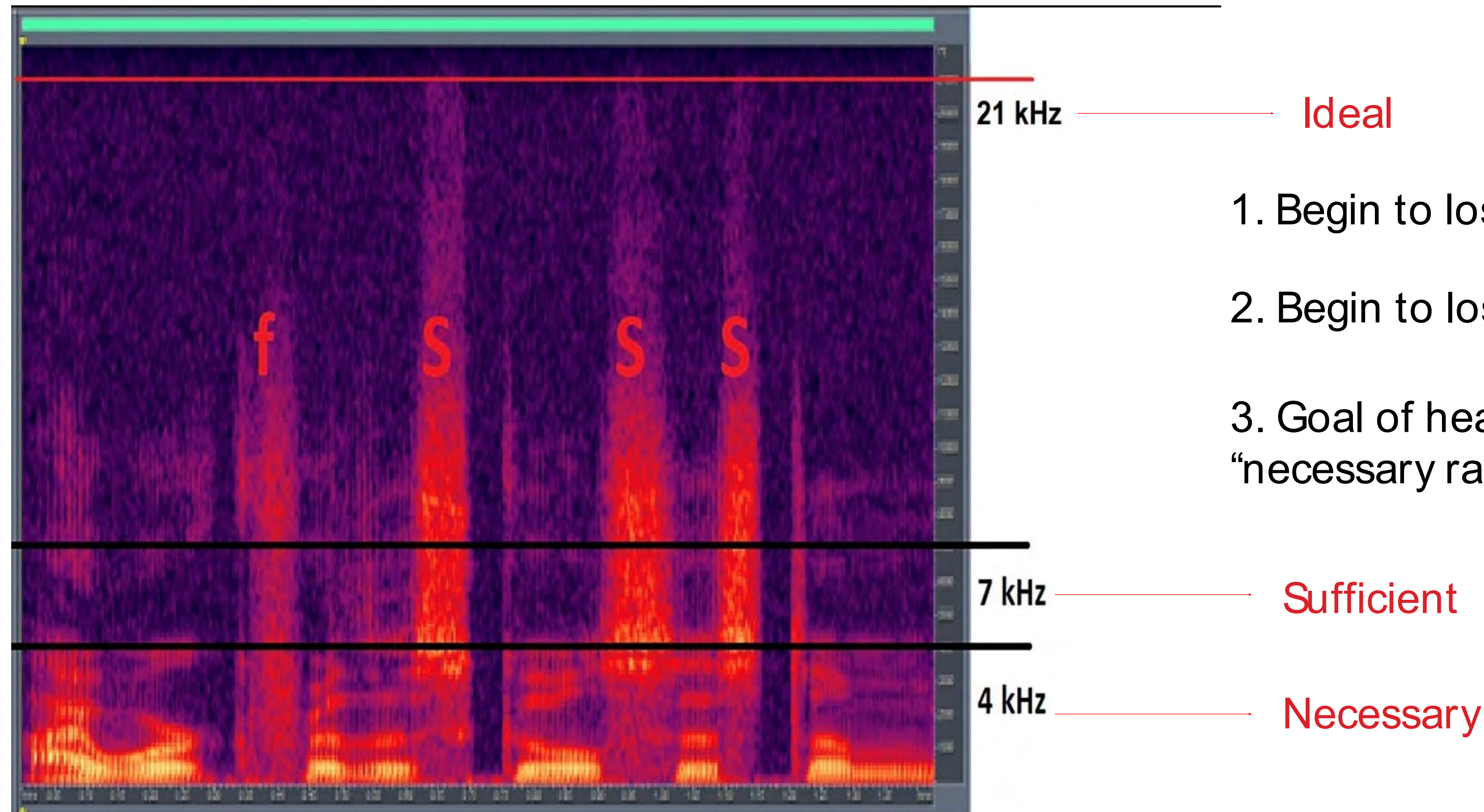


Extended high frequency hearing loss



“I work for the school system”

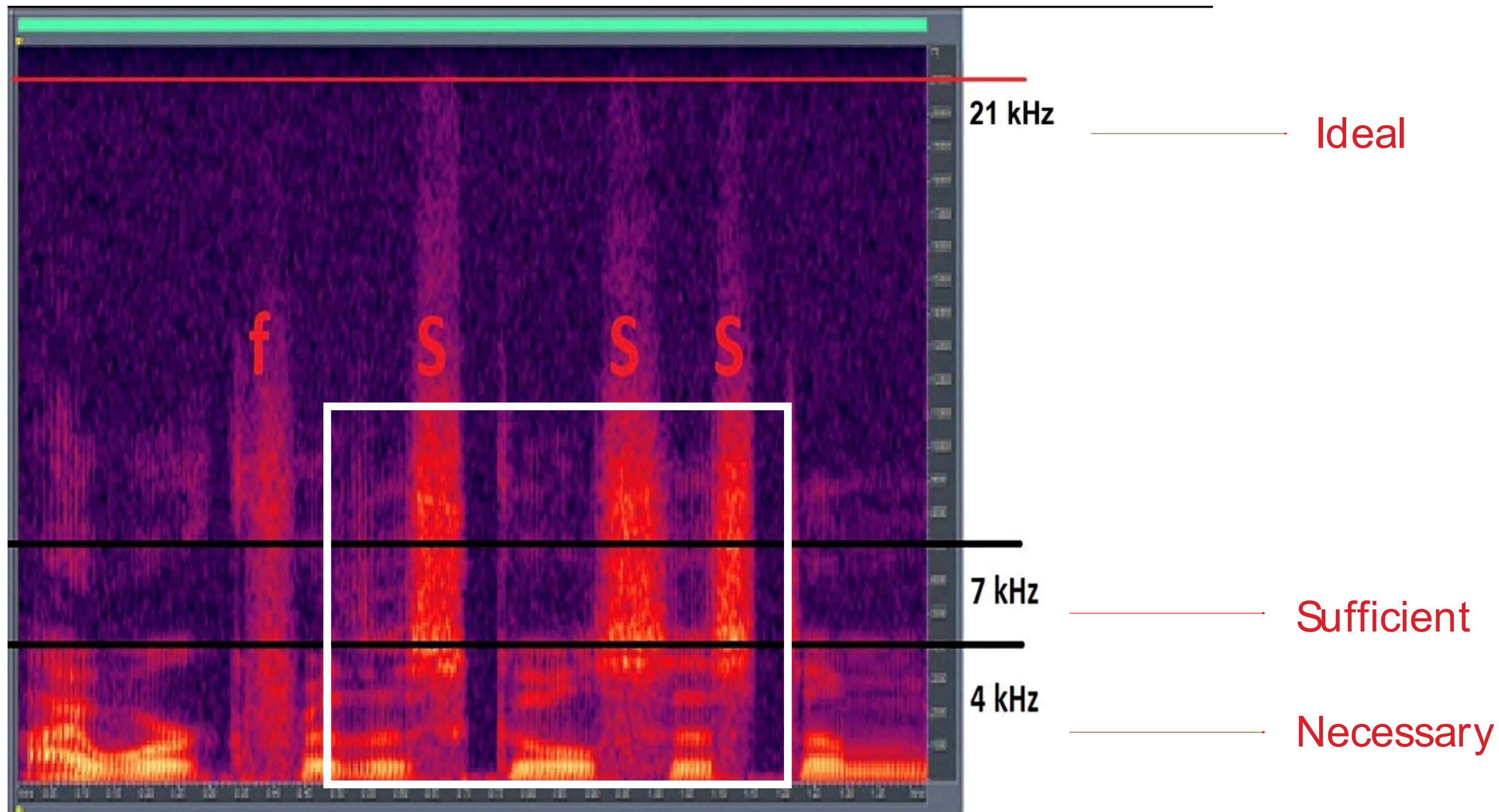
Extended high frequency hearing loss



1. Begin to lose "ideal" range in 20s-30s
2. Begin to lose "sufficient" range in 30-40s
3. Goal of hearing aids is to restore "necessary range"

"I work for the school system"

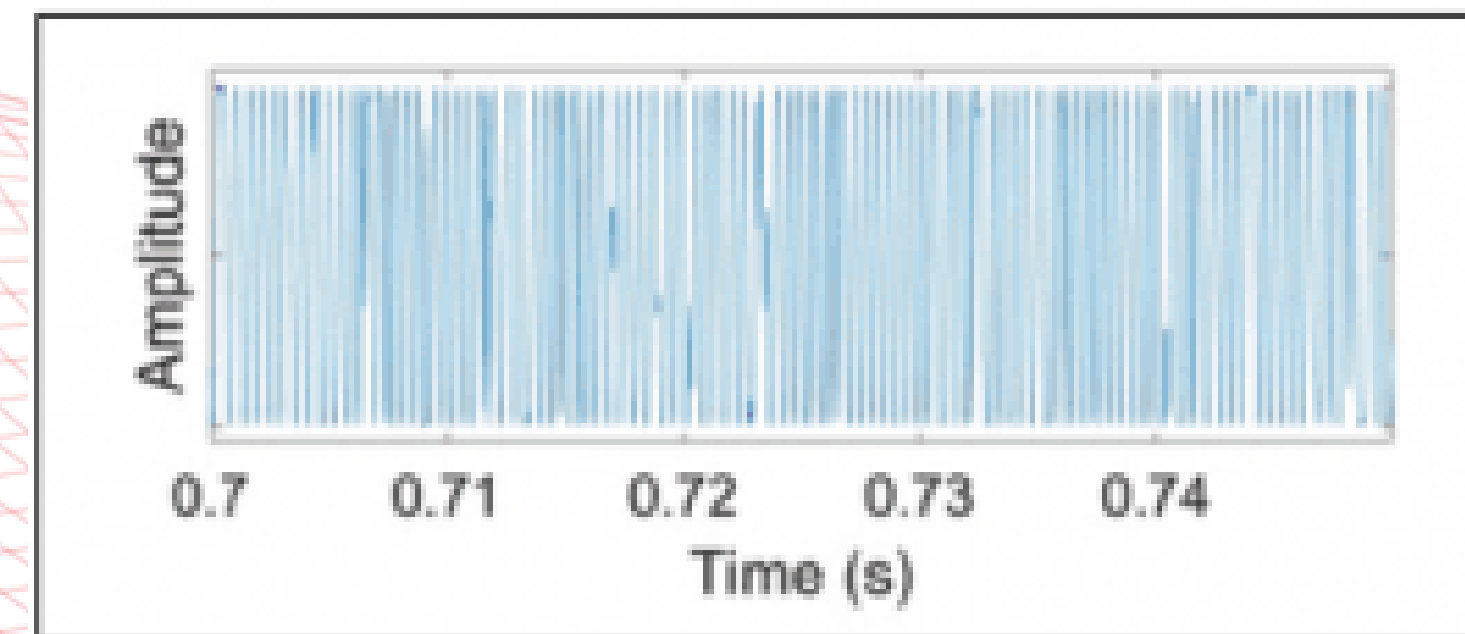
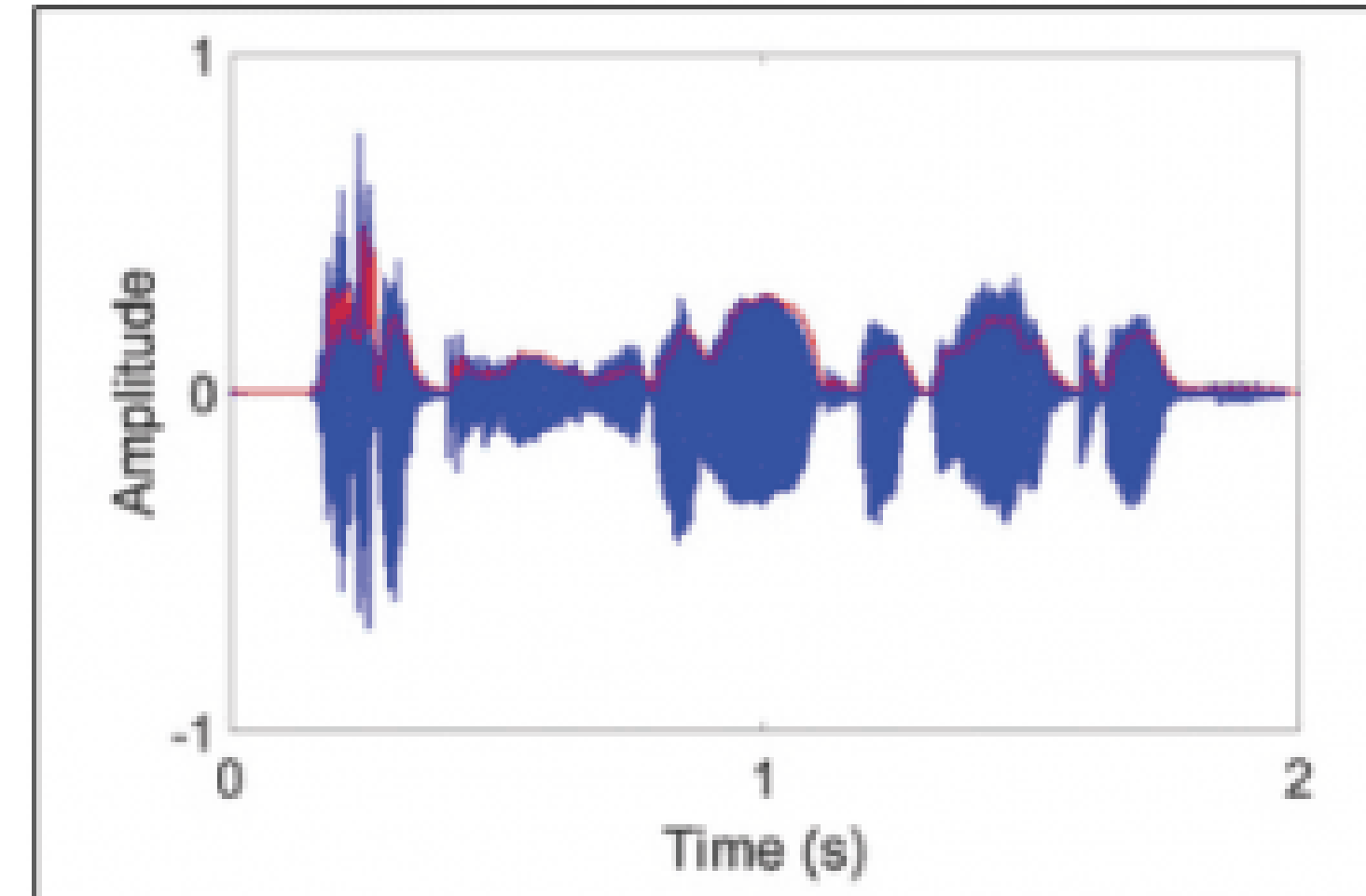
Extended high frequency hearing loss



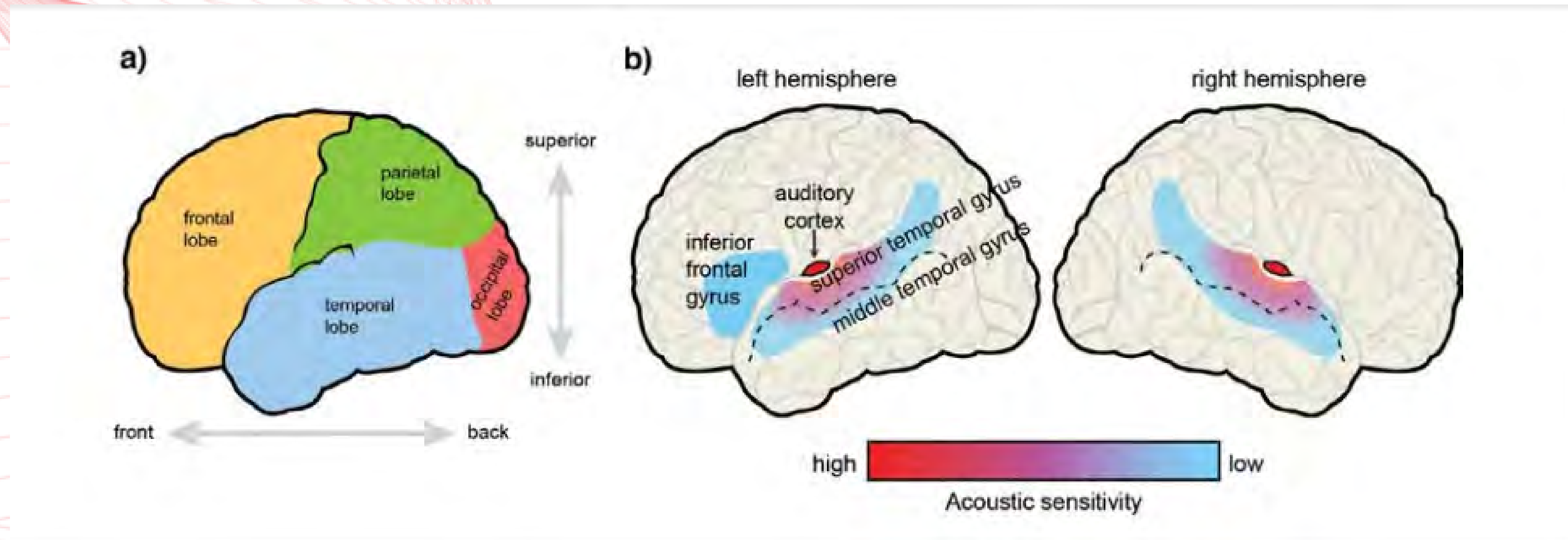
Temporal Fine Structure

Loss of Temporal Fine Structure

- Waveform of a short sentence, 2 seconds long
- Top waveform (red) traveling wave envelope
- Bottom waveform: TFS extracted from envelope and magnified
- Envelope and TFS are “coded” by cochlea and auditory nerve
- Sensitivity to TFS declines with age and hearing loss



Auditory Cortex Reorganization

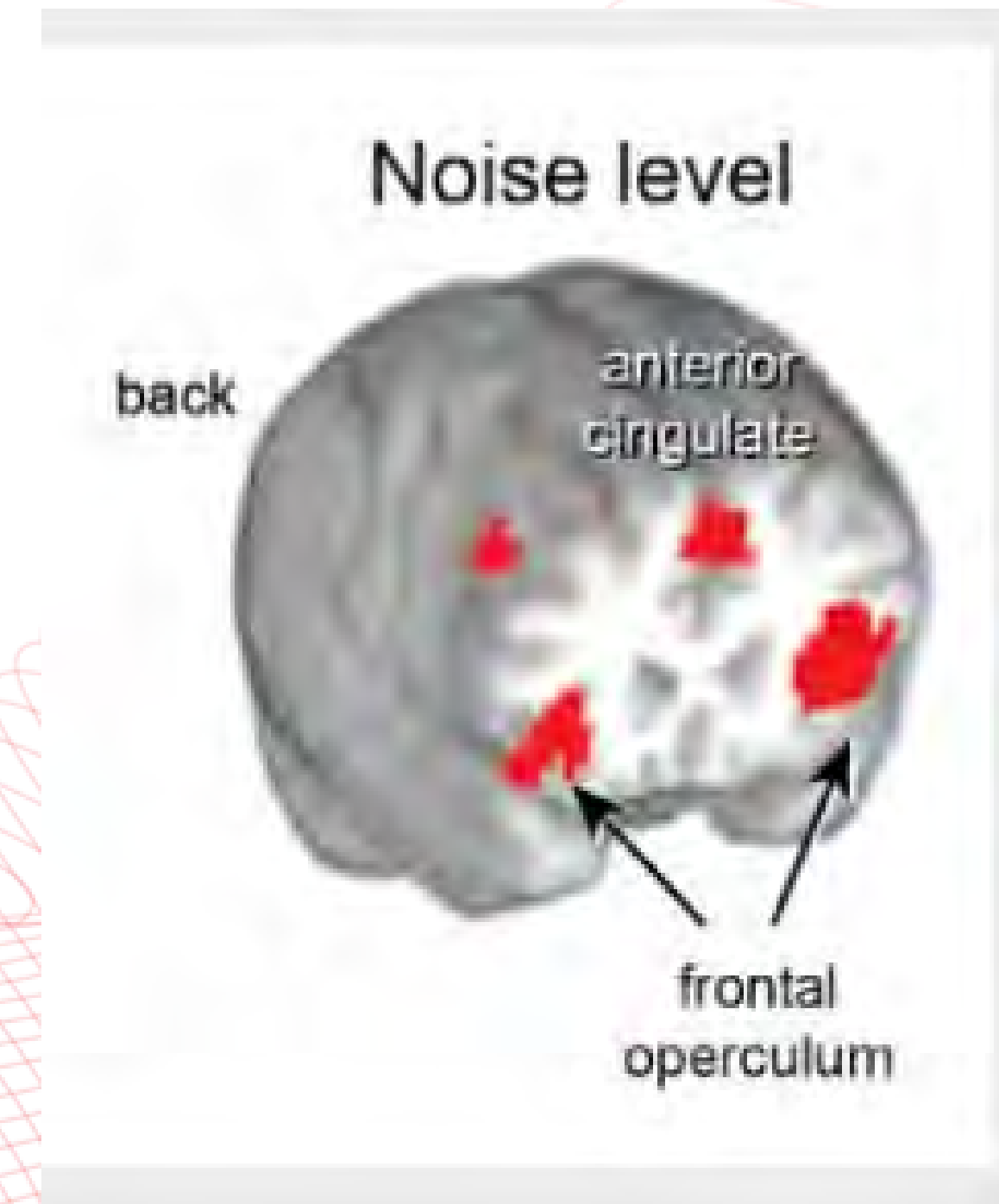


- Parallel pathways (R and L) process speech with increasing complexity
- As the listening situation becomes increasingly complex, more areas of the cortex are needed to “make sense” of the message

Peelle, J. E., and Wingfield, A. (2016). The neural consequences of age-related hearing loss. *Trends in Neurosciences* 39, 486-497.

Loss of Deep Structure Involvement in Acoustically Challenging Environments

- For young adults with normal hearing, the cingulo-opercular network composed of the anterior cingulate and bilateral frontal operculum is engaged during difficult listening
- For aging adults, these cortical landmarks fail to engage as vigorously

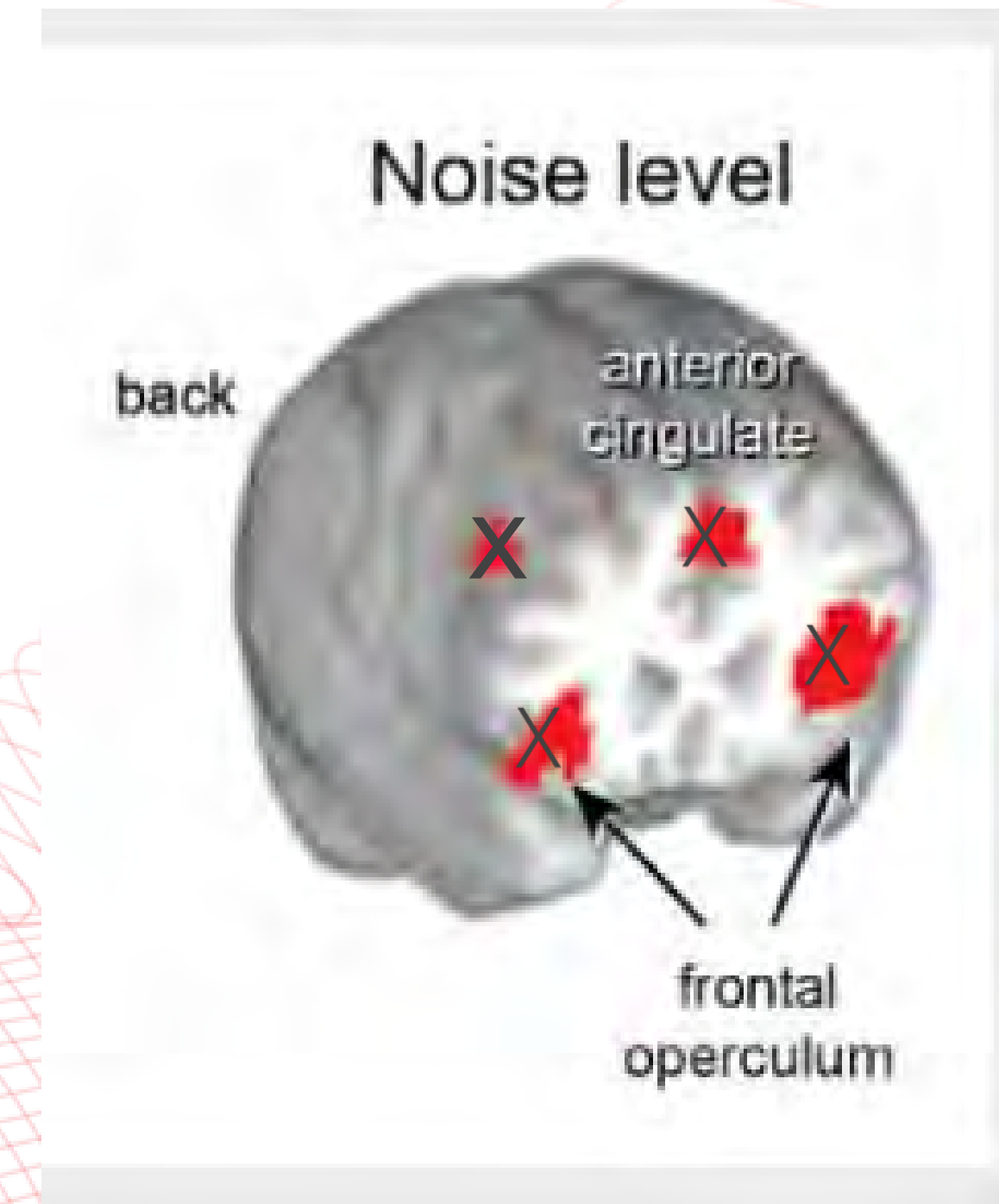


Scan of young adult with normal hearing

Peelle, J. E., and Wingfield, A. (2016). The neural consequences of age-related hearing loss. *Trends in Neurosciences* 39, 486-497.

Loss of Deep Structure Involvement in Acoustically Challenging Environments

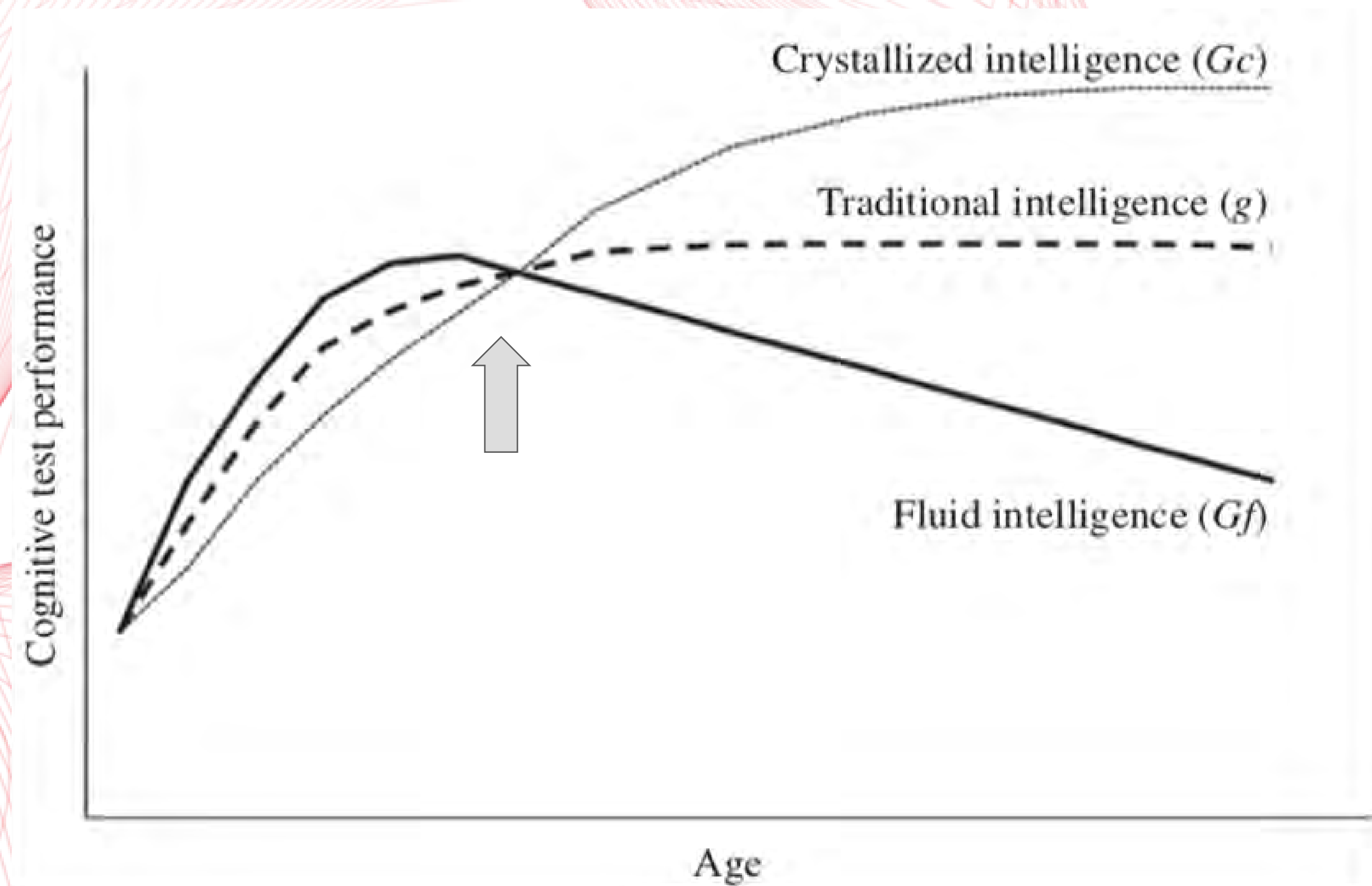
- For young adults with normal hearing, the cingulo-opercular network composed of the anterior cingulate and bilateral frontal operculum is engaged during difficult listening
- For aging adults, these cortical landmarks fail to engage as vigorously
- Cross-modal plasticity and reversal of it from “well-fitted” hearing aids (see work of Anu Sharma’s lab)



Scan of young adult with normal hearing

Peelle, J E., and Wingfield, A. (2016). The neural consequences of age-related hearing loss. Trends in Neurosciences 39, 486-497.

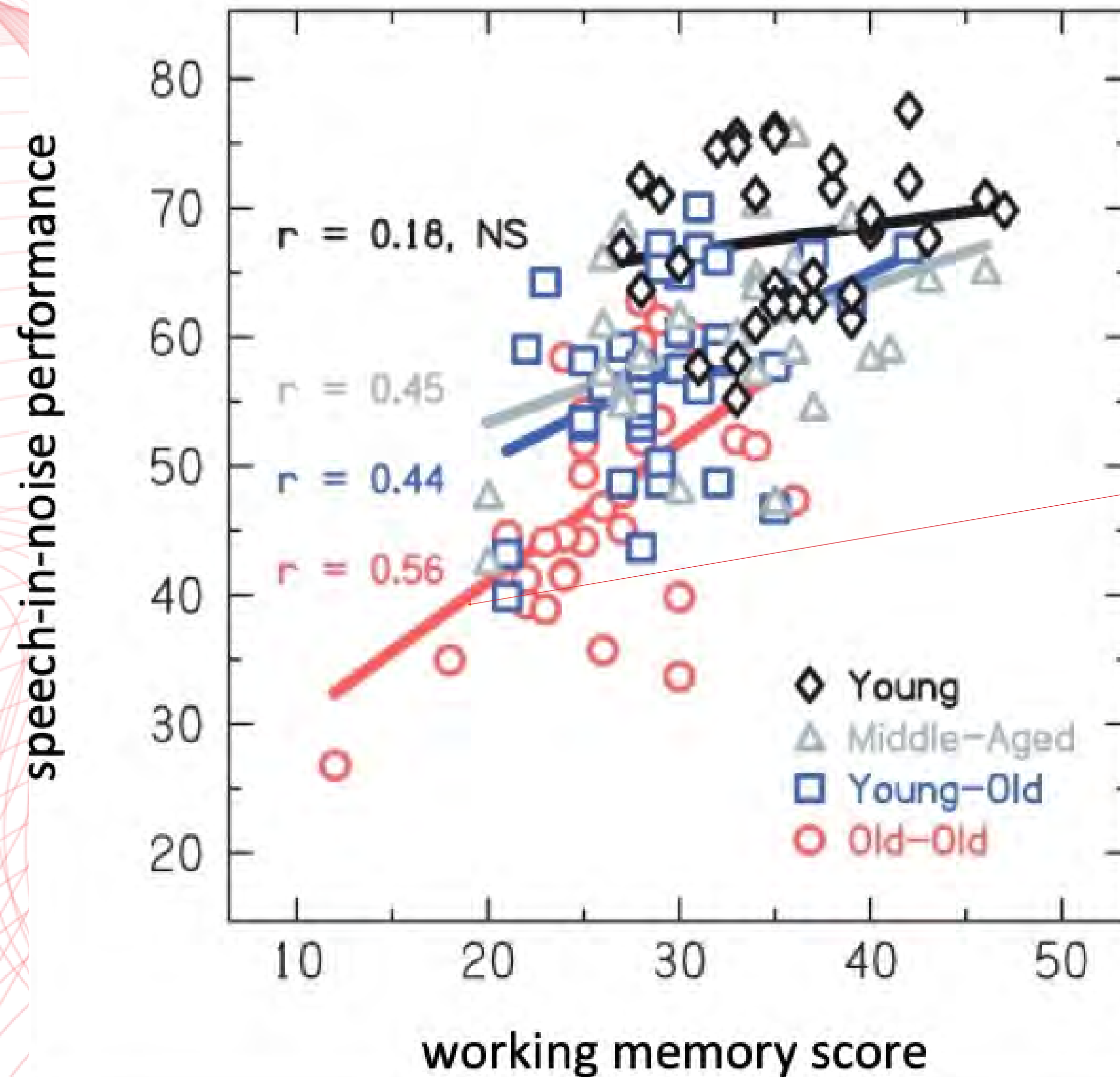
Intelligence and Aging



- “fluid intelligence” : the speed and ability to resolve problems in novel situations, including WM, processing speed, inhibition, and episodic memory;
- “crystallized intelligence”: an accumulation and use of skills, knowledge and experience, including storage of lexical information and syntax. Your lived experience

Fisher, G. G., Chacon, M., & Chaffee, D. S. (2019). Chapter 2 - Theories of Cognitive Aging and Work. In B. B. Baltes, C. W. Rudolph, & H. Zacher (Eds.), Work Across the Lifespan (pp. 17-45). Academic Press.

Relationship between SIN performance and working memory



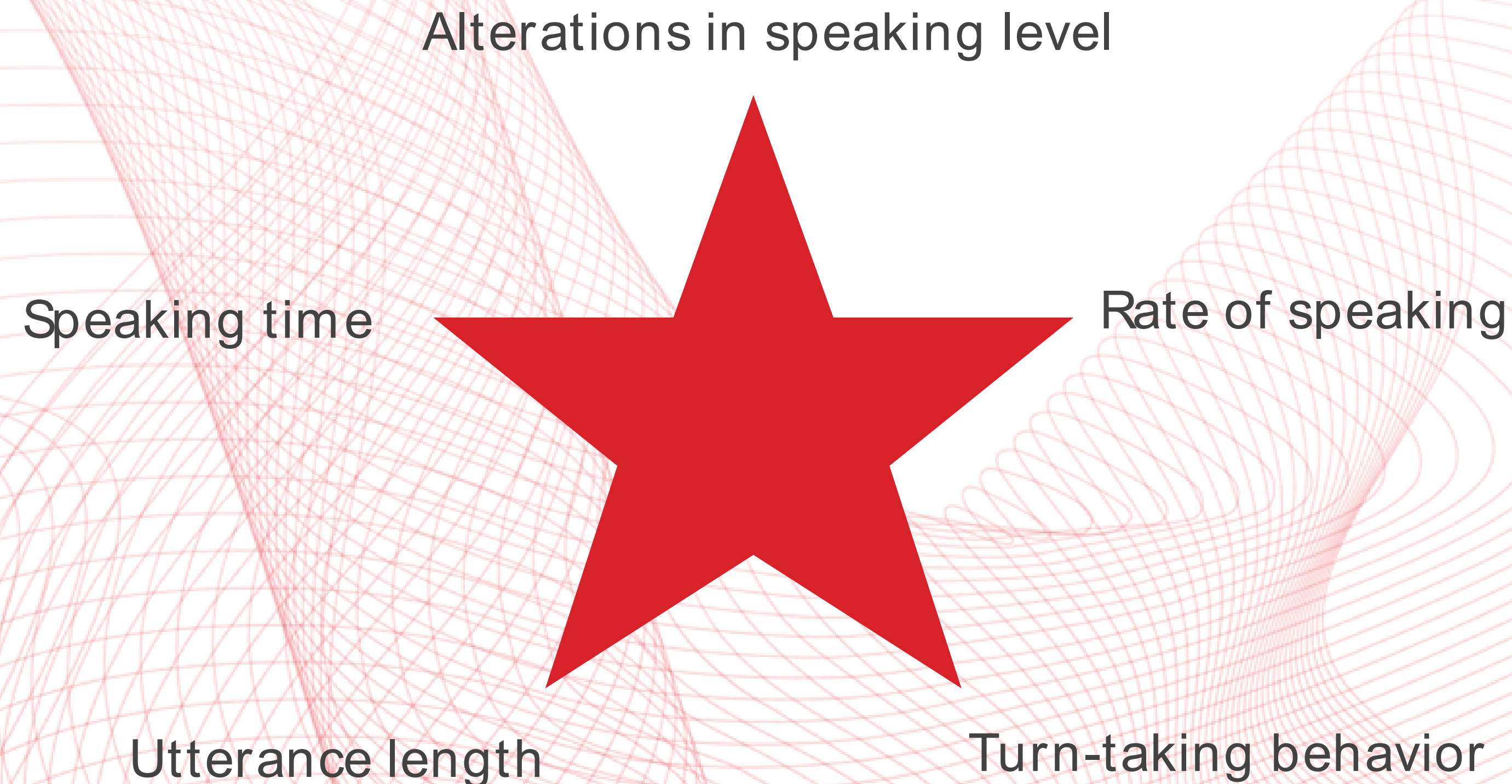
For oldest-old, as fluid cognition declines, it becomes more predictive of SIN ability

How do physical changes that result from normal aging effect day-to-day communication?



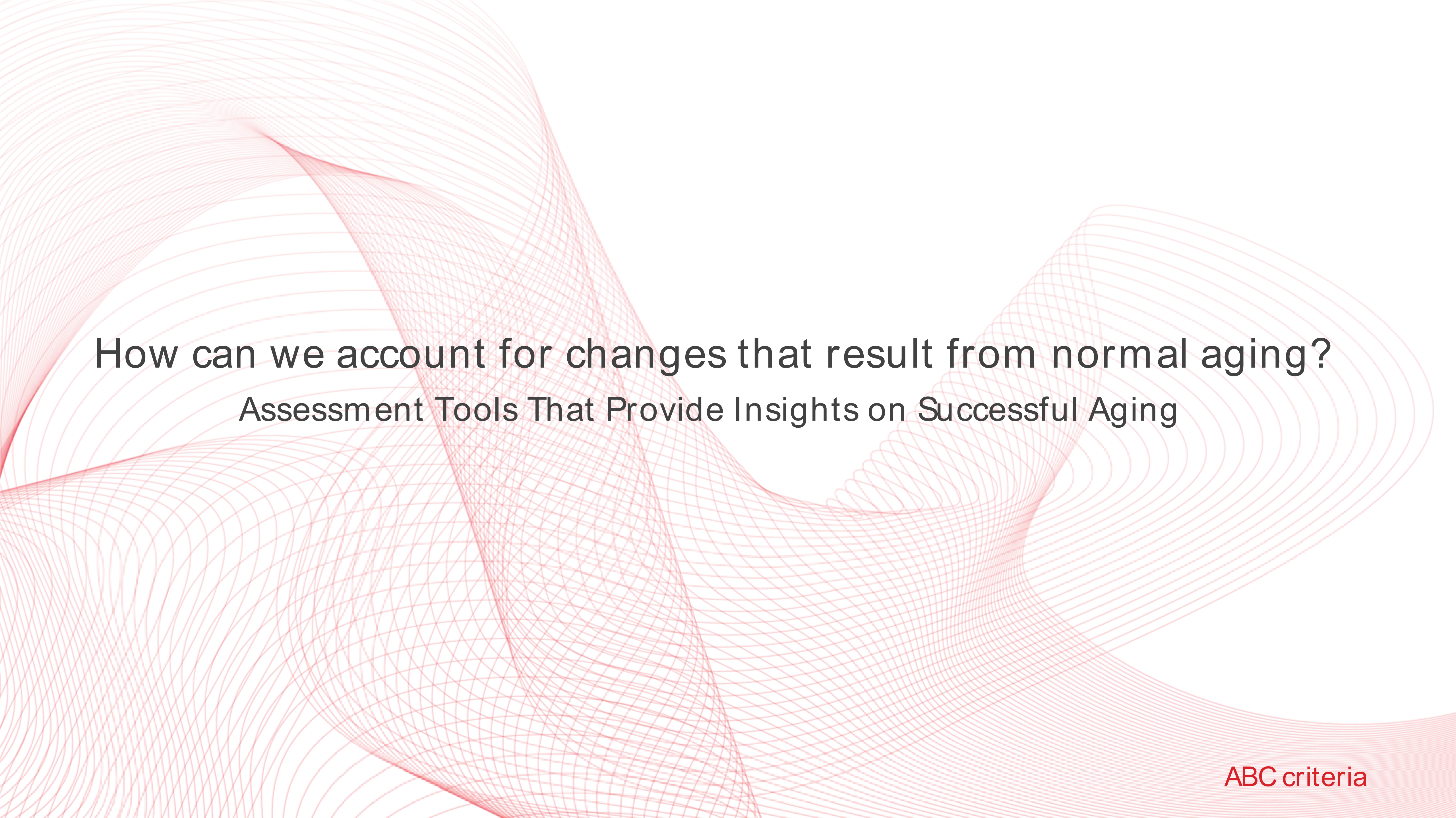
Changes in Conversational Dynamics Affecting All Parties

What are the technical details of all conversations



Results: All five are affected by hearing loss and worsened by background noise





How can we account for changes that result from normal aging?

Assessment Tools That Provide Insights on Successful Aging

The Lived Experience of Hearing Loss

(more that physical changes)

Gradual Hearing Loss



Fatigue & Frustration



Withdrawal & Isolation



Loneliness



Physical

Psychological

Social



Vanderbilt Fatigue Scale: Adult version-10 Items (VFS-A-10)

Sometimes communicating with others, or just listening, can be physically, mentally, or emotionally tiring. For each item below, select the SINGLE response that best describes how often you experience the following in a typical WEEK.

		Never/ Almost Never	Rarely	Sometimes	Often	Almost Always/ Always
1.	I feel worn out from everyday listening. Struggling to listen and understand makes me feel tired.	0	1	2	3	4
2.	I get so exhausted from listening that I cannot do the things I enjoy.	0	1	2	3	4
3.	I schedule my day to avoid getting tired from listening.	0	1	2	3	4
4.	I get so tired from listening that I start to miss details in a conversation.	0	1	2	3	4
5.	I get so exhausted from listening that I go to bed early.	0	1	2	3	4
6.	I withdraw when I am unable to follow conversations in noisy places.	0	1	2	3	4
7.	Feeling tired from listening causes strain on my relationships.	0	1	2	3	4
8.	I feel emotionally drained when it is hard for me to listen and understand.	0	1	2	3	4
9.	It takes a lot of energy to listen and understand.	0	1	2	3	4
10.		0	1	2	3	4

- UCLA 3-item Loneliness Scale**
1. How often do you feel you lack companionship
 2. How often do you feel left out
 3. How often do you feel isolated from others

	Item	Yes (4 pts)	Sometimes (2 pts)	No (0 pts)
E	Does a hearing problem cause you to feel embarrassed when meeting new people?			
E	Does a hearing problem cause you to feel frustrated when talking to members of your family?			
S	Do you have difficulty hearing when someone speaks in a whisper?			
E	Do you feel handicapped by a hearing problem?			
S	Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?			
S	Does a hearing problem cause you to attend religious services less often than you would like?			
E	Does a hearing problem cause you to have arguments with family members?			
S	Does a hearing problem cause you difficulty when listening to TV or radio?			
E	Do you feel that any difficulty with your hearing limits or hampers your personal or social life?			
S	Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?			
TOTAL SCORE = (sum of the points assigned to each of the items)				

Speech in Noise Testing as a Screener

- Quick SIN
- Under earphones
- 70 d HL or louder
- Each ear tested separately
- Measures SNR loss



Neither PTA nor WRS Predict Speech Perception in Noise Ability

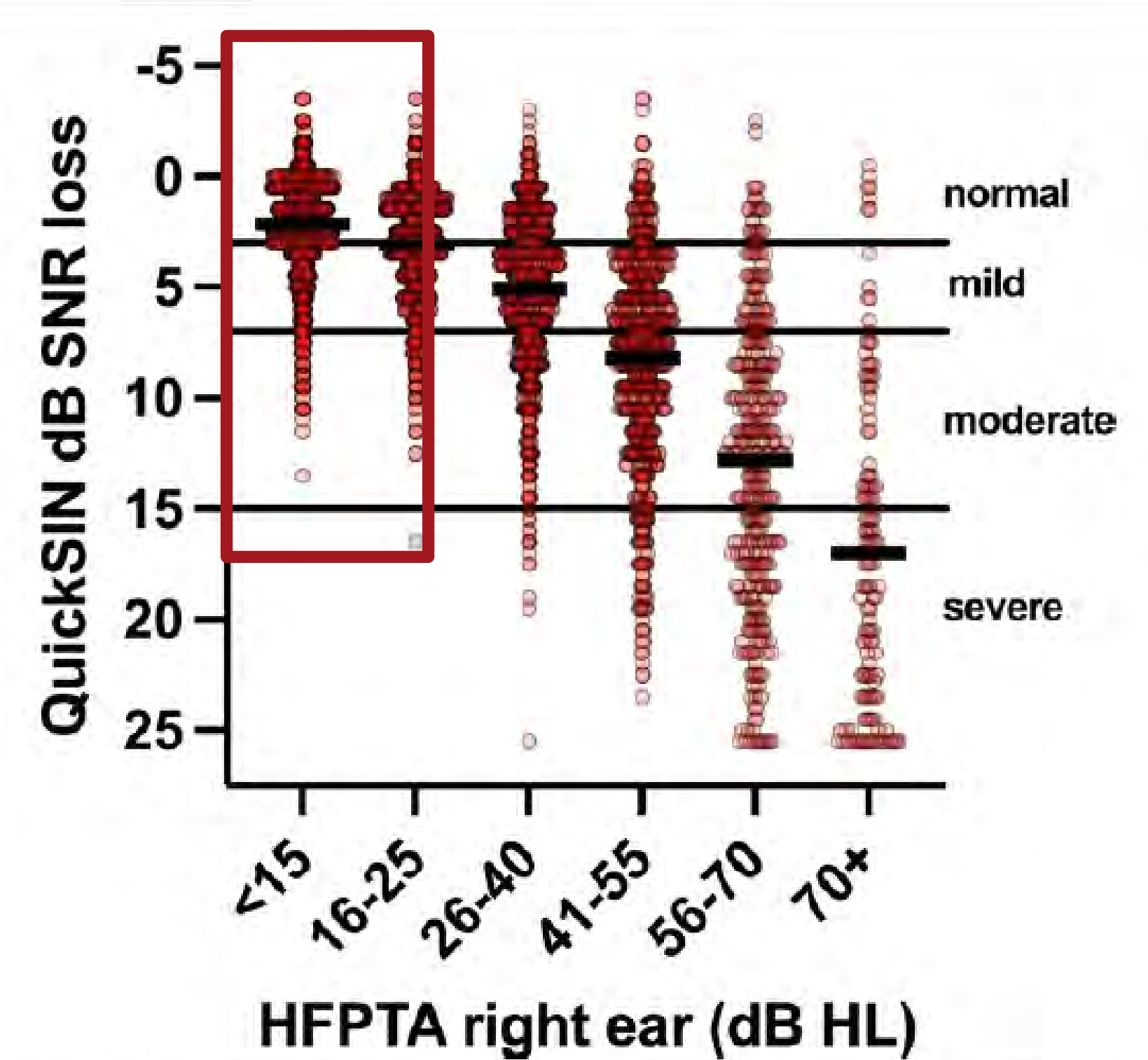


Figure 4. QuickSIN SNR loss (y axis) as a function of HFPTA values (x axis)

Neither PTA nor WRS Predict Speech Perception in Noise Ability

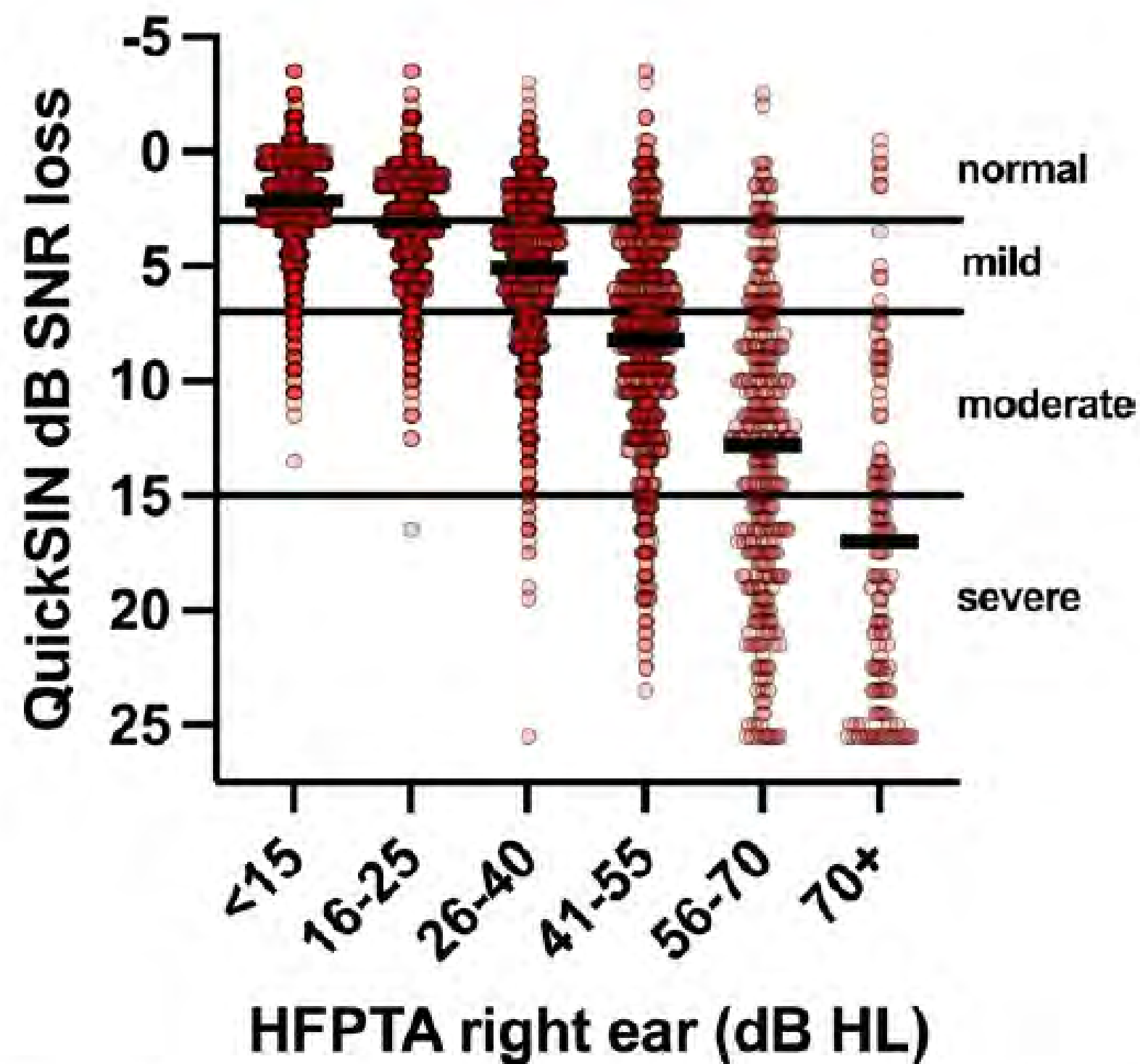


Figure 4. QuickSIN SNR loss (y axis) as a function of HFPTA values (x axis)

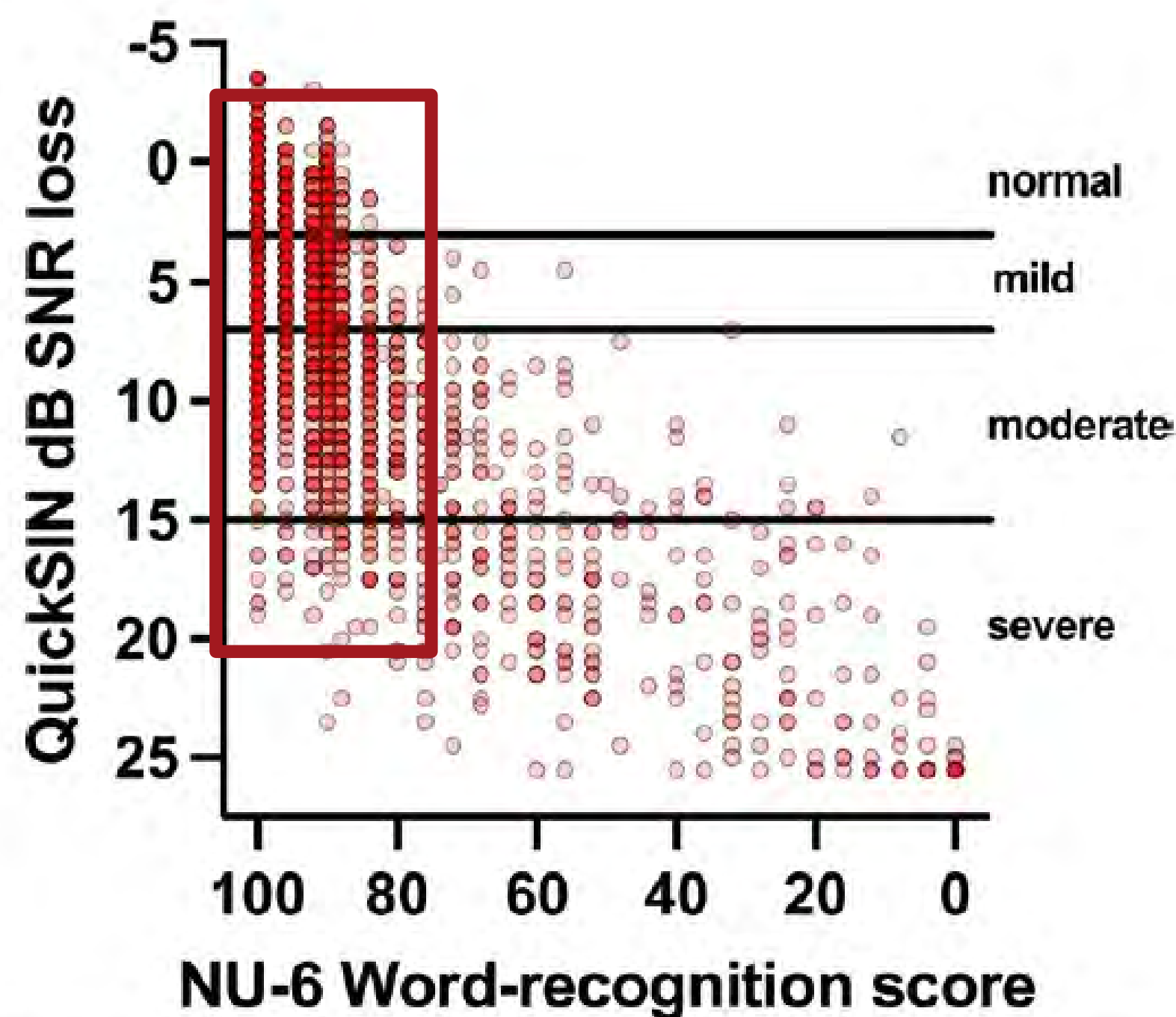


Figure 5. QuickSIN SNR loss (y axis) as a function of word-recognition score (x axis) for 5808 patients. Each circle represents an individual data point. To minimize the effects of overplotting, darker shading reflects values

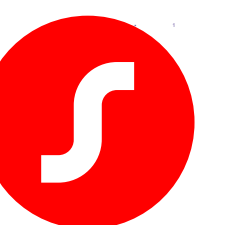
What to expect (age-adjusted norms)

Age Range	Average Score
50-59	7.5 dB
60-69	8.0 dB
70-79	9.5 dB
80-plus	10.5 dB



Degree of SNR Loss

- SNR Loss = 0-2 dB
 - Optimize audibility with any well-fitted hearing aid
- SNR Loss = 3-6 dB
 - Add bilateral beamformers + IX processing
- SNR Loss = 7-12 dB
 - Add “situation management” counseling and encourage use of remote mic
- SNR Loss = >13 dB
 - Add use of remote mic



Fatigue (Physical, Psycho-social)

- Listening-related fatigue
- Less productive at work, more prone to accidents, more socially isolated, more likely to be depressed
- Older people and persons with hearing loss more likely to suffer from listening-related fatigue
- See work of Ben Hornsby, Jack Holman

- Message:

“Properly worn hearing aids have the potential to help you feel less tired during the day”



Screen for Listening-Related Fatigue

Vanderbilt Fatigue Scale- Adult version-10 items (VFS-A-10)

Sometimes communicating with others, or just listening, can be physically, mentally, or emotionally tiring. For each item below, select the SINGLE response that best describes how often you experience the following in a typical WEEK.

		Never/ Almost Never	Rarely	Sometimes	Often	Almost Always/ Always
1.	I feel worn out from everyday listening.	0	1	2	3	4
2.	Struggling to listen and understand makes me feel tired.	0	1	2	3	4
3.	I get so exhausted from listening that I cannot do the things I enjoy.	0	1	2	3	4
4.	I schedule my day to avoid getting tired from listening.	0	1	2	3	4
5.	I get so tired from listening that I start to miss details in a conversation.	0	1	2	3	4
6.	I get so exhausted from listening that I go to bed early.	0	1	2	3	4
7.	I withdraw when I am unable to follow conversations in noisy places.	0	1	2	3	4
8.	Feeling tired from listening causes strain on my relationships.	0	1	2	3	4
9.	I feel emotionally drained when it is hard for me to listen and understand.	0	1	2	3	4
10.	It takes a lot of energy to listen and understand.	0	1	2	3	4

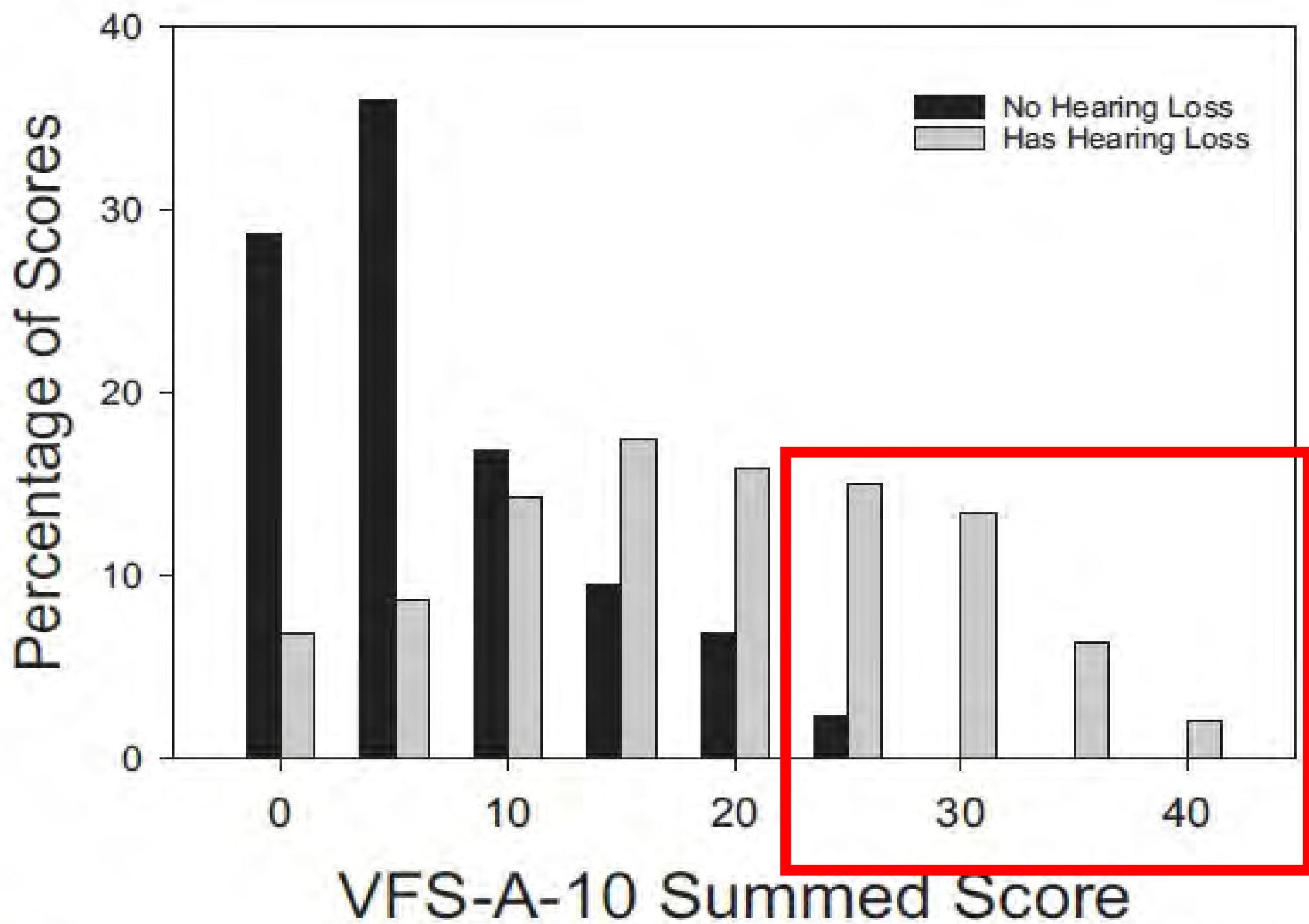


Fig. 2. Histograms showing the distribution of VFS-A-10 summed scores for Phase 2 participants with (grey bars) and without (black bars) self-reported hearing loss. VFS-A-10, 10-item version of the Vanderbilt Fatigue Scale for Adults.

Hornsby, et al 2023

Auditory Wellness (Psycho-Social)

- HHIE/ A-Screening version
- 10-questions
- Emotional and social wellness
- Not a strong relationship between degree of hearing loss and score on HHIE/ A
- See work of Larry Humes (Subjective Well-being Scale)

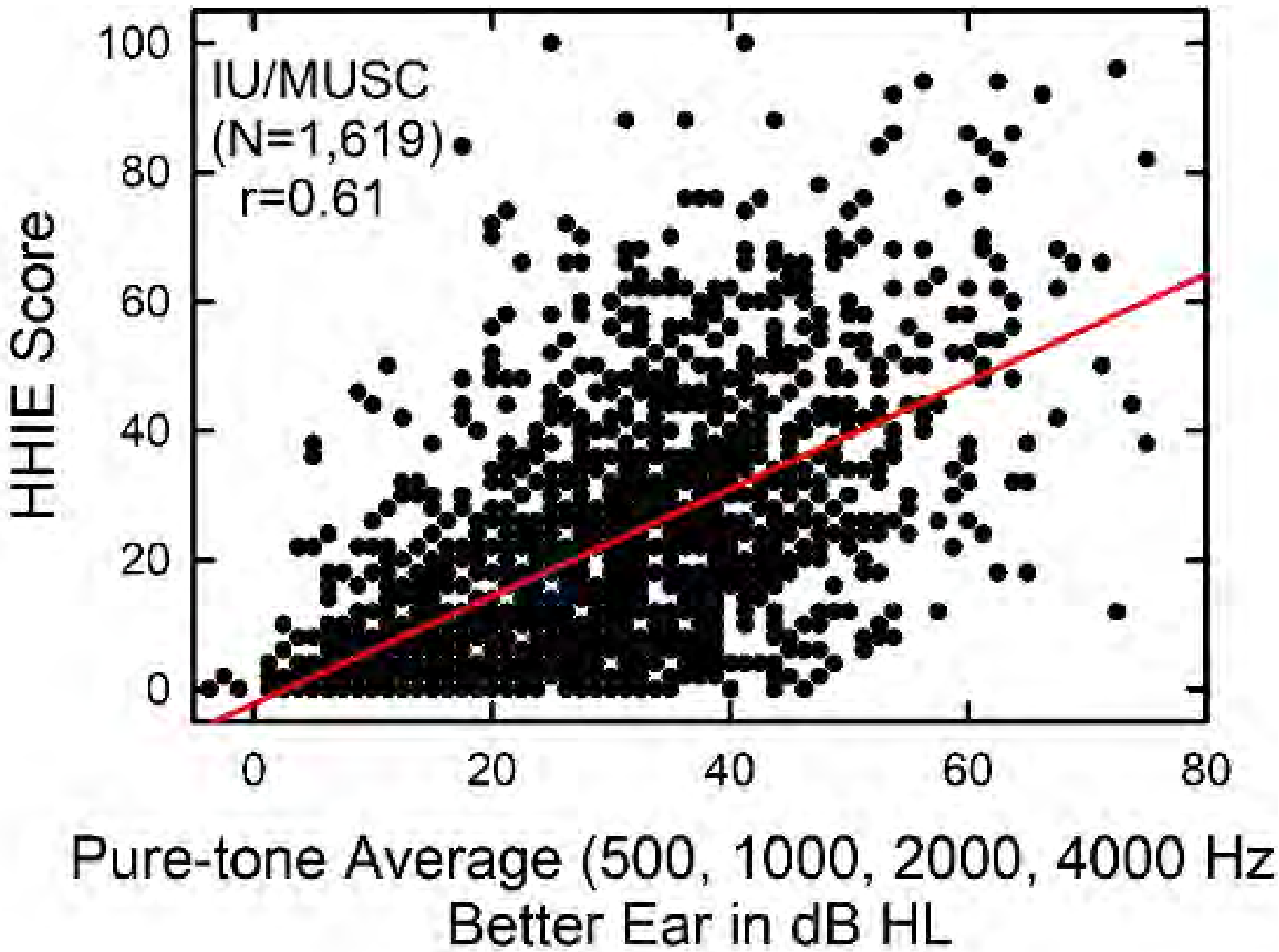
Message:

“For many people hearing aids do a great job of improving emotional and social well-being”



Auditory Wellness

	Item	Yes (4 pts)	Sometimes (2 pts)	No (0 pts)
E	Does a hearing problem cause you to feel embarrassed when meeting new people?	_____	_____	_____
E	Does a hearing problem cause you to feel frustrated when talking to members of your family?	_____	_____	_____
S	Do you have difficulty hearing when someone speaks in a whisper?	_____	_____	_____
E	Do you feel handicapped by a hearing problem?	_____	_____	_____
S	Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?	_____	_____	_____
S	Does a hearing problem cause you to attend religious services less often than you would like?	_____	_____	_____
E	Does a hearing problem cause you to have arguments with family members?	_____	_____	_____
S	Does a hearing problem cause you difficulty when listening to TV or radio?	_____	_____	_____
E	Do you feel that any difficulty with your hearing limits or hampers your personal or social life?	_____	_____	_____
S	Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?	_____	_____	_____
TOTAL SCORE = _____ (sum of the points assigned to each of the items)				



Humes, 2021

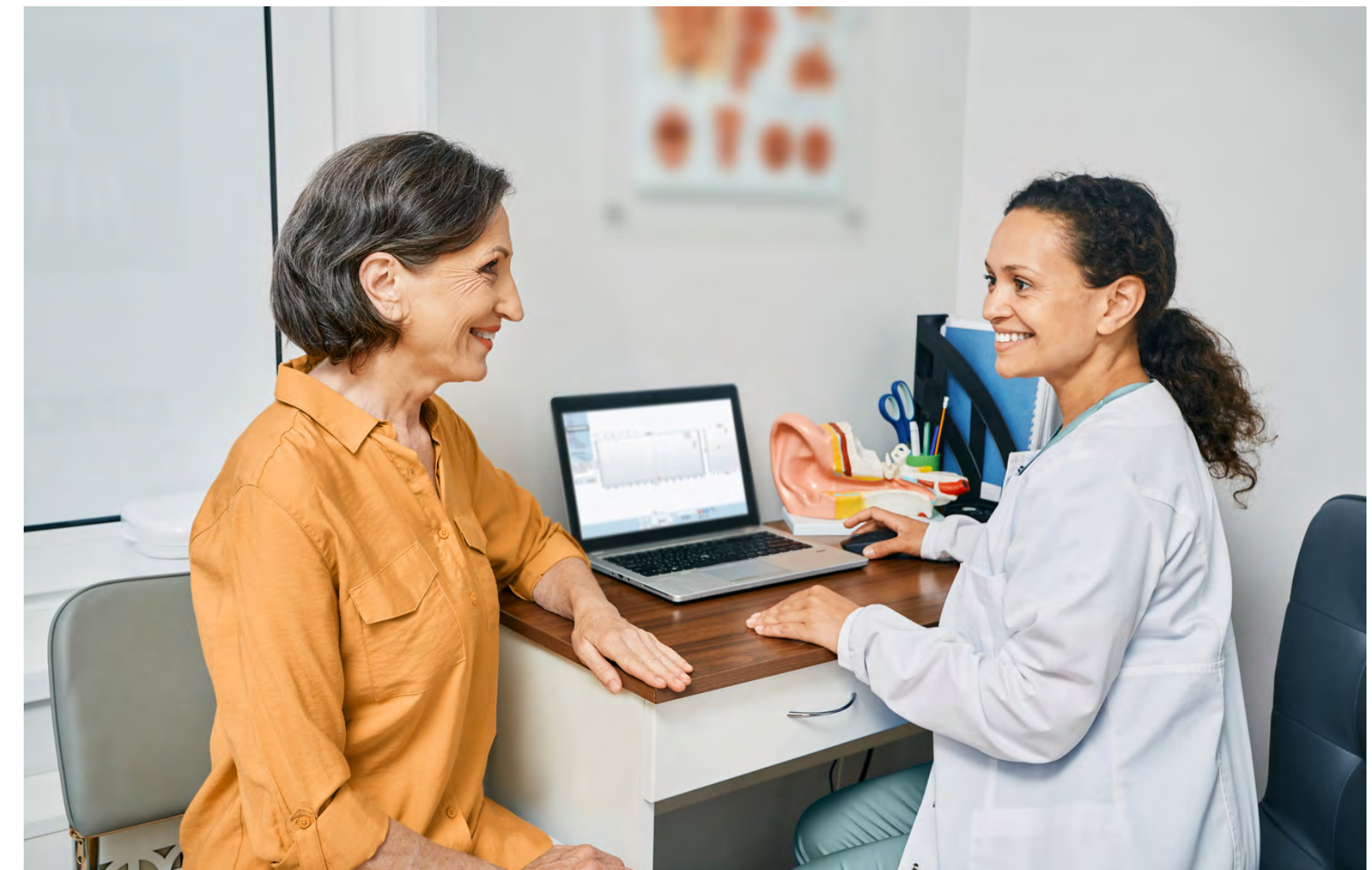
Auditory Wellness Scale
Excellent: 0-2
Good: 3-7
Fair: 8-15
Poor: 16-23
Very Poor: <24

Loneliness (Psycho-social)

- 1 in 5 adults feel socially isolated or lonely
- 37% of adults between 50 and 80 report a lack of companionship “some” or “most of the time”
- Source: University of Michigan Center on Health Care Policy and Innovation (March 2023)
- Worse self-reported hearing loss was associated with 29% greater prevalence of moderate or greater loneliness and worse social network characteristics (Huang et al 2023)

- Message:

“Hearing aids are one treatment that might help you re-connect with others”



Screen for Loneliness

- UCLA 3-item Loneliness Scale
 1. How often do you feel you lack companionship
 2. How often do you feel left out
 3. How often do you feel isolated from others

Response Score

- Hardly ever = 1 point
- Some of the time = 2 points
- Most of the time = 3 points

- Scoring
 - 3-5 “not lonely”
 - 6-9 “lonely”

Screen for cognitive decline

- At the assessment/ case history, ask this question:
- *“During the past year, have you experienced confusion or memory loss that is happening more often or is getting worse?”*
- If the answer is “yes,” refer for a formal cognitive assessment with a trusted source
- Sources:
 - Sarant, J., Lemke, U., Giroud, N., Scherpiet, S., & Weinstein, B. (2023). *International journal of audiology*, 1–11. Advance online publication.). Promoting hearing and cognitive health in audiologic rehabilitation for the well-being of older adults.
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Putting it all together

- Normal aging affects....
- Extended high frequency hearing
- Temporal fine structure
- Loss of deep cortical structure
- Fluid intelligence
- So what?

Tomorrow in the Clinic

- Patient 1
 - Mild sloping to mod-sev HL
 - Medically uncomplicated
 - Qsin scores: 2-3 dB SNR-loss
 - 55-year-old male
- Patient 2
 - Mild sloping to mod-sev HL
 - Medically uncomplicated
 - Qsin score: 8-9 dB SNR-loss
 - 80-year-old male

Would Patient 2's age change the way you fit and fine-tune hearing aids?

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EDITED BY
Aaron Moberly,
Vanderbilt University Medical Center,
United States

REVIEWED BY
Kathryn Arehart,
University of Colorado Boulder, United States
Helen E. Nuttall,
Lancaster University, United Kingdom

*CORRESPONDENCE
Richard Windle
✉ richard.windle@nhs.net

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A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults

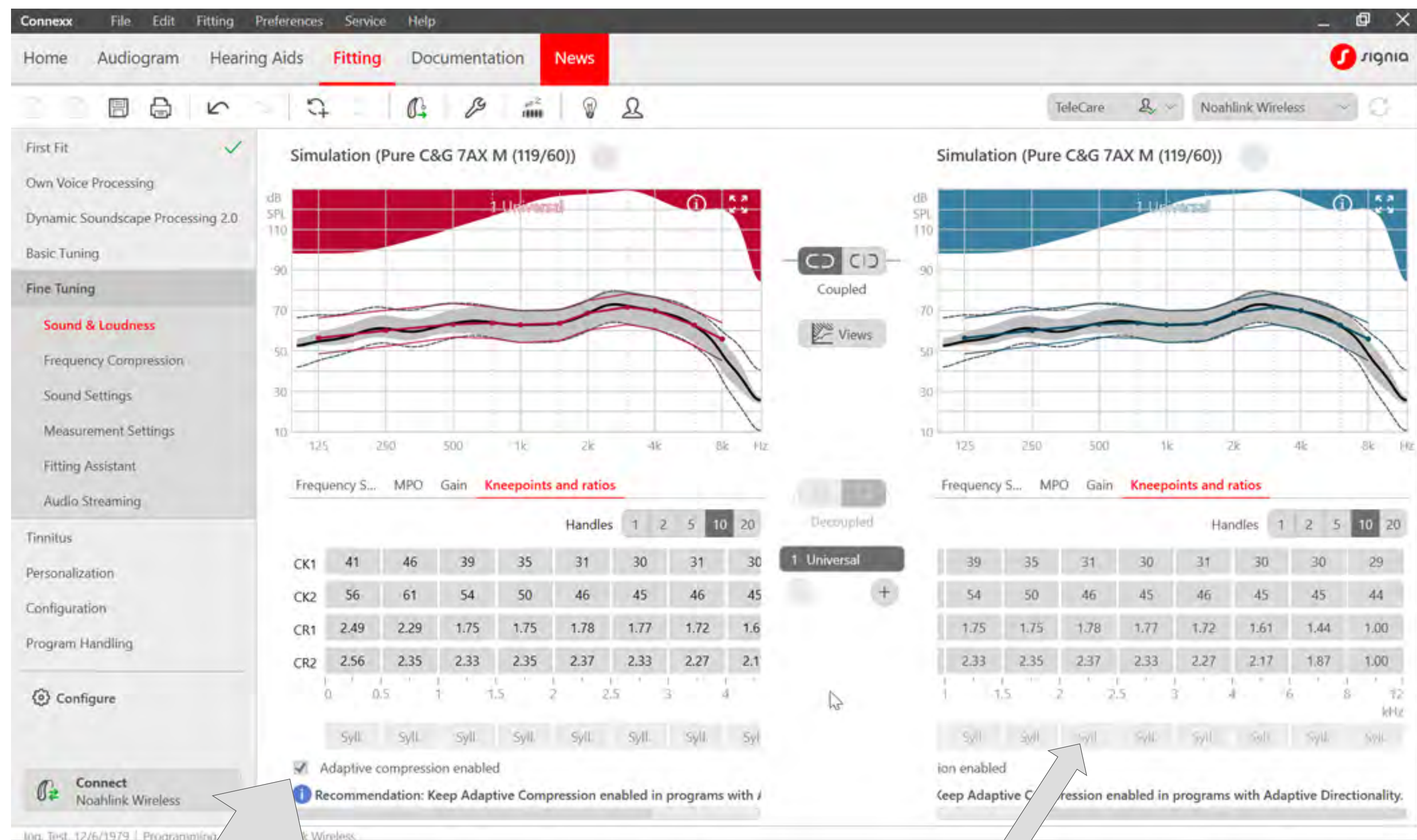
Richard Windle^{1*}, Harvey Dillon^{2,3} and Antje Heinrich^{2,4}

¹Audiology Department, Royal Berkshire NHS Foundation Trust, Reading, United Kingdom, ²NIHR Manchester Biomedical Research Centre, Manchester, United Kingdom, ³Department of Linguistics, Macquarie University, North Ryde, NSW, Australia, ⁴Division of Human Communication, Development and Hearing, School of Health Sciences, University of Manchester, Manchester, United Kingdom

Recommendations for Older Adults

A partial list from Windle et al 2023

- “The combination of peripheral and central, auditory and cognitive decline make older adults some of the most complex patients seen in audiology clinics.”
- Recommendation 1: Avoid hearing aid settings that introduce distortion by keeping compression ratios less than 2:1
- Recommendation 2: Provide smooth, broadband amplification through 4KHz. While conducting REM, listen under earphones for distortion (see Scollie, 2023 for details)
- Recommendation 3: Use molds in place of open-fittings to improve directionality
- Recommendation 4: Avoid features such as frequency lowering that tend to distort the speech envelope
- Recommendation 5: Consider using slow-acting compression (long release times) by adding a second program with these longer release times



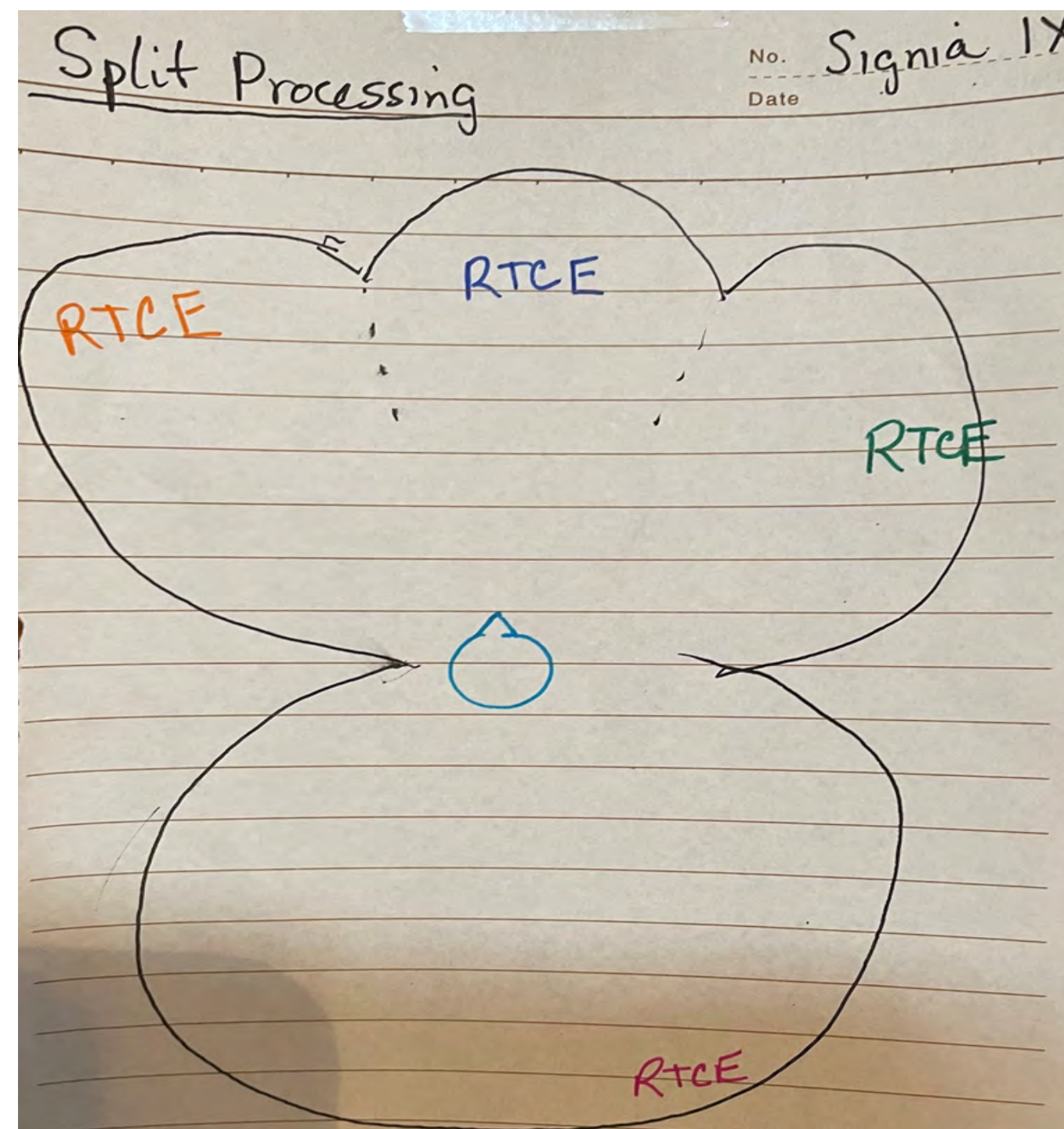
Under First Fit tab, change to NAL or DSL target.
Right click and change "Syl" to "Dual"

Final Question

- How can we ensure “normal aging” is “successful aging?”

Successful aging and hearing aid use

- 7 longitudinal studies from around the world tell us that the secret to a happy life as we grow older are RELATIONSHIPS
- The ability to effectively communicate in GROUP CONVERSATIONS is a critical component of maintaining quality relationships as we age
- Signia XI is specifically designed to optimize performance in group conversations
- How 7XI works?



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Questions?

- brian.taylor@wsa.com