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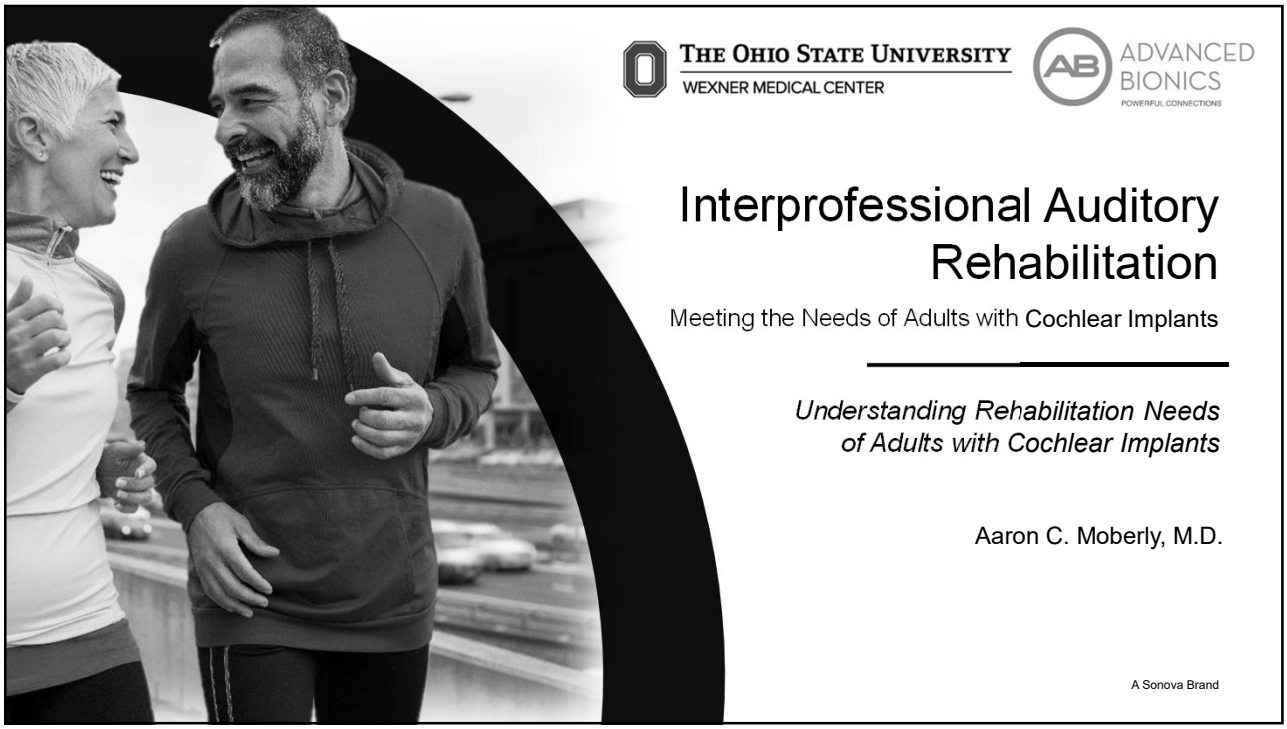

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Learner Outcomes

•After this course learners will be able to describe the rationale for a comprehensive auditory rehabilitation approach for adults with cochlear implants.

•After this course learners will be able to describe additional outcomes worth considering beyond speech recognition in adults with cochlear implants.

•After this course learners will be able to discuss ways in which the rehabilitative needs of older adults with cochlear implants may differ from children and young adults with cochlear implants.

Understanding Rehabilitation Needs of Adults with Cochlear Implants

Aaron C. Moberly, M.D.

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

Big Picture

- Enormous consequences of hearing loss:
  - Poor communication
  - Social isolation
  - Cognitive decline
- Benefits of transition from hearing aid to CI
  - < 10% of candidates transition
- "Comprehensive Auditory Rehabilitation" supports and optimizes this process
  - Interdisciplinary
  - Broadened targets

Outline

- Why "Comprehensive" Auditory Rehabilitation?
- What are we treating?
- Whom are we treating?

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Variability in Adult CI Outcomes

- Hearing aids and CIs restore "audibility" but provide a limited representation of speech, so we depend on the **brain** to interpret
  - Substantial variability remains in speech recognition among CI users (0 to 100%)
  - Some CI users remain "poor" performers for the long term (up to 40%)
  - It can take 2 years (or longer) for some CI users to plateau in speech recognition performance, while others plateau by 3 months
  - Even after 2 years, we see improvements with AR

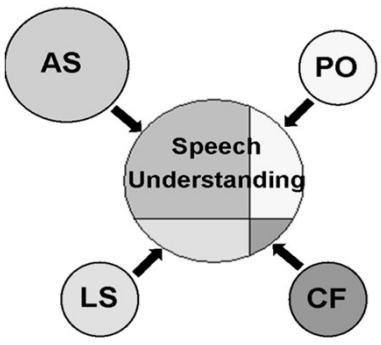
Variability in Adult CI Outcomes

- Demographic
  - Age, socioeconomic status
- Audiologic
  - Duration of hearing loss
  - Severity of hearing loss
  - Prior use of hearing aid
- Only explain <½ the variability!!

Variability in Adult CI Outcomes

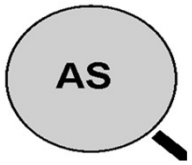
Relates to abilities within four areas:

AS: Auditory Sensitivity
PO: Perceptual Organization
LS: Language Skills
CF: Cognitive Factors



Auditory Sensitivity

- Frequency resolution (Won et al., 2007)
- Temporal resolution (Won et al., 2011)
- Electrode array position (Holden et al., 2013)
- Residual hearing (Fitzpatrick et al., 2014)

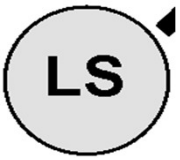


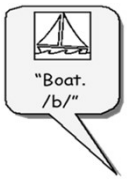
Perceptual Organization

- Perceptual closure
  - Use degraded sensory input to create meaningful form
  - Text Reception Threshold (Zekveld et al., 2007)
  - Fragmented Sentences Test

Language Skills

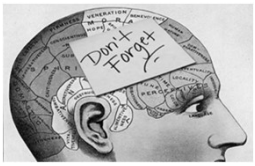
- Phonological sensitivity (Moberly et al., 2017)
- Knowledge of phonotactic probabilities (Vitevitch et al., 2000)
- Ability to use semantic context (Most and Adi-Bensaid, 2001; Moberly & Reed, 2019)





Cognitive Factors

- Information processing skills that underlie perception
- Working memory (Lyxell et al., 1998)
- Inhibitory control (Moberly et al., 2016)
- Verbal learning and memory (Pisoni et al., 2016)
- Information-processing speed
- Nonverbal reasoning (problem-solving) (Mattingly et al., 2018)

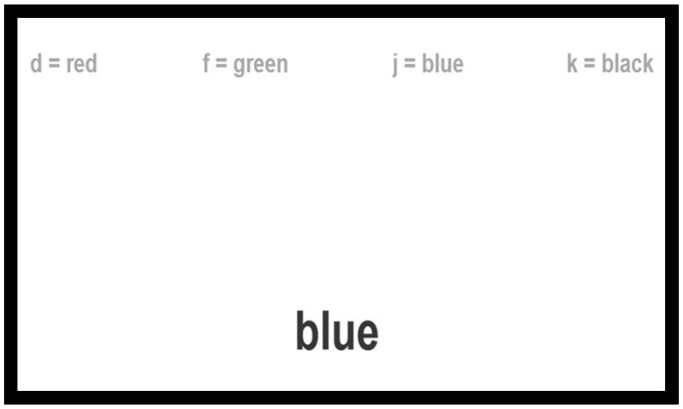


Working Memory

- Visual Digit Span

Inhibitory Control

- Computerized Stroop



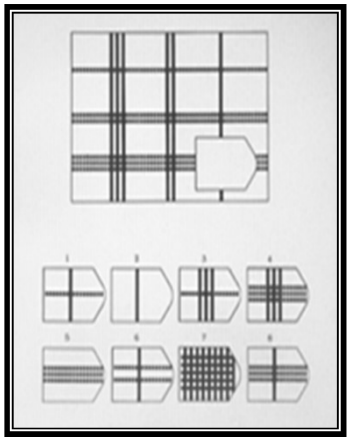
Information-Processing Speed

- **TOWRE words and non-words**

ip	stip	depate
ga	plin	glant
ko	frip	sploosh
ta	poth	dreker
om	vasp	ritlun
ig	meest	hedfert
ni	shlee	bremick
pim	guddy	nifpate
wum	skree	brinbert

Nonverbal Reasoning

- **Raven's Progressive Matrices**



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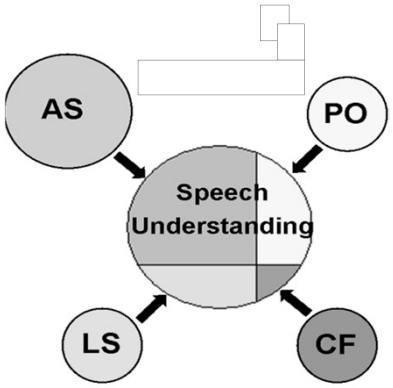
CI Outcome Variability

- **Potentially ALL of these areas could benefit from rehabilitation and training**
- **SLPs can assist in measuring and treating**



Outline

- Why “Comprehensive” Auditory Rehabilitation?
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"WHAT ARE WE TREATING?"

- Traditional focus on speech recognition
  - CNC words
  - HINT or AzBio sentences, +/- noise
- BUT speech recognition and patient-reported outcomes are not strongly related!
  (McRackan et al., 2018; Camille Dunn: "What is Success with CIs?")
- Reframe our conception:

Hearing loss (Audibility) → **Long-term communication impairment**

"WHAT ARE WE <u>REALLY</u> TREATING?"

<u>CIQOL</u> (McRackan et al., 2019)

- Focus groups of adult CI users
- 81 items in 6 independent domains
  - Communication
  - Emotional
  - Entertainment
  - Environment
  - Listening Effort
  - Social

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How Do You Define SUCCESS With Your CI?

"WHAT ARE WE REALLY TREATING?"

Comprehensive Auditory Rehabilitation

- Speech recognition
- Listening comprehension
- Motivation
- Device knowledge
- Psychosocial function
- Communication confidence
- Listening effort
- Self-efficacy
- Social participation/isolation
- Executive functioning and cognition
- Quality of life

Outline

- Why "Comprehensive" Auditory Rehabilitation?
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"WHOM ARE WE TREATING?"

Adult hearing "rehabilitation" ≠ Pediatric hearing "habilitation"

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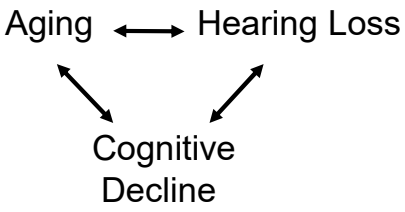
"WHOM ARE WE TREATING?"

- Older adults are the most rapidly growing population of patients receiving CIs
  - Mean age for our sample was 61 years (Beyea et al., 2016)
  - >25% over age 70 (Olze et al., 2016)
- Older adults demonstrate similar or slightly poorer outcomes
- Additional factors to consider:
  - Comorbidities
  - Vestibular dysfunction
  - Hearing aid access
  - Social isolation



"WHOM ARE WE TREATING?"

- Older adults are at even higher risk for impairments:
  - Speech recognition
  - Listening comprehension
  - Motivation
  - Device knowledge
  - Psychosocial function
  - Communication confidence
  - Listening effort
  - Self-efficacy
  - Social participation/isolation
  - Executive functioning and cognition
  - Quality of life

Patient-centered Approach

- Holistic approach
- Self-management
  - Patient knowledge
  - Adherence to treatment
  - Social support
- Assess:
  - Auditory processing
  - Cognitive-linguistic skills
  - Patient-reported measures of
    - Communication ability and confidence
    - Self-efficacy
    - Social participation
    - Quality of life
- Develop patient (and clinician) goals

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References

1. Holden LK, Finley CC, Firszt JB, et al. Factors affecting open-set word recognition in adults with cochlear implants. *Ear Hear.* 2013;34(3):342.
2. Moberly AC, Vasil KJ, Wucinich TL, et al. How does aging affect recognition of spectrally degraded speech? *Laryngoscope.* 2018;128.
3. Fitzpatrick DC, Campbell A, Choudhury B, Dillon M, Forgues M, Buchman CA, Adunka OF. Round window electrocochleography just prior to cochlear implantation: relationship to word recognition outcomes in adults. *Otol Neurotol.* 2014;35(1):64
4. Lawler M, Yu J, Aronoff J. Comparison of the spectral-temporally modulated ripple test with the Arizona Biomedical Institute Sentence Test in cochlear implant users. *Ear Hear.* 2017;38(6):760.
5. Won JH, Drennan WR, Rubinstein JT. Spectral-ripple resolution correlates with speech reception in noise in cochlear implant users. Journal of the Association for Research in Otolaryngology. 2007 Sep 1;8(3):384-92.
6. Won JH, Drennan WR, Nie K, Jameyson EM, Rubinstein JT. Acoustic temporal modulation detection and speech perception in cochlear implant listeners. *J Acoust Soc Am.* 2011;130(1):376-88.
7. Zekveld AA, George EL, Kramer SE, Goverts ST, Houtgast T. The development of the text reception threshold test: A visual analogue of the speech reception threshold test. Journal of Speech, Language, and Hearing Research. 2007.
8. Moberly AC, Harris MS, Boyce L, Nittrouer S. Speech recognition in adults with cochlear implants: The effects of working memory, phonological sensitivity, and aging. Journal of Speech, Language, and Hearing Research. 2017 Apr 14;60(4):1046-61.
9. Vitevitch MS, Pisoni DB, Kirk KI, Hay-McCutcheon M, Yount SL. Effects of phonotactic probabilities on the processing of spoken words and nonwords by adults with cochlear implants who were postlingually deafened. The Volta Review. 2000;102(4):283.
10. Most T, Adi-Bensaid L. The influence of contextual information on the perception of speech by postlingually and prelingually profoundly hearing-impaired Hebrew-speaking adolescents and adults. Ear and hearing. 2001 Jun 1;22(3):252-63.
11. Moberly AC, Reed J. Making Sense of Sentences: Top-Down Processing of Speech by Adult Cochlear Implant Users. Journal of Speech, Language, and Hearing Research. 2019 Aug 15;62(8):2895-905.
12. Lyxell B, Andersson J, Andersson U, Arlinger S, Bredberg G, Harder H. Phonological representation and speech understanding with cochlear implants in deafened adults. Scandinavian Journal of Psychology. 1998 Sep;39(3):175-9.
13. Moberly AC, Houston DM, Castellanos I. Non-auditory neurocognitive skills contribute to speech recognition in adults with cochlear implants. Laryngoscope investigative otolaryngology. 2016 Dec;1(6):154-62.
14. Pisoni DB, Broadstock A, Wucinich T, et al. Verbal learning and memory after cochlear implantation in postlingually deaf adults: Some new findings with the CVLT-II. *Ear Hear.* 2018;39(4):720-45.
15. Mattingly JK, Castellanos I, Moberly AC. Nonverbal reasoning as a contributor to sentence recognition outcomes in adults with cochlear implants. Otology & neurotology: official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otology and Neurotology. 2018 Dec;39(10):e956.
16. McRackan TR, Bauschard M, Hatch JL, Franko-Tobin E, Droghini HR, Nguyen SA, Dubno JR. Meta-analysis of quality-of-life improvement after cochlear implantation and associations with speech recognition abilities. The Laryngoscope. 2018 Apr;128(4):982-90.
17. Dunn, Camille. "What is success with CI's?" Hearing Health Matters. What is success with CI's? Hearing Health Matters, February 4, 2020. https://hearinghealthmatters.org/hearingandkids/2020/what-is-success-with-cis/
18. McRackan TR, Hand BN, Velozo CA, Dubno JR, Cochlear Implant Quality of Life Development Consortium. Development of the Cochlear Implant Quality of Life item bank. Ear and hearing. 2019 Jul 1;40(4):1016-24.
19. Olze H, Knopke S, Gräbel S, Szczepek AJ. Rapid positive influence of cochlear implantation on the quality of life in adults 70 years and older. Audiology and Neurotology. 2016;21(Suppl. 1):43-7.
20. Beyea JA, McMullen KP, Harris MS, Houston DM, Martin JM, Bolster VA, Adunka OF, Moberly AC. Cochlear implants in adults: effects of age and duration of deafness on speech recognition. Otology & Neurotology. 2016 Oct 1;37(9):1238-45.

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Questions?

Thank you for joining us!

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