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Modern Approach to Evaluating Speech Perception with the Minimum Speech Test Battery – Revision 3

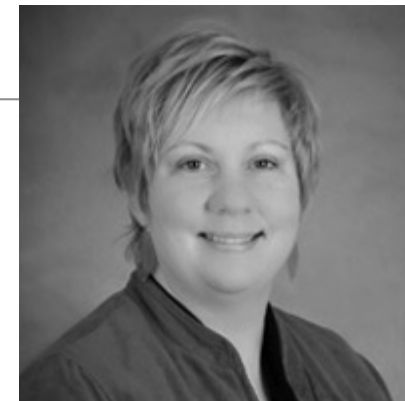
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Terry Zwolan, PhD

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Camille Dunn, PhD

Camille Dunn, PhD, joined the Department of Otolaryngology—Head and Neck Surgery at the University of Iowa in 2003 where she is an Assistant Professor and the Director of the Cochlear Implant Program. She received her Masters of Science Degree in Audiology from the University of Nebraska-Lincoln in 1998 and her Doctor of Philosophy Degree from University of Nebraska-Lincoln in 2003. Dr. Dunn holds her Audiology license from the State of Iowa. She maintains her Certificate of Clinical Competence in Audiology (CCC-A) and is a member of the American Speech-Language-Hearing Association (ASHA) and the American Cochlear Implant Alliance (ACIA). She is a Principal Investigator on a NIH-funded grant studying Hybrid cochlear implants and an Investigator on a Department of Defense Grant studying Hybrid cochlear Implants in veterans.



Terry Zwolan, PhD

Terry Zwolan, PhD, is Director of Audiology Access and Standard of Care at Cochlear Americas. She is Professor Emerita in the Department of Otolaryngology – Head and Neck Surgery at Michigan Medicine where she served as Director of the Cochlear Implant from 1990-2021, and previously served as Director of Audiology for Hearing First from 2021-2022. She is a co-founder of the American Cochlear Implant Alliance and served on its initial Board of Directors. She previously served as Director for two courses for the Institute for Cochlear Implant Training (ICIT) and also served as an adjunct faculty member for Wayne State University's AUD Program. She has authored/co-authored numerous articles and chapters related to adult and pediatric cochlear implants.

Disclosures

- **Presenter Disclosure:** Financial: Camille Dunn is a consultant for and receives research grant funding from MED-EL Corporation. She received an honorarium for this course. Non-financial: Camille Dunn has no relevant non-financial relationships to disclose. Financial: Terry Zwolan is an employee of Cochlear Americas. She received an honorarium for this course. Non-financial: Terry Zwolan has no relevant non-financial relationships to disclose.
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Learning Outcomes

After this course, participants will be able to:

- Describe the process of consensus used to develop the MSTB-3.
- Define the MSTB-3 test battery for pre- and post-operative candidates and recipients.
- Explain how to apply case study examples to assist with decision making processes for cochlear implant candidacy and post-operative follow-up.

MSTB-3 Team

- Co-Leads: Camille Dunn, PhD and Terry Zwolan, PhD
- Methodologist: Tom Balkany, M.D.
- Administrative Lead: Heather Strader, AuD
- Content Experts:

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Heidi Hill, AuD	William Shapiro, AuD
Meredith Holcomb, AuD	Sarah Sydlowski, PhD, AuD
English King, AuD	Jace Wolfe, PhD

Disclaimer: The CI Manufacturers provided partial funding for this project. They do not endorse any off-label use of their products, and it is not their intent to promote off-label use. For information on the indications for an implant, refer to the relevant Instructions for Use.

Why a new test battery?

- CI Candidacy has changed since the last MSTB was released in 2011
- Disconnect between clinical recommendations and FDA and insurer indications
- Clinics are inconsistent regarding test measures used to evaluate and determine candidacy, leading to confusion amongst referral sources, CI professionals, and patients
- Greater consistency leads to improved collection of real world evidence

Purpose of the MSTB-3

- Develop an evidence-based, streamlined test battery that will be widely and consistently used among CI audiologists for pre-operative determination of candidacy and postoperative assessment of adult cochlear implant performance

Goals

- Test materials in an electronic format
- Streamlined test batteries for all patients:
 - Traditional, SSD/Asymmetrical, Bimodal/EAS
- A minimal battery for most patients with additional measures when needed
- Candidacy is so much more than audiometric results:
 - Recommendations for functional test measures/questionnaires
 - Recommendations for cognitive screener to supplement decision-making and additional referrals for care
- Templates to streamline report writing and increase efficiency and consistency
- Inclusion of recommendations for pre- and post-operative care

How was the MSTB-3
developed?

Leading experts participated in a modified Delphi consensus to develop the MSTB-3

1. Rigorous literature review using search guidelines
2. Test protocols written based on literature review with full references
3. Likert Statements generated and voted on for each test protocol
4. Protocol sections developed based on 56 approved Likerts
5. Edits made to protocols based on feedback provided by stakeholders (ASHA, ACIA, AAA, HLAA, etc.)
6. Final MSTB-3 submitted for publication and will be provided on the ICIT website

What the MSTB-3 is not

- It is not a research protocol
 - It focuses on clinical care and provides clinicians with the *minimal* tests needed to determine candidacy for most patients
- It is not designed to align with current FDA or insurer indications
 - Focuses on measures that will *assist* clinicians in making clinical decisions and recommendations
 - Once a clinical decision is made, additional tests can be administered to determine if the patient qualifies for a CI based on their insurer's indications
- It is not a guideline of test scores to determine candidacy
 - It recommends **test measures** that should be used when evaluating candidacy and post-operative performance

What's changed?

1. “Best aided” defined as testing using a hearing aid that has been optimized for hearing loss *in the ear to be implanted*

This represents a change from the more traditional procedure of basing candidacy on a bilateral “best aided” score

“Best aided represents evolvement of clinical care

- Other aspects that have evolved over time:
 - Stimuli presented at 60 dB versus 70 dB
 - Transition from CID Sentences to HINT to AzBio
 - Sentences presented in quiet to presented in noise (+10/+5/0 SNR)
- Impacted by recent FDA approvals for Hybrid/EAS, SSD, and Asymmetric Hearing Loss

What's changed?

1. “Best aided” defined as testing using a hearing aid that has been optimized for hearing loss in the ear to be implanted
2. Everyday Listening Condition: testing with the optimized hearing configuration typical of everyday listening (e.g., bilateral hearing aids, unilateral hearing aid, bilateral unaided/unoccluded)

What's changed?

1. “Best aided” defined as testing using a hearing aid that has been optimized for hearing loss *in the ear to be implanted*
2. Everyday Listening Condition: testing with the optimized hearing configuration typical of everyday listening (e.g., bilateral hearing aids, unilateral hearing aid, bilateral unaided/unoccluded)
3. Focus on CNC Words for *initial clinical determination of CI Candidacy*

Why CNC Words?

- Recent FDA-approved indications utilize CNC word scores (Hybrid, EAS, AHL, and SSD)
- Numerous investigators recommend CNCs as the preferred measure to evaluate speech recognition Balkany et al., 2007; C.C. Dunn, 2022; Sladen et al., 2017
- Less likely to demonstrate ceiling effects post-implant than sentences Gifford et al., 2008; Sladen et al, 2017
- “Cleaner” test of hearing than sentences presented in varying levels of background noise Sladen et al, 2017
- Firszt et al (2023) found that patient age impacted AzBio scores but not CNC scores, and for this reason they recommend using CNCs to monitor a CI ear over time
- “Cleaner” test of hearing than sentences presented in varying levels of background noise, which can be impacted by top-down processing (Sladen et al, 2017)

What CNC score = candidacy?

- It's up to clinics to determine their clinical cut-off score*
 - Various scores have been recommended:
 - 40%** (Sladen et al, 2017; Firszt et al, 2023)
 - 50%** (ACIA: Zeitler et al, 2023; Dunn, 2022)
 - Up to **60%** (Perkins et al, 2021)

Monosyllabic Word Test Key (CNC, List 1)
MSTB CD
Track 09 (Channel 1)

Score all words for a beginning consonant sound, a nucleus (vowel) sound and an ending consonant sound.
(Total phoneme count per word = 3. Phonemes must be in the appropriate order.)

Practice Items	Test Items	Whole Word Response (Optional)	# Correct Phonemes	Test Items	Whole Word Response (Optional)	# Correct Phonemes
			0 1 2 3			0 1 2 3
1. GOOSE				26. WRECK	<u>wreck</u>	
2. NAME				27. ROUT	<u>bow</u>	
3. SHORE	<u>chore</u>			28. BOAT	<u>lie</u>	
4. BEAN	<u>fin</u>			29. RIPE	<u>feel</u>	
5. MERGE				30. WHEEL		
6. DITCH				31. DEAD		
7. SUN	<u>some</u>			32. SOB	<u>witch</u>	
8. TOUGH				33. MESS		
9. SEIZE	<u>size</u>			34. WISH		
10. LEASE	<u>least</u>			35. CHORE		
11. HOME				36. WOOD	<u>tow</u>	
12. JAR				37. KING		
13. PAD				38. TOAD		
14. FALL	<u>safe</u>			39. CHECK		
15. VAN	<u>fan</u>			40. LOOP	<u>nag</u>	
16. JUG	<u>jump</u>			41. LAG	<u>sang</u>	
17. YEARN	<u>earn</u>			42. SALVE	<u>time</u>	
18. MAKE	<u>mate</u>			43. DIME		
19. GALE	<u>toot</u>			44. HULL	<u>fun</u>	
20. TOOTH				45. THIN		
21. PATCH	<u>foil</u>			46. SHIRT	<u>frose</u>	
22. BOIL	<u>gate</u>			47. ROSE	<u>sit</u>	
23. HATE	<u>sick</u>			48. FIT		
24. PICK	<u>nice</u>			49. KITE	<u>kate</u>	
25. KNIFE				50. CAPE		

Sum of boxes checked for: 0 1 2 3

Grand Total: 1 Phoneme Correct: 4 X 1 = 4
2 Phonemes Correct: 25 X 2 = 50
3 Phonemes Correct: 20 X 3 = 60

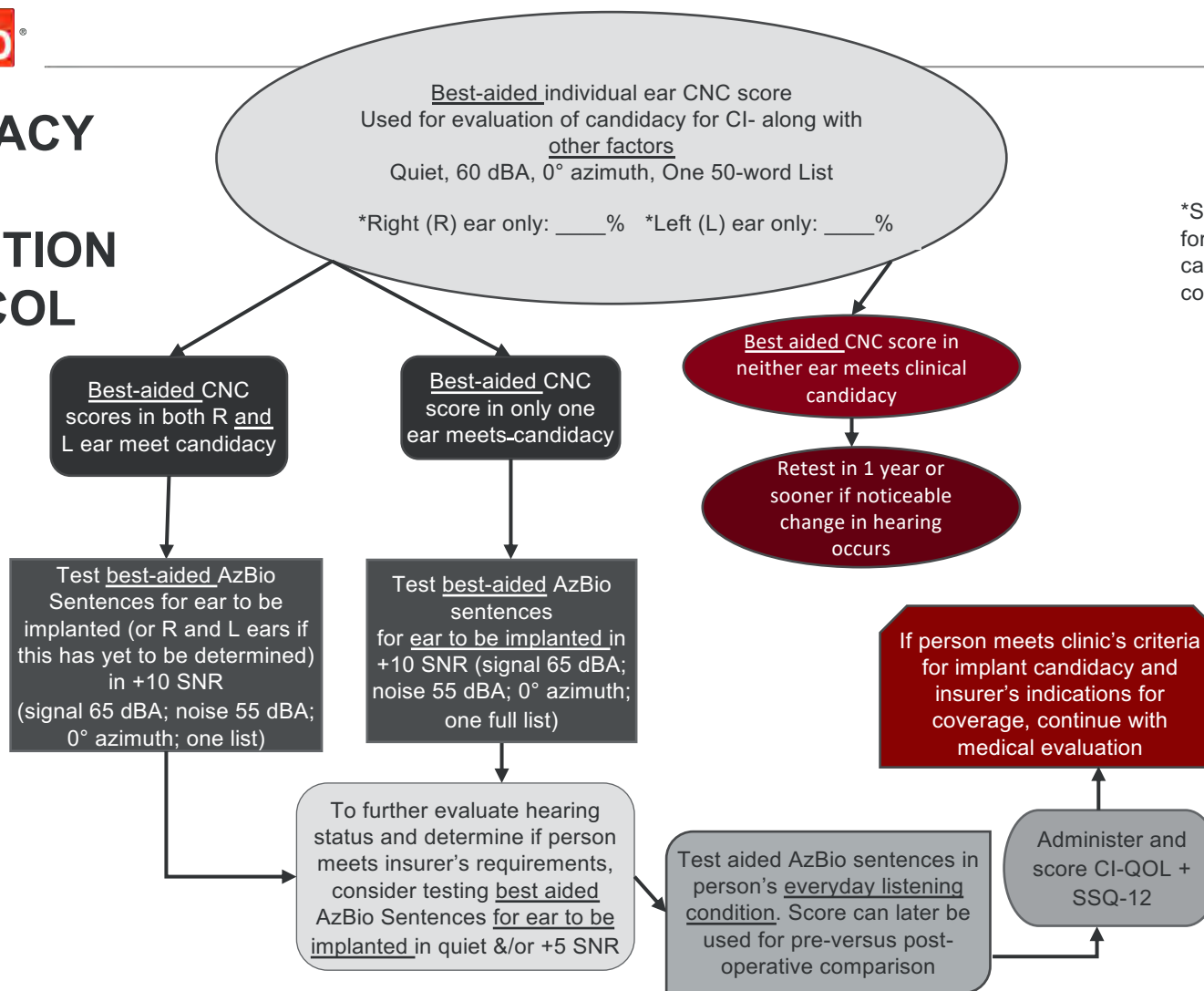
Words with 3 Phonemes Correct = 20 / 50 Words
(.20 x 100 = 40% or 2 x 20 = 40%)

Grand Total: 114 / 150 Phonemes
(.76 x 100 = 76%)

*This enables clinical decisions to evolve/change over time

CANDIDACY SPEECH PERCEPTION PROTOCOL

CNC
Monosyllabic
Word scores and
other factors are
used as the
clinical basis for
determining
candidacy. Other
measures and
test conditions
could be
considered for
further
evaluation.



*See Appendix
for additional
candidacy
considerations

Best-aided: testing using a hearing aid that has been optimized for hearing loss

Everyday Listening Condition: testing with the optimized hearing configuration typical of a person's everyday listening (e.g., unoccluded, unilateral hearing aid or bilateral hearing aids)

Other Factors: audiometry, medical, radiological, cognition, motivation and preference, etiology, expectations, person support

SNR: Signal to Noise Ratio

CALIBRATE THE TEST EQUIPMENT		
1.	Present 1K Hz calibration noise and ensure that the VU meter is not “clipping” the external stimulus (EXT A and/or EXT B). Use the calibration noise associated with a given stimulus (e.g., provided via CD).	
TEST & ROOM SET-UP		
1.	Loudspeaker placed in corner of booth or on side wall	
2.		
3.		
3.	UNAIDED AUDIOMETRIC TESTING	COMPLETED
4.	1. Recommended if:	☒
5.	a. Testing has not been performed within the past six months	
6.	b. Clinician has any concerns regarding the reliability of previous test results	
7.	c. There are concerns of recent change in hearing	
	• Test clip open • Pre-condition as • Perf	
	AIDED SPEECH TEST BATTERY	COMPLETED
	Purpose: The CNC monosyllabic word test is used as the clinical basis for determining candidacy. The condition as	
	• Admin • The b • Impl • For p • If test • langu	
	CNC Quiet: T best-aided co	
	1. Admin	
	2. Admin	
	3. Compare scores to determine better versus poorer ear and EI*	☒
	Other Factors: In addition to aided speech recognition, <u>other factors</u> should be considered in determination of EI. These may include, but not limited to, hearing history, demographic info, motivation and expectations, lifestyle, etiology of hearing loss.	
	FUNCTIONAL OUTCOMES	COMPLETED
	Purpose: Questionnaires are used to further evaluate CI candidacy, document pre-operative hearing c	
	OPTIONAL COGNITIVE SCREENING	COMPLETED
	1. A	
	2. A	
	Purpose: Although cognitive screening is not specifically included in the MSTB-3, if a clinician chooses to perform cognitive screening, the tool should be chosen based on validity, specificity and sensitivity.	
	1. V	
	• Results of the cognitive screening tool should not be used to exclude a person from cochlear implantation	
	*See Appendix X for additional information regarding optional cognitive screening tools	

Case Studies



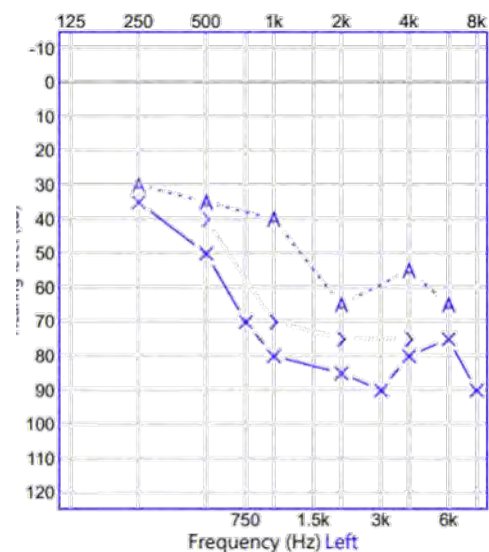
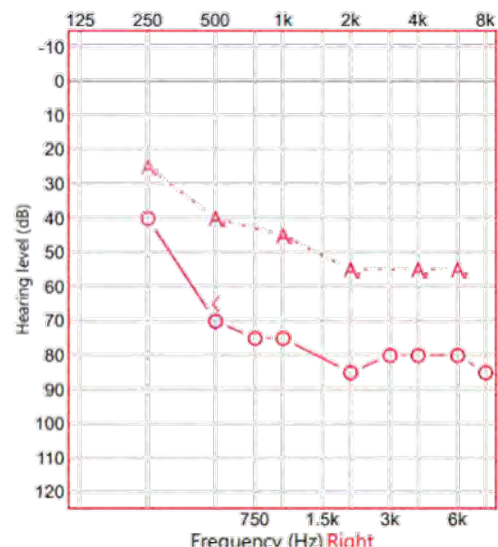
Patient referred for CI evaluation

Gathering our “Other Factors”

- 31 yo male with long history of bilateral profound SNHL identified at 1-1.5 years.
- Worn hearing aids since the HL was identified.
- Participated in auditory training and speech therapy since childhood.
- No known family hx of hearing loss; cause is unknown.
- Hx of chemotherapy at two years and at six years of age.

His hearing goals:

- Continue to enhance his hearing at work
- Understand in large work meetings
- Understand in church
- More effective communication with co-workers
- General improvement in quality of life



CI Candidacy Evaluation

Step 1: Audiometric testing (if indicated), HA verification, Best Aided CNC Words for each ear

Determines (along with other factors) if patient meets clinical indication for CI candidacy

Best-aided individual ear CNC score
Used for evaluation of candidacy for CI- along with other factors
Quiet, 60 dBA, 0° azimuth, One 50-word List
*Right (R) ear only: ____% *Left (L) ear only: ____%

	Right Ear Best Aided	Left Ear Best Aided
CNC Words	36	26

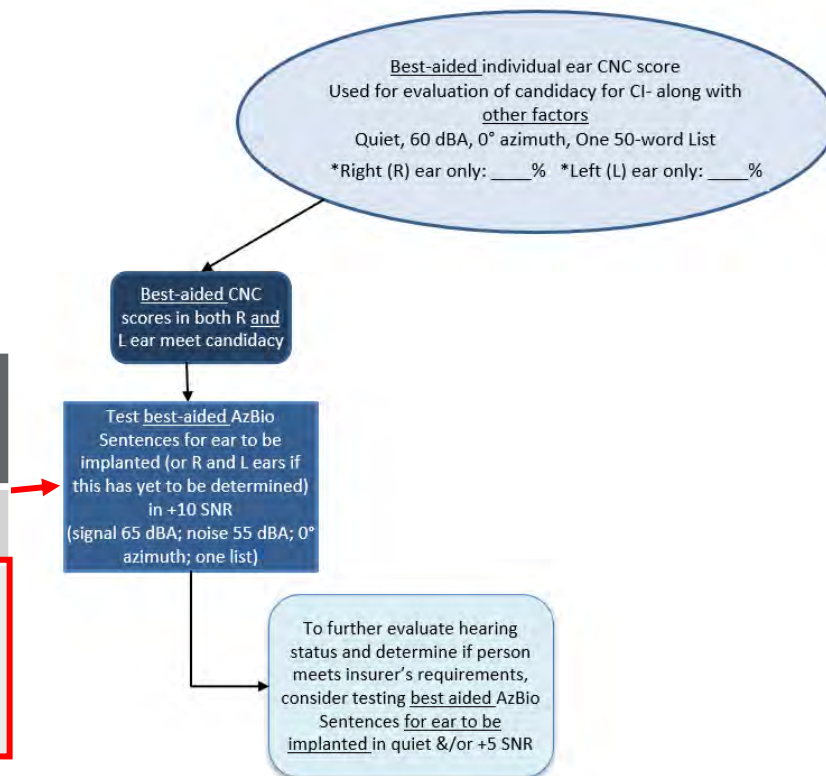
Each ear meets this clinic's clinical recommendation for CI of CNC < 50%

CI Candidacy Evaluation

Step 2: Best aided AzBio Sentences +10 SNR

Provides additional information regarding clinical candidacy of the ear to be implanted (Left Ear Best aided)

	Right Ear Best Aided	Left Ear Best Aided
CNC Words	36	26
AzBio Sentences +10 SNR		19



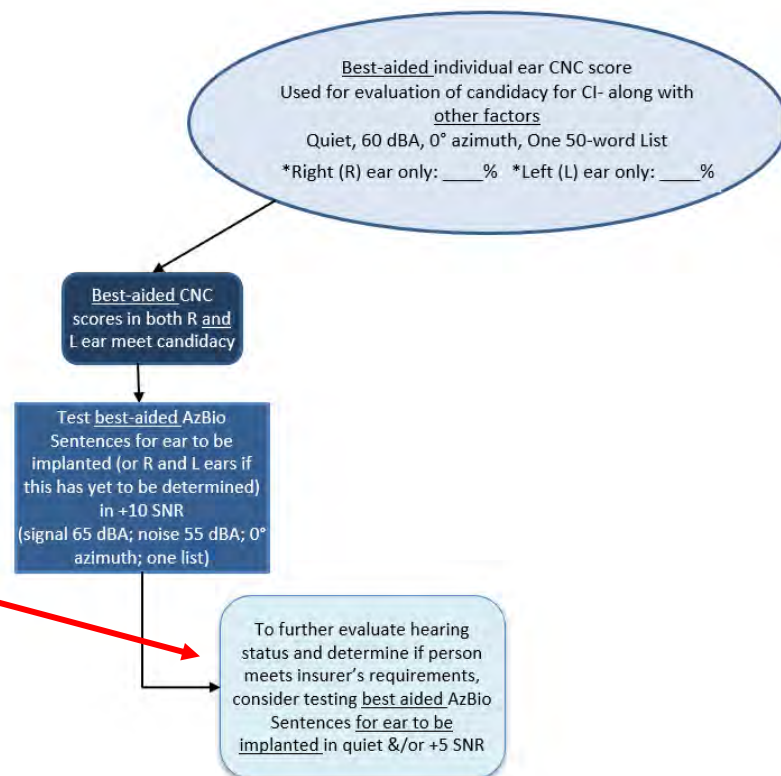
The Left ear meets the clinic's recommendation for a CI. Clinician could consider additional testing, such as in quiet or at a +5 SNR.

CI Candidacy Evaluation

Step 2: Best aided AzBio Sentences +10 SNR

Provides additional information and determines if best aided meets insurer indications for the ear to be implanted (Left Ear)

	Right Ear Best Aided	Left Ear Best Aided
CNC Words	36	26
AzBio Sentences		19



The clinician determined that this patient meets the insurer's indication of a best aided sentence score $\leq 60\%$

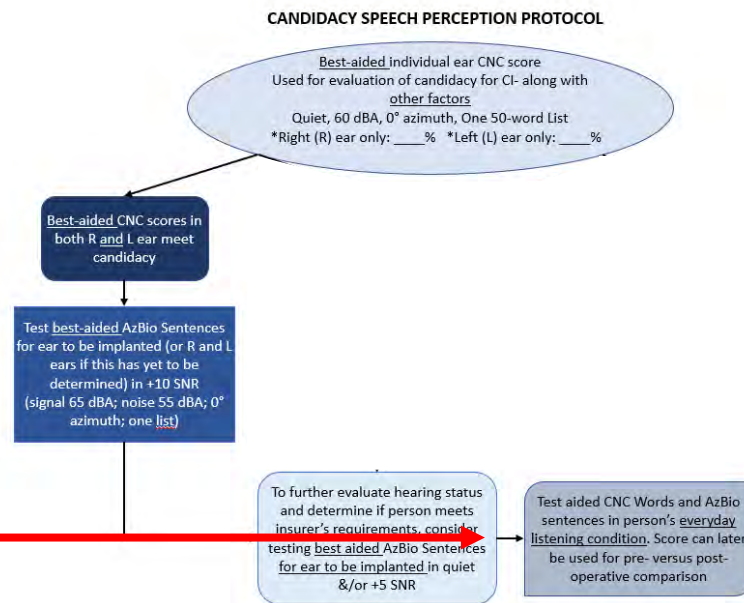
CI Candidacy Evaluation

Step 3: AzBio Sentences +10 SNR

Everyday Listening Condition

This is the first time testing the everyday listening condition.

	Best Aided Right Ear	Best Aided Left Ear	Everyday Listening (Bilateral)
CNC Words	36	26	
AzBio Sentences		19	28



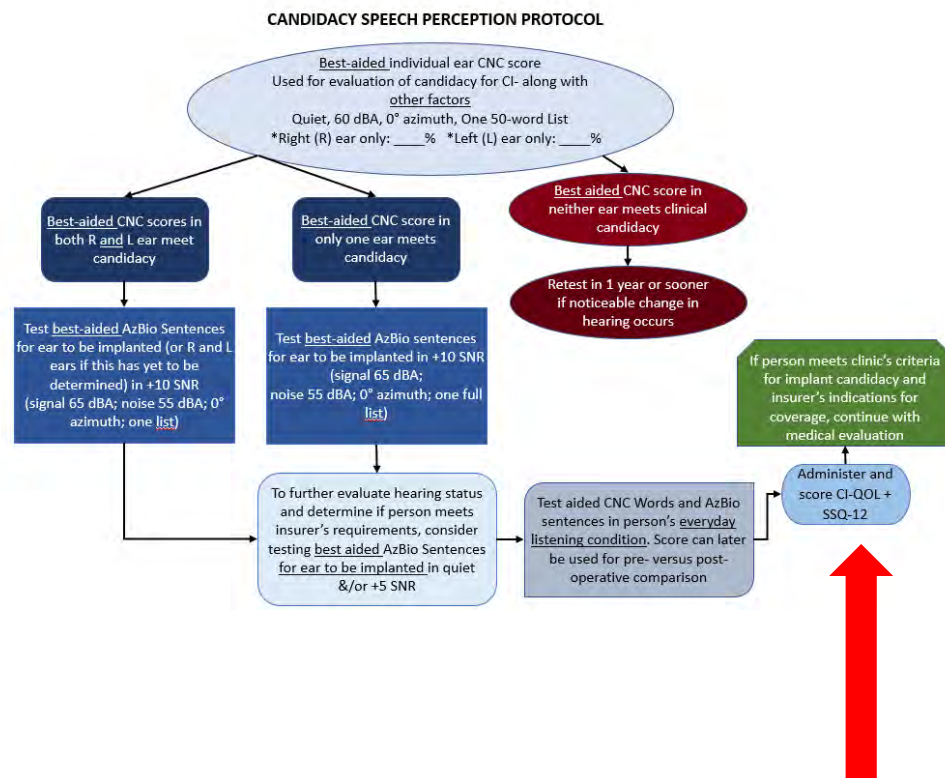
Everyday Listening Condition provides additional information and enables pre/post-op comparison of everyday listening

CI Candidacy Evaluation

Step 4: Administer patient questionnaires and refer to surgeon

This is the first time testing the everyday listening condition.

	Best Aided Right Ear	Best Aided Left Ear	Everyday Listening (Bilateral)
CNC Words	36	26	
AzBio Sentences		19	28



Everyday Listening Condition provides additional information and enables pre/post-op comparison of everyday listening

What if only one ear meets
clinical candidacy?



CI Candidacy Evaluation

Step 1: CNC Words for each ear

Determines if patient meets
clinical candidacy

Best-aided individual ear CNC score
Used for evaluation of candidacy for CI- along with
other factors
Quiet, 60 dBA, 0° azimuth, One 50-word List
*Right (R) ear only: ____% *Left (L) ear only: ____%

	Right Ear Best Aided	Left Ear Best Aided
CNC Words	12	54

Only Right ear Best Aided meets clinic's recommendation for CI of
CNC < 50%

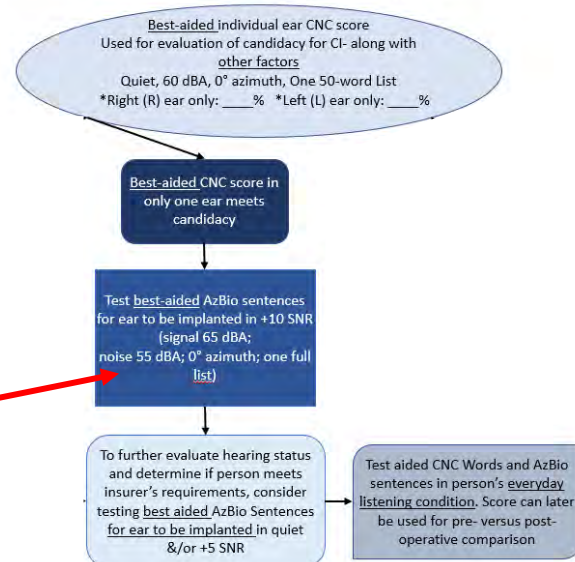
CI Candidacy Evaluation

Step 2: AzBio Sentences

Test best-aided AzBios for the ear to be implanted for additional information

	Right Ear Best Aided	Left Ear Best Aided
CNC Words	12	54
AzBio Sentences +10 SNR	8	

CANDIDACY SPEECH PERCEPTION PROTOCOL



Right ear demonstrates decreased speech recognition in noise. Clinician can consider additional testing (quiet or in +5 SNR) if that helps with candidacy decision

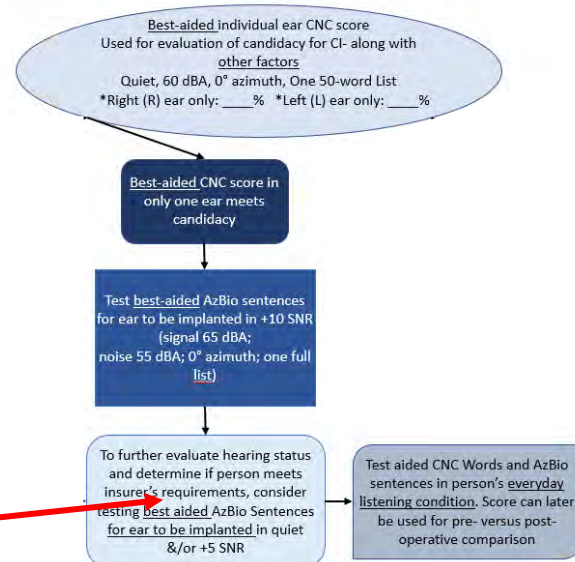
CI Candidacy Evaluation

Step 2: AzBio Sentences

Determines if patient qualifies for insurance coverage of CI

	Right Ear Best Aided	Left Ear Best Aided
CNC Words	12	54
AzBio Sentences +10 SNR	8	

CANDIDACY SPEECH PERCEPTION PROTOCOL



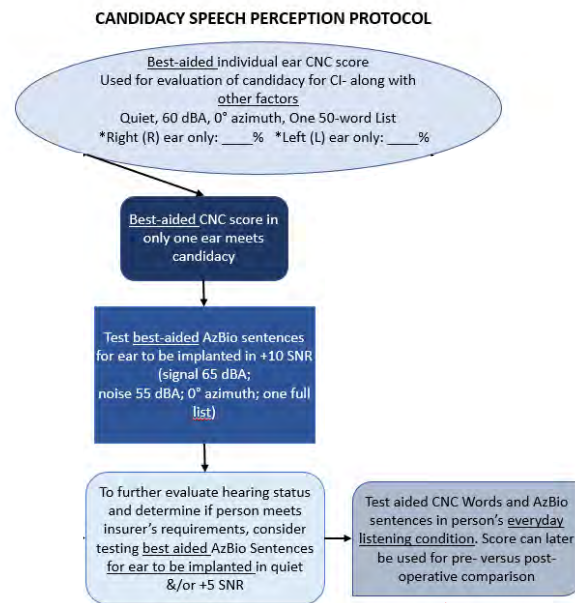
Right ear meets insurer's indication of best aided sentence score < 60%

CI Candidacy Evaluation

Step 3: Test Everyday Listening Condition

Clinicians chose to test Everyday Listening at +5 SNR

	Right Ear Best Aided	Left Ear Best Aided	Bilateral Aided – Everyday Listening
CNC Words	12	54	
AzBio +10	8		
AzBio +5			54

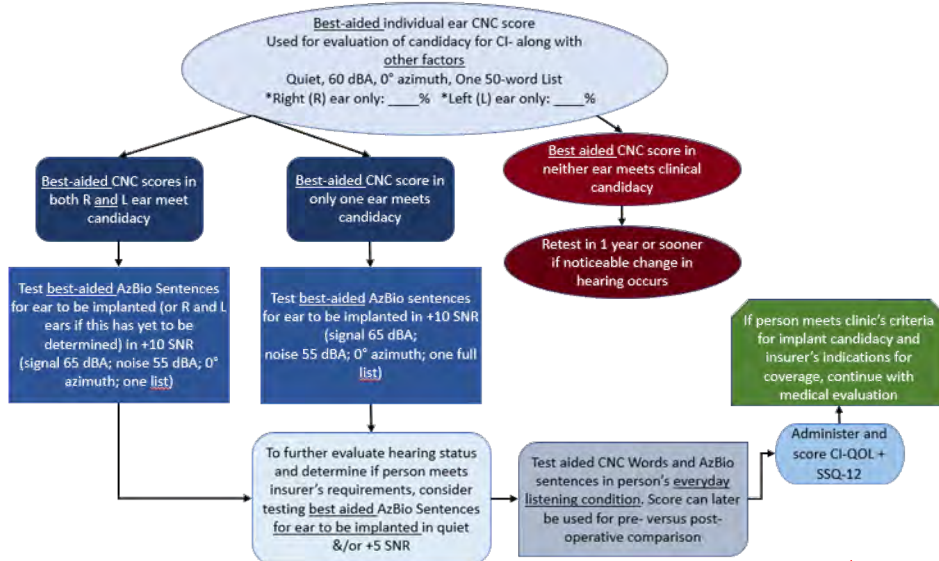


Everyday Listening Condition examined for pre/post-op comparison

Step 4: Administer patient questionnaires and refer to surgeon

Clinicians chose to test Everyday Listening at +5 SNR

CANDIDACY SPEECH PERCEPTION PROTOCOL



	Right Ear Best Aided	Left Ear Best Aided	Bilateral Aided – Everyday Listening
CNC Words	12	54	
AzBio +10	8		
AzBio +5			54

Everyday Listening Condition examined for pre/post-op comparison

Documentation – don't forget about the templates



CI Evaluation Template

AUDIOLOGY HEARING REHABILITATION CENTER

COCHLEAR IMPLANT EVALUATION - AUDIOLOGY SUMMARY REPORT

DATE: _____ PATIENT ID: _____
 PATIENT'S NAME: _____ D.O.B.: _____

HISTORY and EVALUATION

- Otologic history:
 - o Tinnitus: Choose an item.
 - o Dizziness: Choose an item.
 - o Otalgia: Choose an item.
 - o Otorrhea: Choose an item.
 - o Aural fullness: Choose an item.
 - o Family history of hearing loss: Choose an item.
 - o Ear surgery: Choose an item.
 - o Noise exposure: Choose an item.
 - o Anatomy of pathology that puts hearing at risk:
- Relevant medical history:
- Audiology history:
 - o Duration of hearing loss: Choose an item.
 - o Degree of hearing loss: Choose an item. Choose an item.
 - o Etiology:
 - o Amplification history:
 - Patient first began: Choose an item. In chronic item, at age XX.
 - Patient: Choose an item. Choose an item.
 - Current amplification make/models:
 - Hearing aid programming: Choose an item.
- Communication history:
 - o Current communication mode:
 - o Communication limitations:
 - Television: Choose an item.
 - Telephone: Choose an item.
 - Social: Choose an item.
 - Occupational: Choose an item.
 - Other:
 - o Communication goals and expectations:

SPEECH TEST RESULTS

- Best-aided speech testing was conducted using Choose an item. Hearing aid fitting was verified using Choose an item with aid(s) programmed to meet Choose an item. Choose an item. Choose an item.
- The non-test Choose an item ear Choose an item. Choose an item during testing.
- Speech in noise testing Choose an item.



CI Evaluation Template

TESTS	RIGHT EAR BEST-AIDED	LEFT EAR BEST-AIDED	EVERYDAY LISTENING CONDITION
CNC - Primary Criteria			
Presentation level: XX dB A	X	X	X
Whole Word Score	X	X	X
Phonemic Score	X	X	X
AzBio Choose an item.	X	X	X
Presentation level: Choose an item.			

OTHER ASSESSMENTS

The patient completed the following questionnaires:

Questionnaire	Composite Score
Choose an item.	XX
Choose an item.	
Choose an item.	
Choose an item.	
Choose an item.	
Choose an item.	

- Cognitive screening revealed...

IMPRESSIONS

- Results of speech testing today suggest the patient Choose an item. This patient Choose an item.
- Patient reports a negative impact on quality of life, as demonstrated on the XX.
- Patient is Choose an item. to pursue a cochlear implant as possible treatment Choose an item.
- Patient's current hearing aid technology Choose an item.
- Based on the patient's residual pure-tone thresholds, Choose an item.

CONSULTATION

[Patient Name] was counseled on today's findings. Choose an item. Choose an item. Choose an item.

RECOMMENDATIONS

- Choose an item.
- Choose an item.

LENGTH OF APPOINTMENT

XX minutes were spent with the patient today of which XX minutes was spent verifying hearing aids and evaluating auditory status.

Audiologist Name/Signature: _____

The MSTB-3 provides an improved ability to cross check candidacy

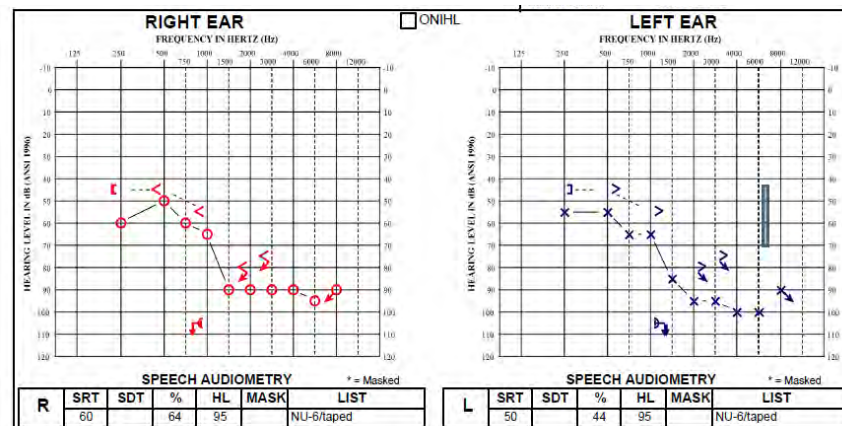
Traditional Candidate Case Study

Gathering our “Other Factors”

- 76 yo male with progressive bilateral moderate to profound SNHL
- Worn hearing aids regularly past 5 years
- Unknown cause of HL
- Insurer = traditional Medicare

His hearing goals:

- Understand family and friends in small groups
- Improve hearing in noise
- General improvement in quality of life
- Wife encouraged him to come for CI evaluation
 - expressed concerns regarding his hearing, inability to pay attention, and memory



Previous Testing for Candidacy:

- Aided AzBio Sentences **AU +10 SNR = 42%**
- Patient is deemed a candidate and proceeds with a CI

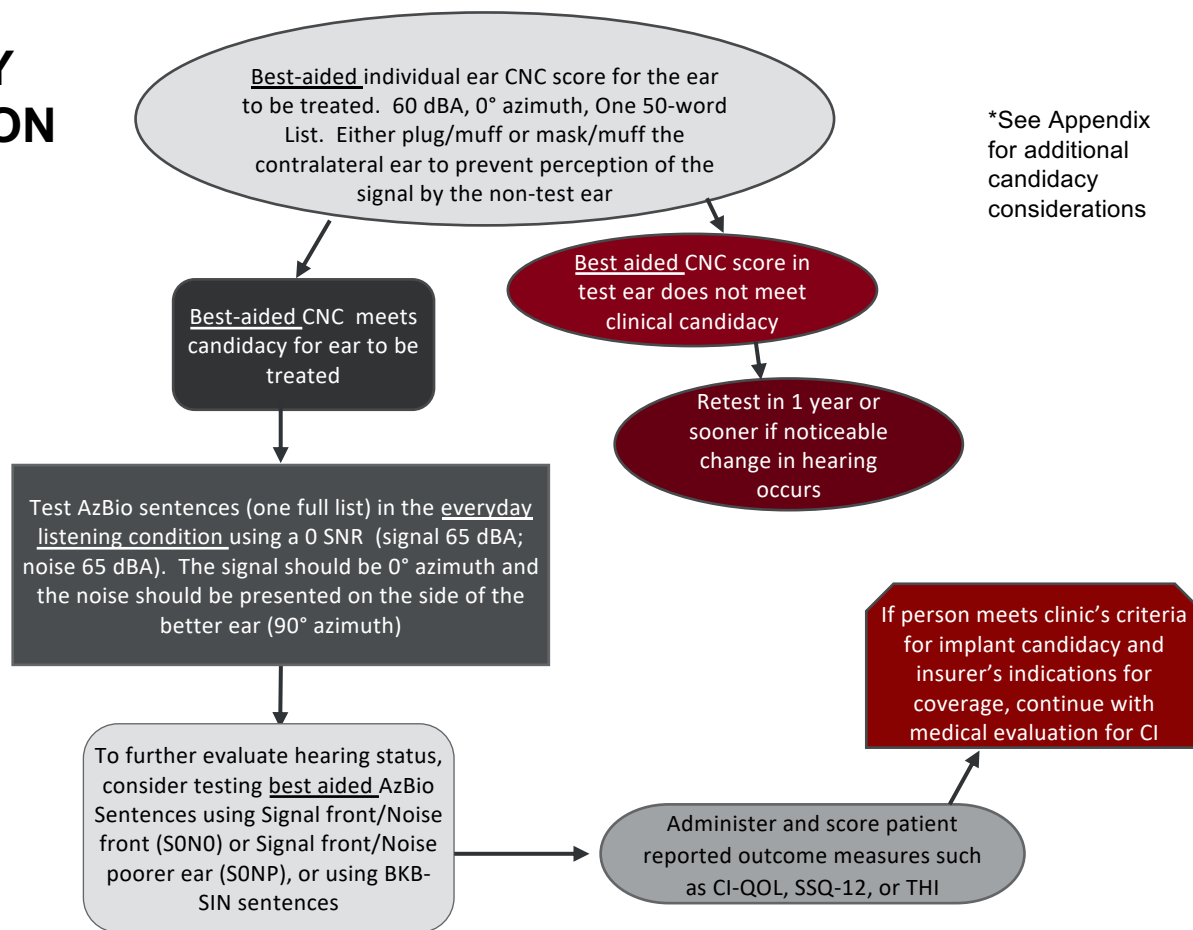
MSTB-3 Testing

- **Best Aided CNC: RE=68% LE: 66%**
- CI is not recommended
- Cognitive screener administered
- Patient may become a candidate later if CNC score(s) decline

MSTB-3 CANDIDACY SPEECH PERCEPTION PROTOCOL: SSD

The pre-operative candidacy evaluation should be preceded by a medical evaluation to ensure appropriate treatment has been tried when applicable.

CNC Monosyllabic Word scores and other factors are used as the clinical basis for determining candidacy. Other measures and test conditions could be considered for further evaluation.



Best-aided: testing using a hearing aid that has been optimized for hearing loss

Everyday Listening Condition: testing with the optimized hearing configuration typical of a person's everyday listening (e.g., unoccluded, unilateral hearing aid or bilateral hearing aids)

Other Factors: audiometry, medical, radiological, cognition, motivation and preference, etiology, expectations, person support

SNR: Signal to Noise Ratio

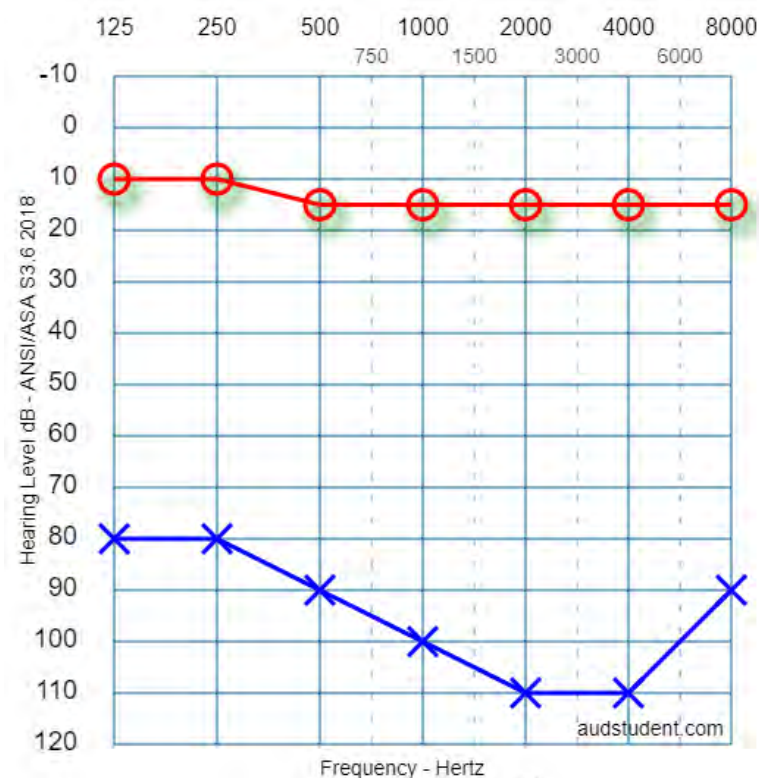
SSD-Case Study

Gathering our “Other Factors”

- 65 year old female with SSNHL LE 6 months ago
- Normal hearing RE
- Unsuccessful steroid treatment
- Tried CROS but did not help
- Debilitating tinnitus in LE
- Insurer does cover CI for SSD
- But what if she had straight Medicare?

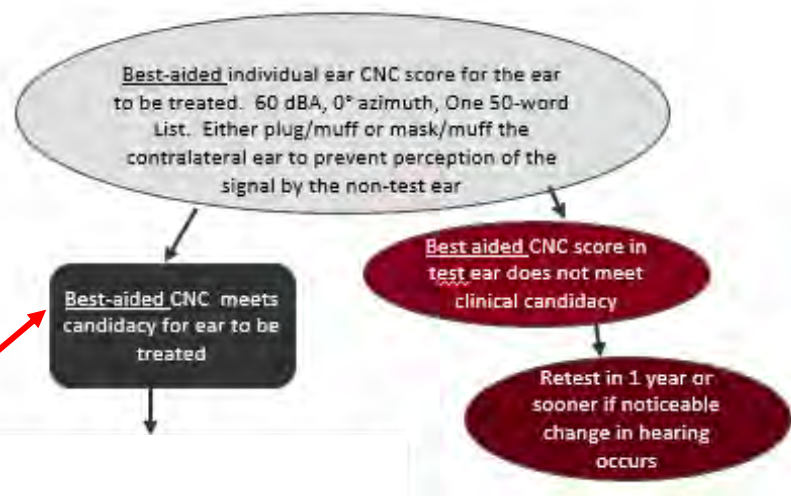
Her hearing goals:

- Improve speech understanding at work
- Improve communication in social settings
- Improved hearing in noise
- General improvement in quality of life



CI Candidacy Evaluation Step 1: CNC Words for each ear

Determines if left ear meets clinical
candidacy



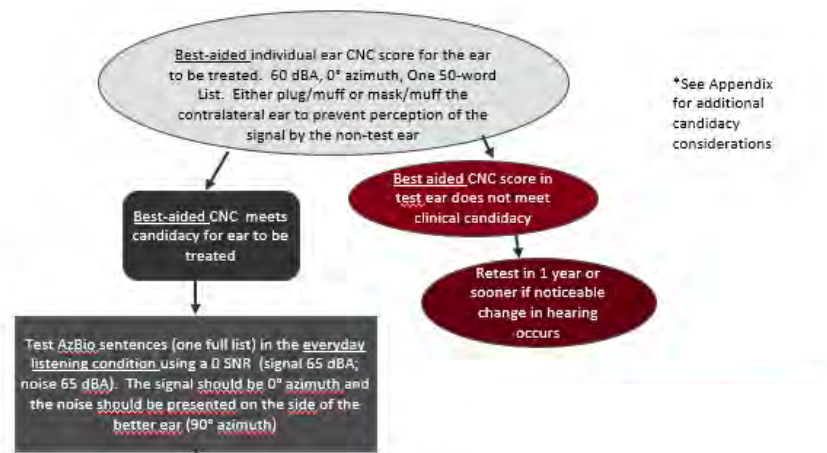
	Right Ear Unaided	Left Ear Best Aided
CNC Words	100	2

Left ear Best Aided meets clinic's recommendation for CI of CNC < 50%

Left ear meets insurer's indication of CNC < 5%

SSD Candidacy Evaluation Step 2: AzBio Sentences in Noise for Ear to be Treated

Information can be used to help
justify need for treatment with CI



	Right Ear Unaided	Left Ear Best Aided
CNC Words	100	2
AzBio Sentences 0 dB SNR		10

*Noise is from speaker facing (unoccluded/unaided RIGHT EAR. Signal is from speaker facing LEFT EAR. SNR = 0 dB to replicate difficult listening situation.

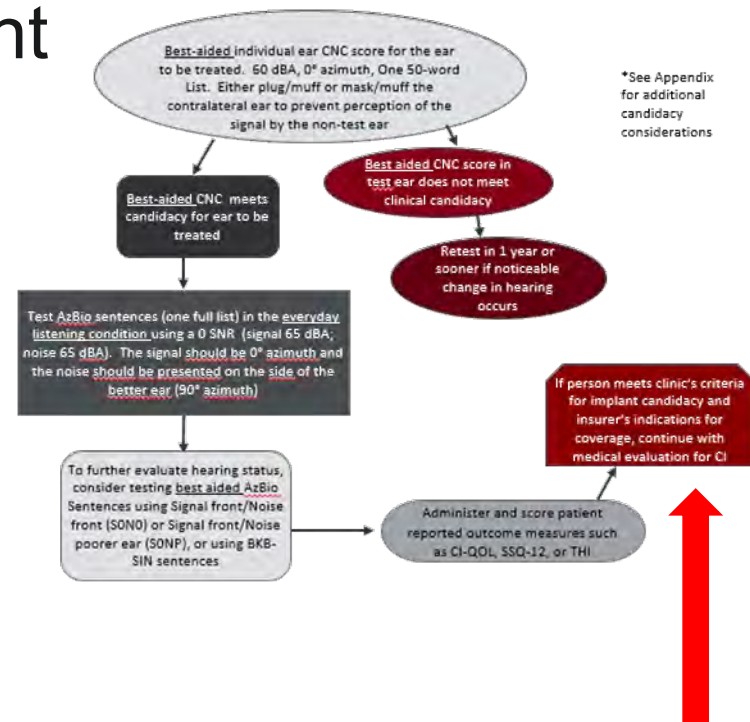
May help to demonstrate that LEFT EAR meets CI indication of <60% on sentences

SSD Candidacy Evaluation

Step 3: Administer THI if patient reports tinnitus in Left ear

Information can be used to help justify need for treatment with CI

	Right Ear Unaided	Left Ear Best Aided
CNC Words	100	2
AzBio Sentences 0 dB SNR		10



Potential impact of CI on tinnitus can be addressed with insurer to help support medical necessity of CI for LEFT EAR

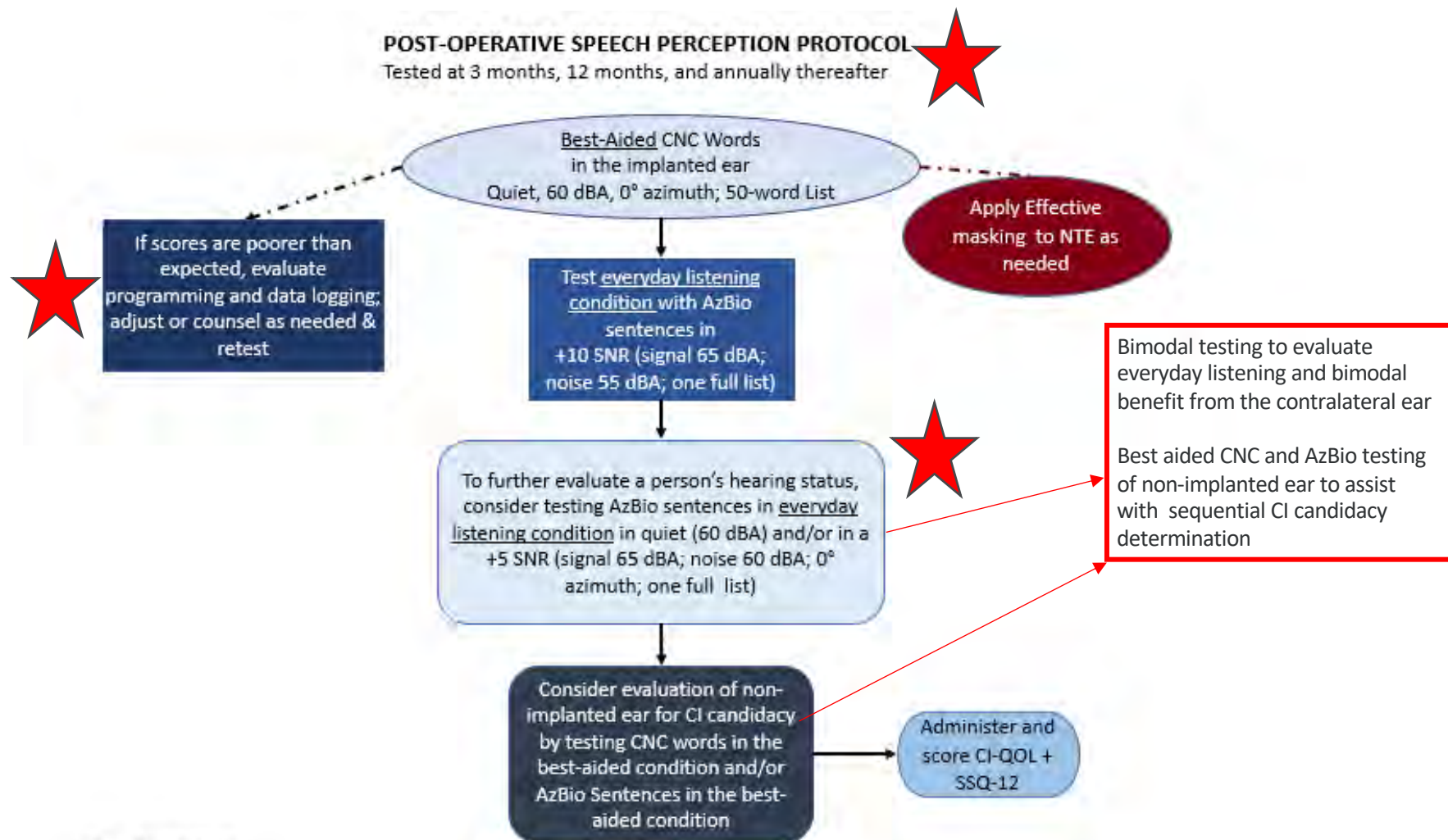
Post-operative Follow-Up – What's different?

- Fewer evaluations recommended (3,12)
- Streamlined test battery focusing on clinical care
- Enhanced consideration of the non-implanted ear
 - Best aided CNC and AzBio testing for sequential CI candidacy determination
 - Bimodal testing to evaluate everyday listening and to further evaluate benefit from the contralateral ear

Post-Operative Protocol

POST-OPERATIVE SPEECH PERCEPTION PROTOCOL

Tested at 3 months, 12 months, and annually thereafter



NTE: Non-test ear

Best-aided: testing using an optimized acoustic amplifier as needed based upon functionally aidable residual hearing.

Everyday Listening Condition: testing with the optimized hearing configuration typical of a person's everyday listening (e.g., bimodal, unilateral CI, bilateral CIs, EAS with contralateral HA; testing should be completed best-aided when a HA/acoustic amplifier is used).

SNR: Signal to Noise Ratio

Post-operative Follow-up Protocol

TEST & ROOM SET-UP		
Refer to the Protocol Document for calibration		
1.	Loudspeaker placed in corner of booth or on side wall	
2.	Person seated 1 meter from the loudspeaker	
3.		
4.	1. Threshold testing for IE is performed:	COMPLETED
5.	a) If functionally aidable thresholds are present prior to implantation	☒
6.	b) At subsequent visits if aidable with an acoustic amplifier	☐
*Consider		
2. Threshold testing		COMPLETED
a) Annually	• Administer all tests using calibrated recorded material	
b) If clinician		
c) If there are		
Guidelines for Managing Speech-Language-Hearing		
FUNCTIONAL OUTCOMES		COMPLETED
Purpose: Questionnaires are used to compare to pre-operative results and evaluate functional		
BIMODAL USERS BEING CONSIDERED FOR BILATERAL CI		COMPLETED
Refer bimodal persons for CI candidacy evaluation in non-implanted ear if:		
a)	there is little-to-no bimodal benefit observed for speech perception measures (except in cases of CI-alone ceiling effects for which bimodal benefit cannot be measured)	
b)	there is an observed bimodal interaction or decrement such that speech and auditory perception is significantly poorer in the bimodal as compared to the CI-alone condition, and/or	
c)	the person reports little-to-no perceived benefit from the HA in the non-implanted ear	
CNC Quiet		
1.	Administer one 50-word list in <u>best aided</u> IE(s) at 60 dBA	☒
• Complete in the person's <u>everyday listening condition</u> (bimodal, bilateral) if additional information is desired.		As Needed: ☒

Postoperative Case Studies

Traditional Case Study – Sequential Evaluation Speech Perception

- HA verified to meet targets as much as possible
- Best aided CNC Words (1-list at 60 dBA)
 - Right: 6% (at eval of left ear it was 19%)

✓ • **Is this patient a candidate based upon what we know right now?**

- Consider “other factors”
- Best aided individual ear CNC scores
- Consider for implant in right ear



Traditional Case Study – Sequential Evaluation Speech Perception

- Best aided AzBio Sentences in quiet
 - Right: 9%
- ✓ • **Does this patient qualify for insurance coverage and meet FDA indications?**
- Continue testing for postoperative comparisons
 - Everyday listening Condition (bimodal)
 - AzBio Sentences in quiet: 63%
 - CNC words: 52%
 - Administer functional questionnaires
- Provide CI evaluation counseling
- Patient should move forward with medical evaluation



Traditional Case Study – Post-Operative Speech Perception

CNC Words

IE - Right

6% pre

44% 3 mos

IE - Left

42% 12 mos

Traditional Case Study – Post-Operative Speech Perception

CNC Words

IE – Right

6% pre

44% 3 mos

IE - Left

42% 12 mos

Everyday Condition

52% (12 mos bimodal)

66% (3 mos CI right; 21 mos CI left)

Traditional Case Study – Post-Operative Speech Perception

CNC Words

IE - Right

6% pre

44% 3 mos

IE - Left

42% 12 mos

Everyday Condition

52% (12 mos bimodal)

66% (3 mos CI right; 21 mos CI left)

AzBio Sentences in quiet

Everyday Condition

52% (12 mos bimodal)

79% (3 mos CI right; 21 mos CI left)

IE – Right

9% pre

75% 3 mos

IE - Left

61% (12 mos)

Traditional Case Study – Post-Operative Sequential Speech Perception

CNC Words

IE - Right IE - Left

6% pre 42% 12 mos

44% 3 mos

74% 12 mos 54% 31 mos

Everyday Condition

52% (12 mos bimodal)

66% (3 mos CI right; 21 mos CI left)

66 % (12 mos CI right; 31 mos CI left)

AzBio Sentences in quiet

Everyday Condition

52% (12 mos bimodal)

79% (3 mos CI right; 21 mos CI left)

84% (12 mos CI right; 31 mos CI left)

IE – Right

9% pre

75% 3 mos

82% 12 mos

IE - Left

61% (12 mos)

63% (31 mos)

Some closing thoughts

- The MSTB-3 places great emphasis on **clinical decision-making**
 - Candidacy decisions begin with a clinical decision before determining if patient meets their insurer's indications
 - Clinicians need to determine:
 - The aspects of the MSTB3 you will embrace as an evolving part of your clinical care
 - The CNC cut off score for candidacy
 - The aspects of the MSTB-3 that you will embrace as an evolving part of clinical care
 - Clinicians should be the ones making decisions about CI care

The MSTB-3 is not just for CI

- Several professionals have expressed interest in using the MSTB-3 to evaluate and monitor performance with hearing aids
- The CNC Words test is an ideal measure for functionally evaluating performance with any type of hearing technology
 - Wouldn't it be great if *all clinicians used the same material*, so we could longitudinally evaluate functional performance over time?
 - Wouldn't it be great if clinicians were confident someone qualified for a CI before they sent them for a CI eval? CNCs could do that
 - Talk with your colleagues about using CNCs to monitor performance with hearing aids over time

MSTB-3 Manual

- Test Battery Literature reviews
- Referral Guidelines
- Additional Calibration Information
- Functional Outcomes Review
- Cognitive Screening Review
- Optional post-operative testing set up for SSD/AHL
- Glossary of terms

Next steps

- MSTB-3 Manuscript submitted for publication MSTB-3 Website: Available Now!
- <https://www.cochlearimplanttraining.com/mstb>



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