Minimum Speech Test Battery (MSTB-3) 3rd Edition

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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, patients, and payers
- Clinicians WANT consistency and guidance
- 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 of the MSTB-3

- 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

https://www.cochlearimplanttraining.com/mstb3

How was the MSTB-3 developed? Leading experts participated in a modified Delphi consensus

- Rigorous literature review using search guidelines
- Test protocols written based on literature review with full references
- Likert Statements generated and voted on for each test protocol
- Protocol sections developed based on 56 approved Likerts
- Edits made to protocols based on feedback provided by stakeholders (ASHA, ACIA, AAA, HLAA, etc.)
- 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

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

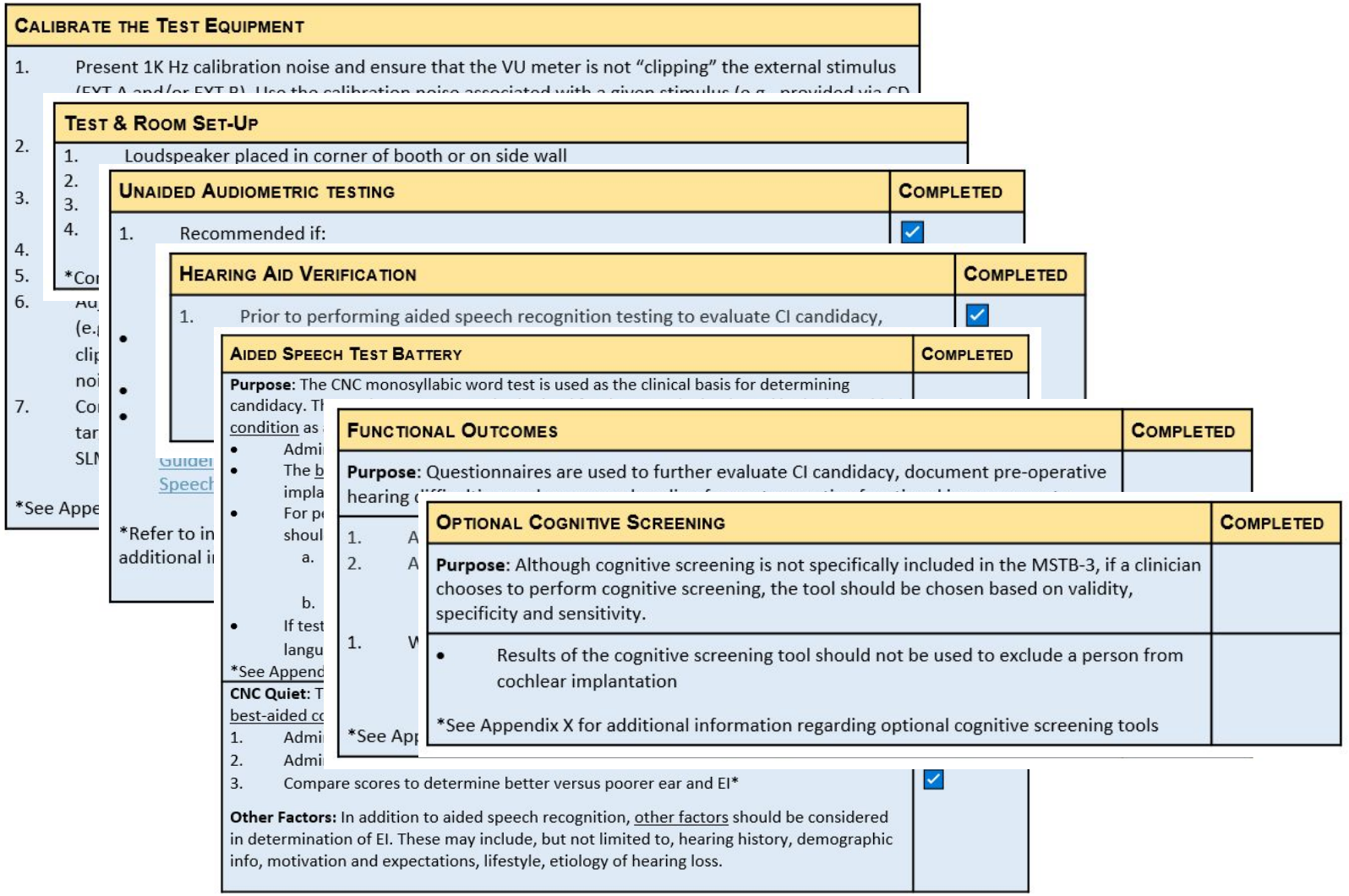
Focuses on measures that will *assist* clinicians in making clinical decisions

Recommends additional tests to be administered based on their insurer's indications

It is not a guideline of test scores to determine candidacy

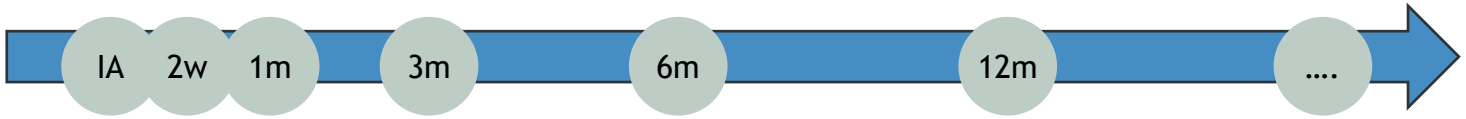
Recommends **test measures** that should be used when evaluating candidacy and post-operative performance

Lots of Details Provided in the Preoperative Candidacy Protocol



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. Decrease in recommended follow-up testing:



4. Focus on CNC Words for initial *determination of CI Candidacy*
5. Increased presentation level in noise: Signal = 65 dB in noise, 60 dB in quiet

Definition of “Best Aided”

Evolution of Clinical Care

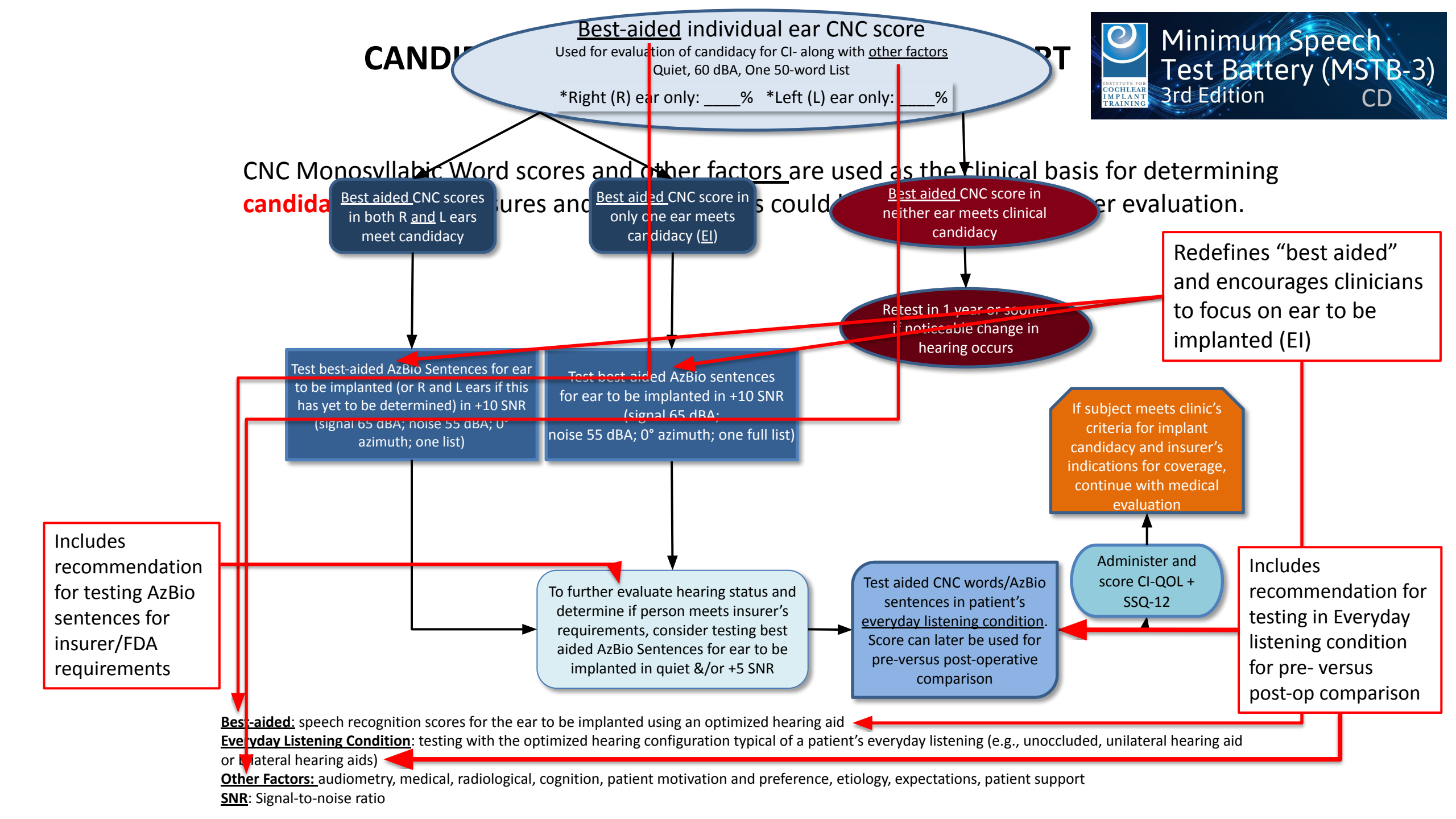
- **Several aspects of clinical care have evolved over time:**
  - Stimuli presented at 70 dB SPL to 60 dB SPL
  - Transformation of CID - HINT - AzBio Sentences
  - Presentation in quiet to testing in noise (+10, +5, 0 SNR)
  - Best aided defined as both ears together to focus on the ear to be implanted

Recent FDA indications

- Takes into consideration recently approved FDA indications (EAS, SSD, AHL) that emphasize the EAR to be TREATED
- These Indications base candidacy on CNC words

Best Aided

- Defined as testing using a hearing aid that has been optimized for hearing loss in the EAR to be TREATED. It makes sense to stop having the contralateral body part play such a strong role in candidacy decisions.


CANDI RT
Best-aided individual ear CNC score
Used for evaluation of candidacy for CI- along with other factors
Quiet, 60 dBA, One 50-word List
*Right (R) ear only: ____% *Left (L) ear only: ____%
Minimum Speech Test Battery (MSTB-3)
3rd Edition
CD
CNC Monosyllabic Word scores and other factors are used as the clinical basis for determining
candida sures and s could er evaluation.
Best aided CNC scores in both R and L ears meet candidacy
Best aided CNC score in only one ear meets candidacy (EI)
Best aided CNC score in neither ear meets clinical candidacy
Retest in 1 year or sooner if noticeable change in hearing occurs
Redefines "best aided" and encourages clinicians to focus on ear to be implanted (EI)
Test best-aided AzBio Sentences for ear to be implanted (or R and L ears if this has yet to be determined) in +10 SNR (signal 65 dBA; noise 55 dBA; 0° azimuth; one list)
Test best-aided AzBio sentences for ear to be implanted in +10 SNR (signal 65 dBA; noise 55 dBA; 0° azimuth; one full list)
If subject meets clinic's criteria for implant candidacy and insurer's indications for coverage, continue with medical evaluation
Includes recommendation for testing AzBio sentences for insurer/FDA requirements
To further evaluate hearing status and determine if person meets insurer's requirements, consider testing best aided AzBio Sentences for ear to be implanted in quiet &/or +5 SNR
Test aided CNC words/AzBio sentences in patient's everyday listening condition. Score can later be used for pre-versus post-operative comparison
Administer and score CI-QOL + SSQ-12
Includes recommendation for testing in Everyday listening condition for pre- versus post-op comparison
Best-aided: speech recognition scores for the ear to be implanted using an optimized hearing aid
Everyday Listening Condition: testing with the optimized hearing configuration typical of a patient's everyday listening (e.g., unoccluded, unilateral hearing aid or bilateral hearing aids)
Other Factors: audiometry, medical, radiological, cognition, patient motivation and preference, etiology, expectations, patient support
SNR: Signal-to-noise ratio

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 (Firszt et al, 2023; 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)

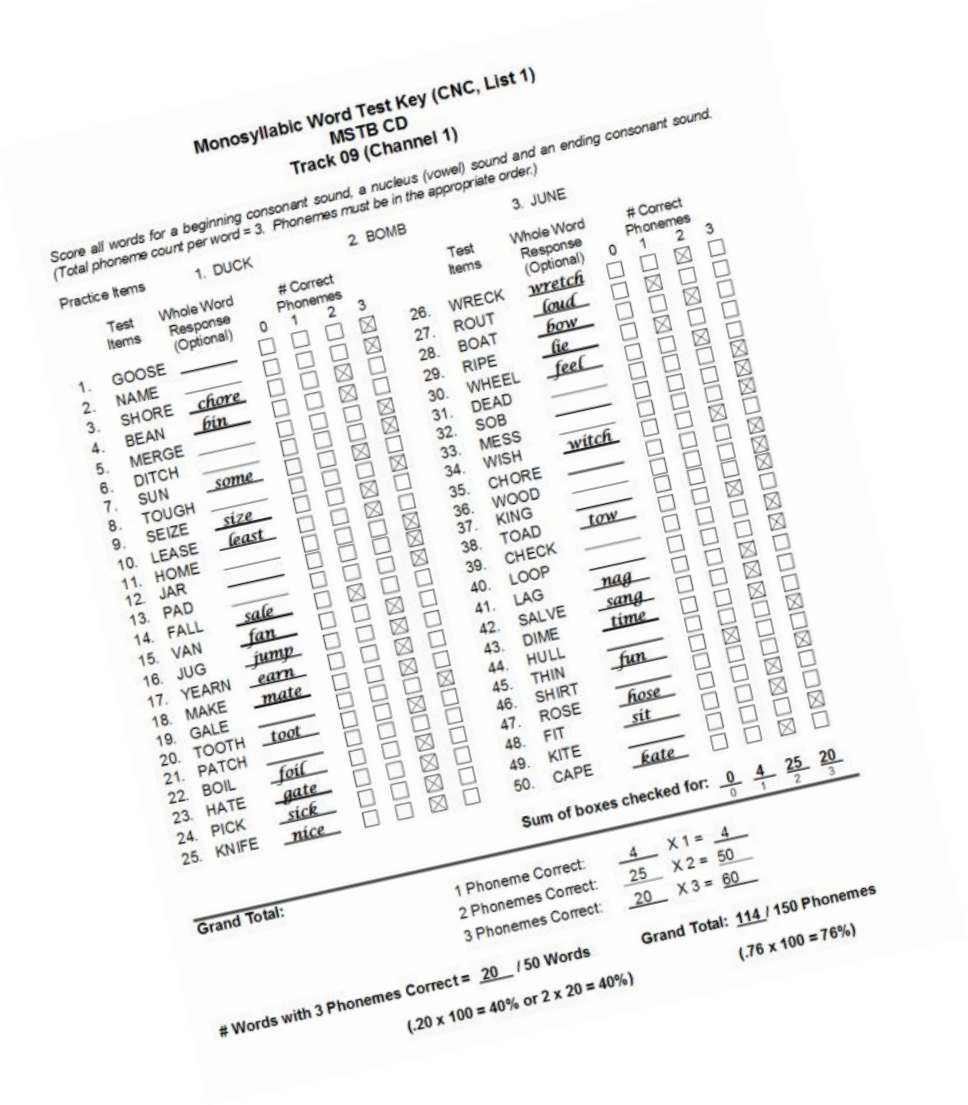
“Cleaner” test of hearing than sentences presented in varying levels of background noise (Sladen et al, 2017)

Word scores bring the US closer to indications of other countries (Vickers et al 2016)

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: 1. DUCK 2. BOMB 3. JUNE

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

Sum of boxes checked for: 0 (0) 4 (1) 25 (2) 20 (3)

Grand Total:

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

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

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

***This enables clinical decisions to evolve/change over time**

Referral Process

***When* should I refer my patient for a cochlear implant evaluation?**

60/60 rule, refer for CI

If poorer than 60% word recognition on audiogram, in ear to be treated

PTA at 500, 1000 & 2000 Hz

Recommend CI evaluation

If poorer than 60% word recognition on audiogram, in ear to be treated

Zwolan, et al. Development of a 60/60 Guideline for Referring Adults for a Traditional Cochlear Implant Candidacy Evaluation. Otol Neurotol. 2020 Aug;41(7):895-900.

Case Examples

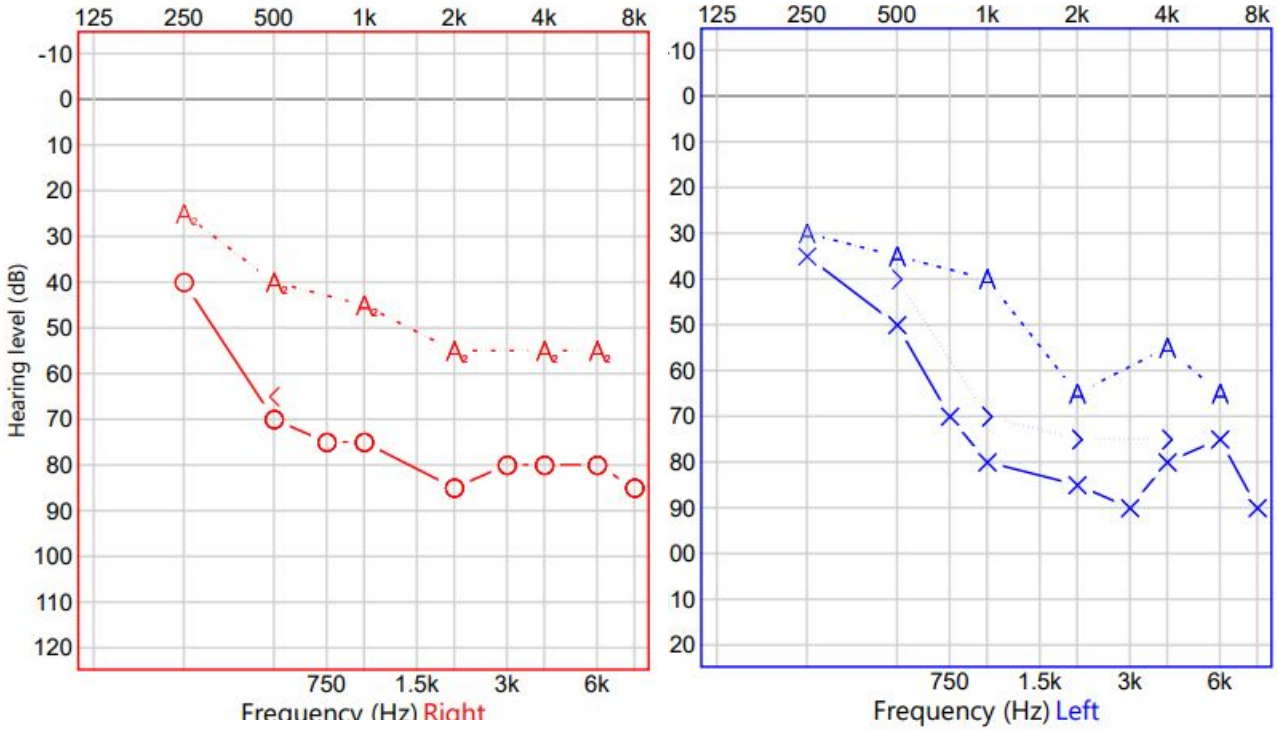
Patient referred for CI evaluation

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.

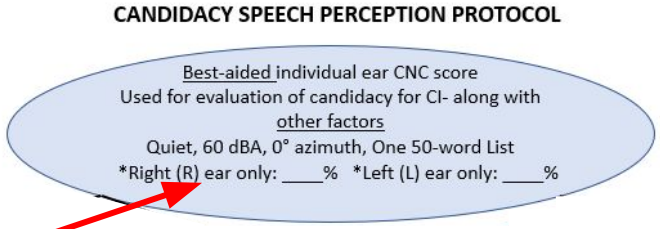
His hearing goals:

- 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



	Right Ear Best Aided	Left Ear Best Aided	Everyday Listening Condition
CNC Words	36	26	

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

CI Candidacy Evaluation
Step 2: Best aided AzBio Sentences +10 SNR

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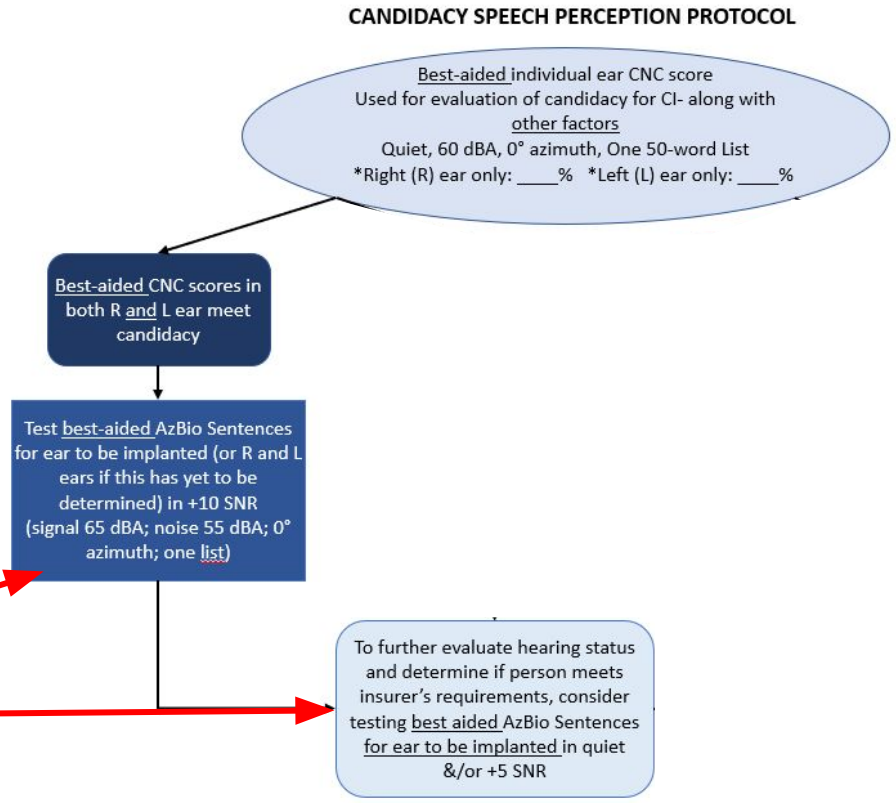
Determine if best aided meets insurer indications for the ear to be treated (Left Ear)

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

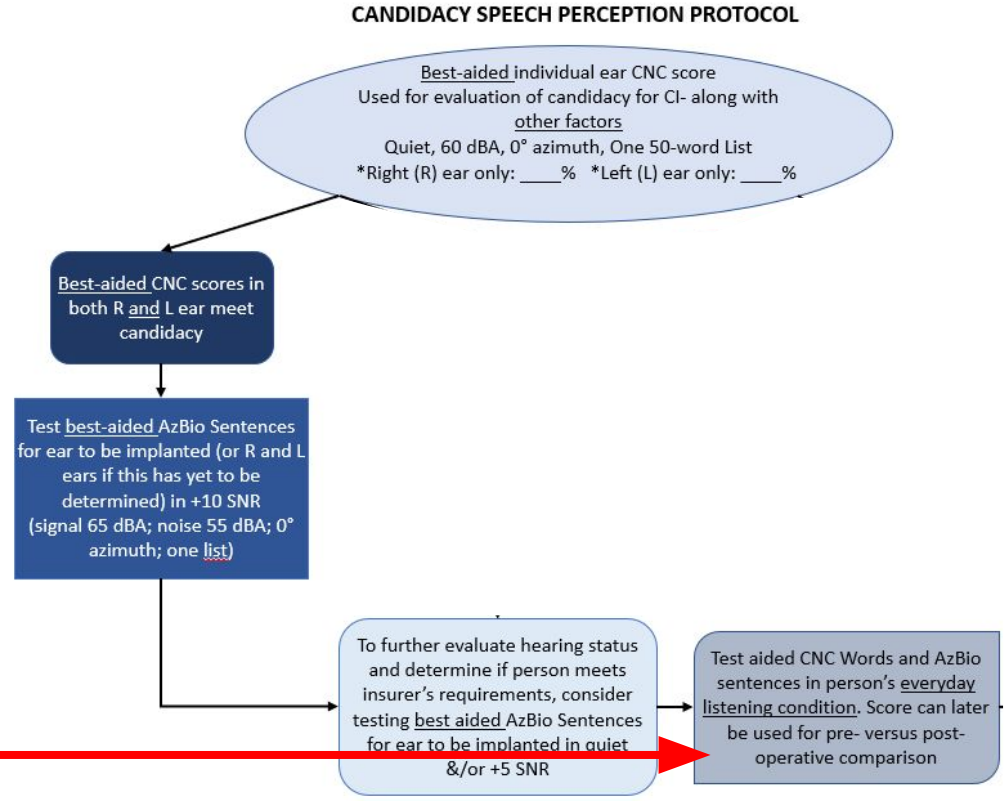


The Left ear meets the clinic's recommendation for a CI as well as the insurer's indication of best aided sentence score ≤ 60%

CI Candidacy Evaluation
Step 3: AzBio Sentences +10 SNR Everyday Listening Condition

This is the first time testing the everyday listening condition.

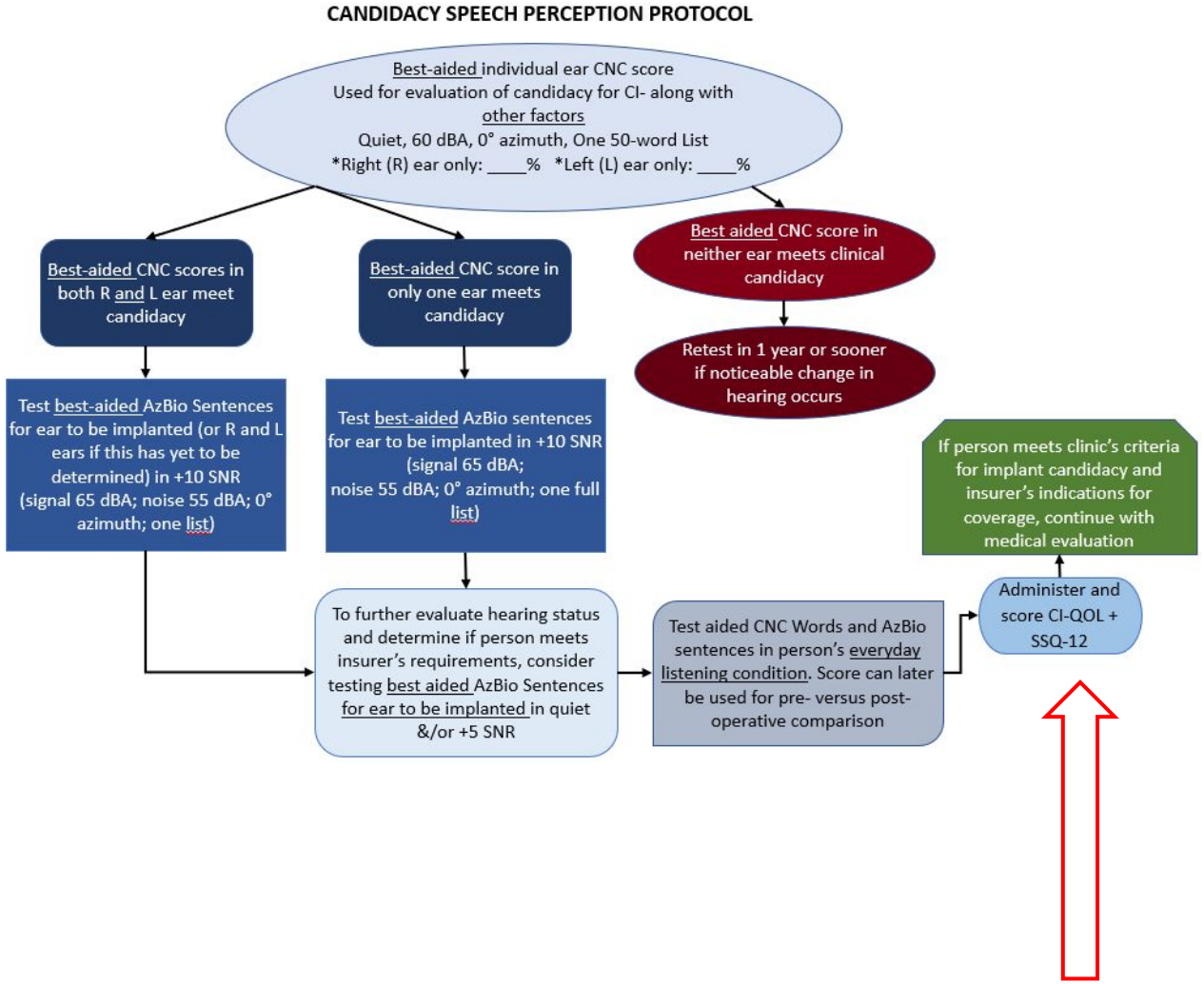
	Right Ear Best Aided	Left Ear Best Aided	Everyday Listening Condition
CNC Words	36	26	
AzBio Sentences +10 SNR		19	28



Everyday Listening Condition examined as this provides additional information and enables pre/post-op comparison.

CI Candidacy Evaluation
Step 4: Administer patient questionnaires and refer to surgeon

	Right Ear Best Aided	Left Ear Best Aided	Everyday Listening Condition
CNC Words	36	26	
AzBio Sentences +10 SNR		19	28



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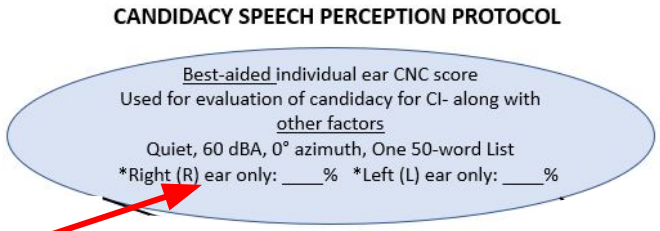
What if only one ear meets clinical candidacy?

CI Candidacy Evaluation
Step 1: CNC Words for each ear

Minimum Speech Test Battery (MSTB-3) 3rd Edition CD

-Determines if patient meets clinical candidacy



	Right Best Aided	Left Best Aided	Everyday Listening Condition
CNC Words	12	54	

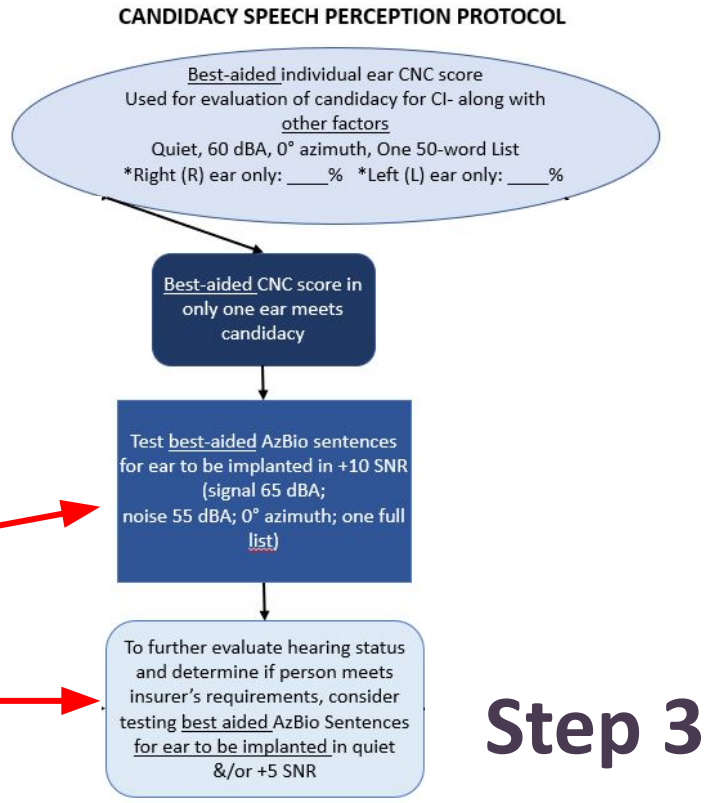
Only Right ear Best Aided meets clinic's recommendation for CI of CNC < 50%

CI Candidacy Evaluation
Step 2: AzBio Sentences

Minimum Speech Test Battery (MSTB-3) 3rd Edition CD

-Determines if patient qualifies for coverage of implantation

	Right Best Aided	Left Best Aided	Everyday Listening Condition
CNC Words	12	54	
AzBio Sentences +10 SNR	8		



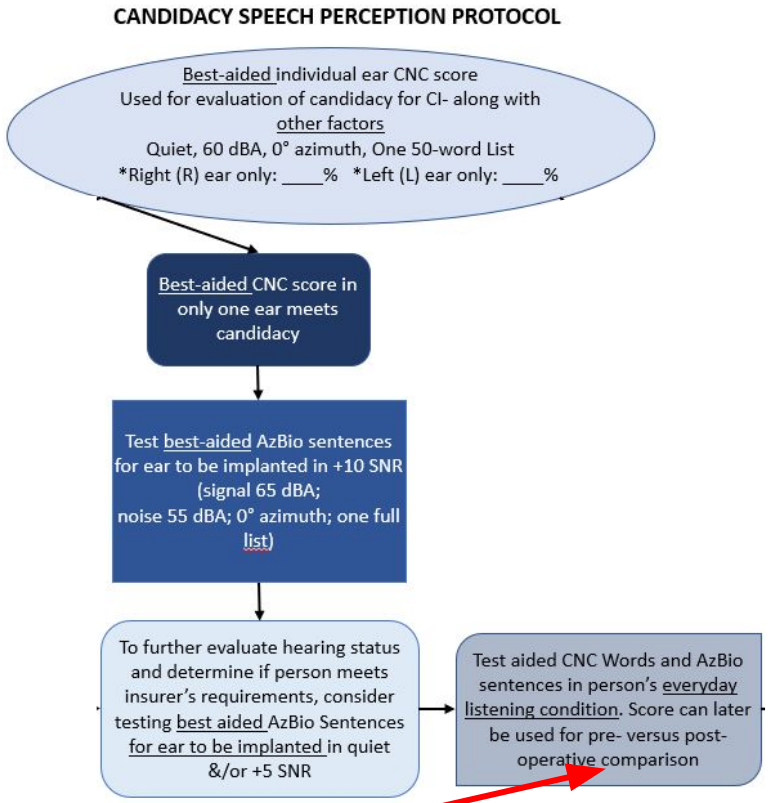
Step 3

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

CI Candidacy Evaluation
Step 4: Test Everyday Listening Condition

-Consider +5 SNR because of best aided left ear score

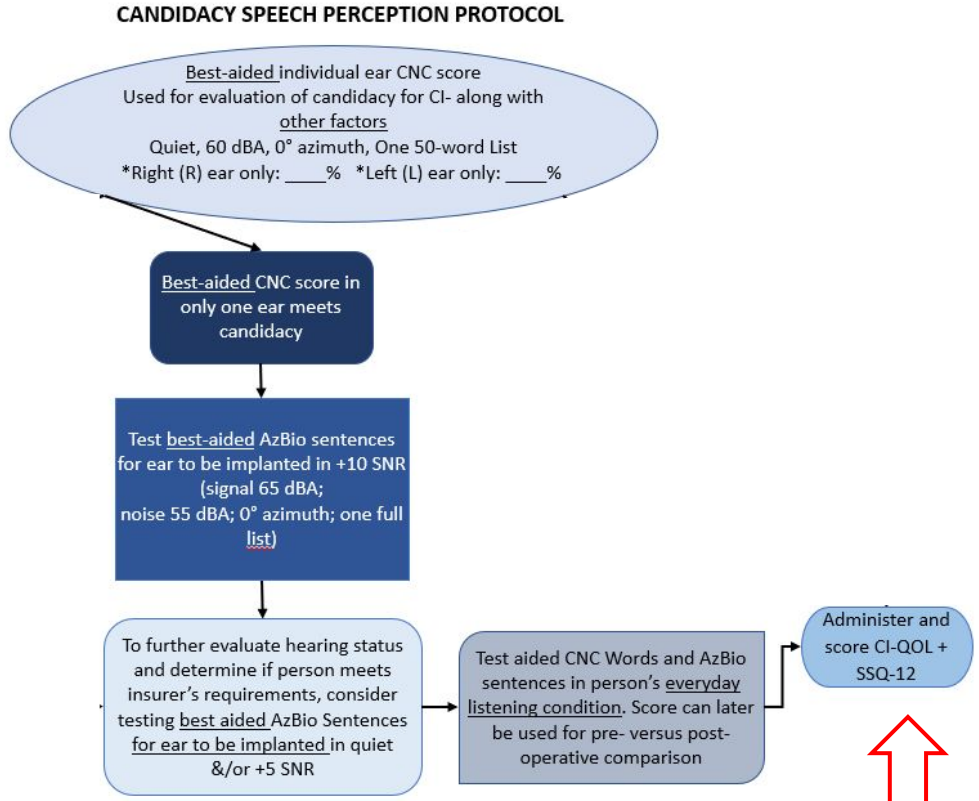
	Right Best Aided	Left Best Aided	Everyday Listening Condition
CNC Words	12	54	
AzBio Sentences +10 SNR	8		
AzBio Sentences +5 SNR			52%



Everyday Listening Condition
examined for pre/post-op comparison

CI Candidacy Evaluation
Step 5: Administer patient questionnaires and refer to surgeon

	Right Best Aided	Left Best Aided	Everyday Listening Condition
CNC Words	12	54	
AzBio Sentences +10 SNR	8		
AzBio Sentences +5 SNR			52%



Everyday Listening Condition
examined for pre/post-op comparison

Documentation – don't forget about the templates

Minimum Speech Test Battery (MSTB-3) 3rd Edition

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

1

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CI Evaluation Template

TESTS	RIGHT EAR BEST-AIDED	LEFT EAR BEST-AIDED	EVERYDAY LISTENING CONDITION
CNC- Primary Criteria			
Presentation level: XX dB A			
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

2

Minimum Speech Test Battery (MSTB-3) 3rd Edition

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

Traditional Candidate Case Study

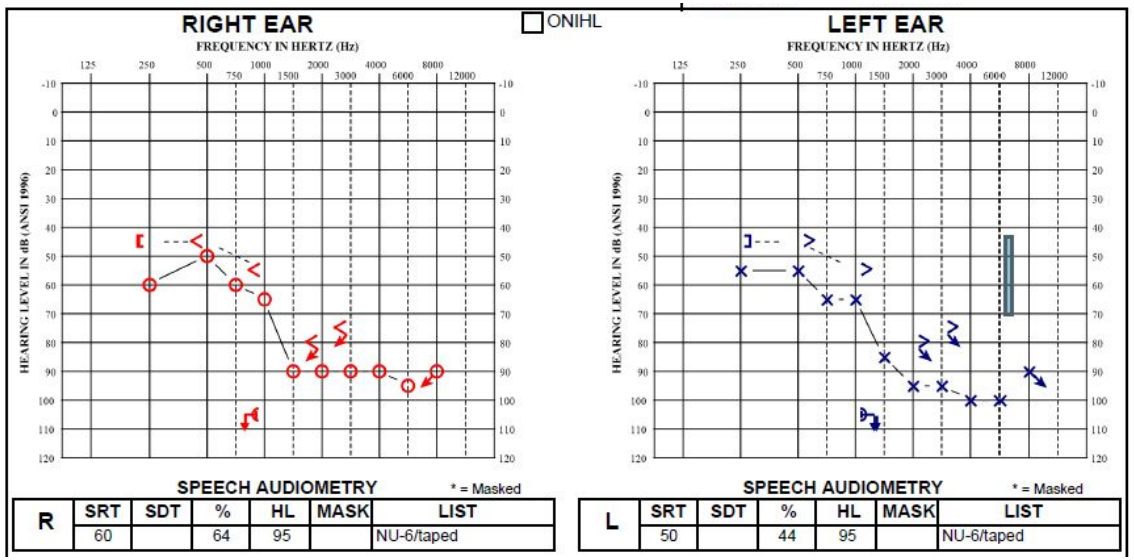
Minimum Speech Test Battery (MSTB-3) 3rd Edition CD

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



SPEECH AUDIOMETRY * = Masked

	SRT	SDT	%	HL	MASK	LIST
R	60		64	95		NU-6/taped

SPEECH AUDIOMETRY * = Masked

	SRT	SDT	%	HL	MASK	LIST
L	50		44	95		NU-6/taped

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

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INSTITUTE FOR COCHLEAR IMPLANT TRAINING

Post-Operative Follow-Up

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

Fewer evaluations recommended

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

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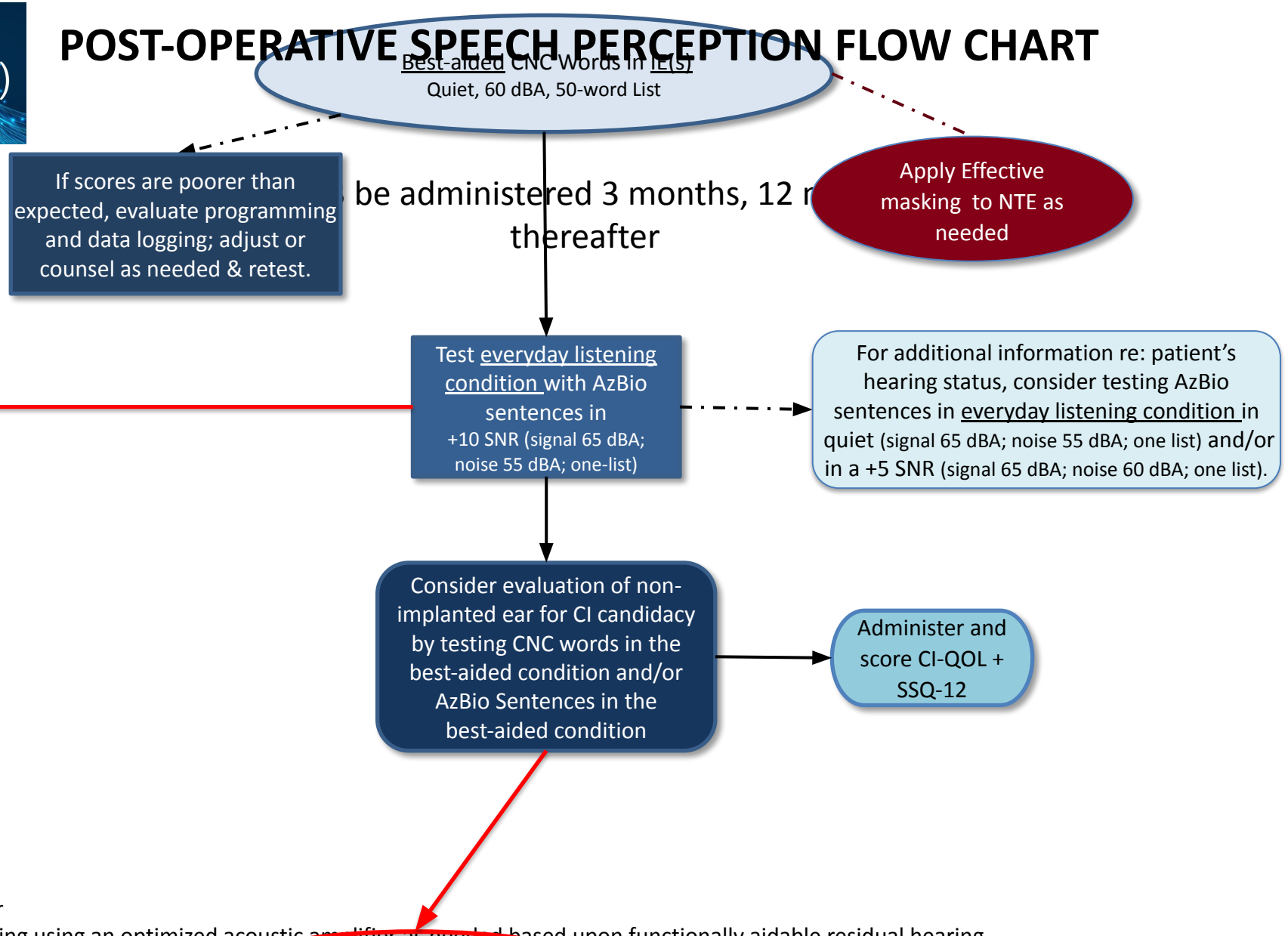
3rd Edition

POST-OPERATIVE SPEECH PERCEPTION FLOW CHART



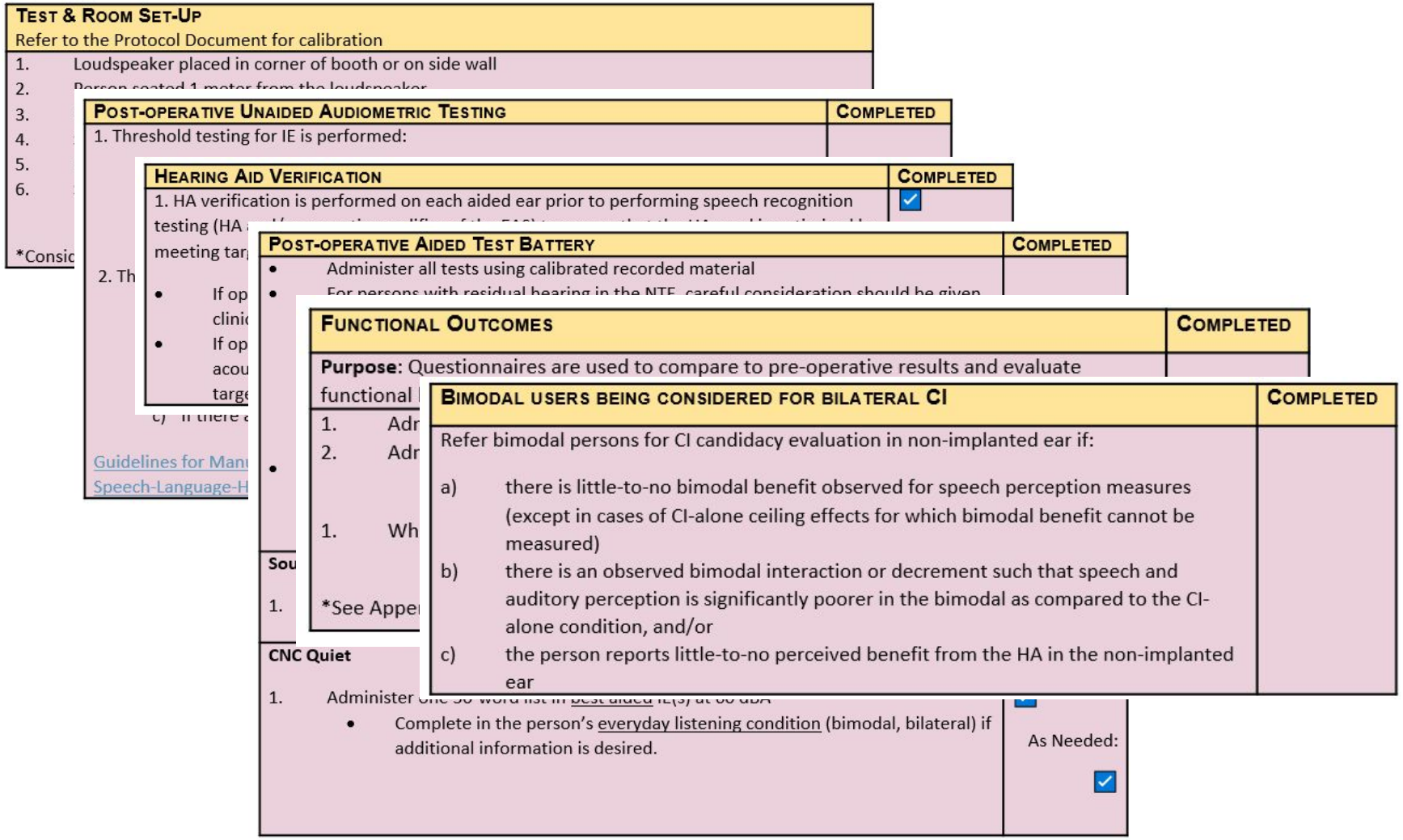
NTE: Non-test ear

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 patient'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)

Other Factors: audiometry, medical, radiological, cognition, patient motivation and preference, etiology, expectations, patient support, aural rehabilitation

Post-operative Follow-up Protocol



How can the MSTB3 improve access?

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 patient performance over time?
- Wouldn't it be great if clinicians were confident someone qualified for a CI before they sent them to you? 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

Some closing thoughts....

The MSTB-3 places great emphasis on **clinical decision-making**

-Candidacy decisions begin with a clinical decision before determining if the patient meets their insurer's indications

-Clinics need to determine

-The aspects of the MSTB3 to incorporate into clinical care

-The CNC cut off score for candidacy

-How you define/use "best aided"

Clinicians should be the ones making decisions about CI care

Next steps

MSTB-3 Manuscript submitted for publication

Audiology Online about the MSTB3 is available now: Modern Approach to Evaluating Speech Perception with the Minimum Speech Test Battery – Revision 3 (audiologyonline.com)

MSTB-3 Website: Now available: https://www.cochlearimplanttraining.com

Questions?

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