Cochlear Implant Candidacy in 2022

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NJAHHP Hearing Conference

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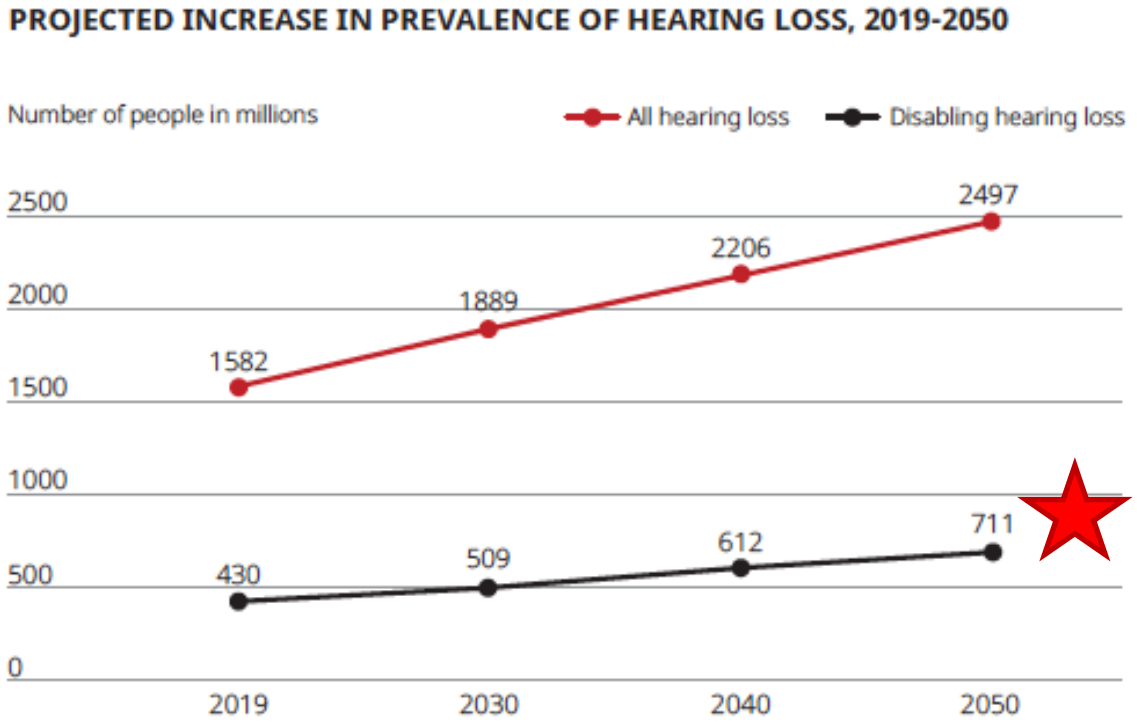
Learning Objectives

1) Understand current cochlear implant candidacy.
2) Understand the 60/60 referral guideline to identify potential candidates.
3) Identify non-auditory factors that are considered when evaluating cochlear implant candidates.

Hearing Loss Prevalence

- Over 40 million Americans suffer from disabling hearing loss
- 3rd most prevalent chronic health condition following arthritis and heart disease
- Projected to impact over 700 million by 2050

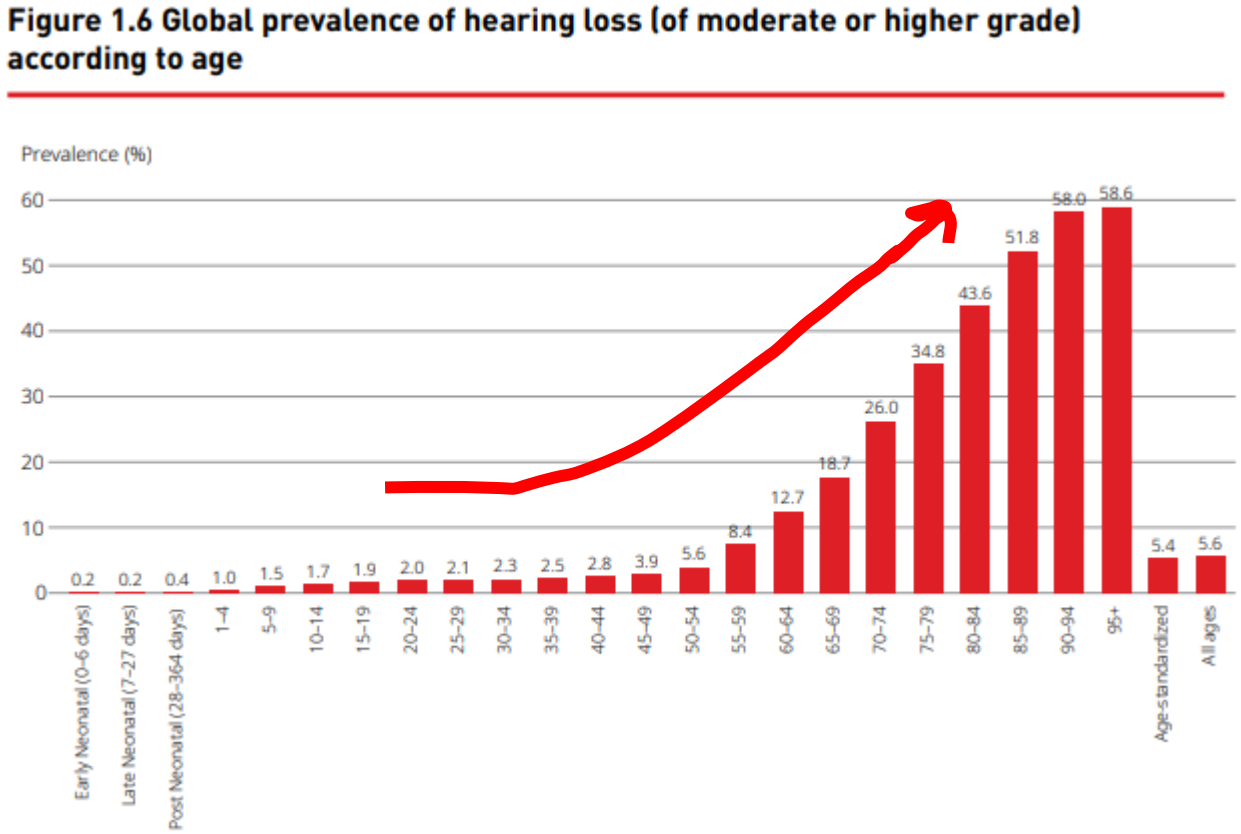


WHO, 2021;

Advanced Aging

Associated with hearing loss:

- Depression
- Social isolation
- Poor quality of life
- Loss of autonomy
- Cognition

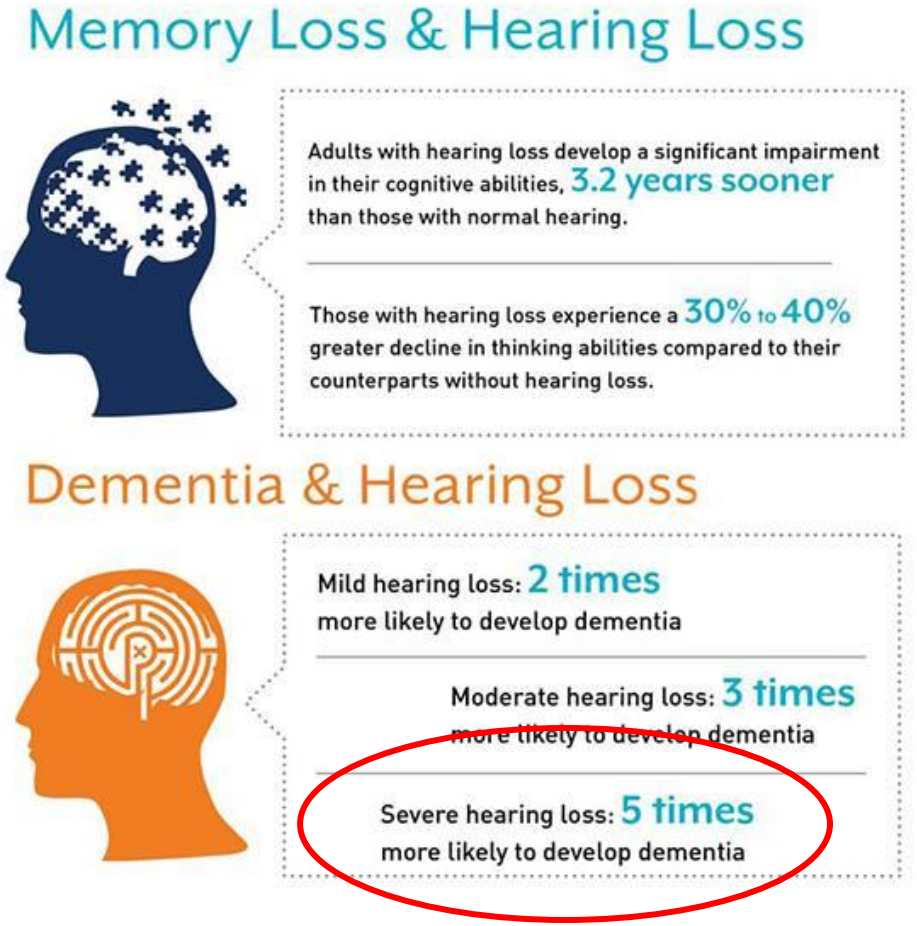


(Kramer et. Al., 2002; Davis et al, 2016)

WHO, 2021

Hearing Loss and Dementia

- The risk of dementia and Alzheimer's disease increases with hearing loss severity[1]
- Hearing loss is the single largest modifiable risk factor for dementia[2]
- Dementia incidence could be reduced with the treatment of hearing loss[2]



1. *Lin FR et al. Arch Neurol 2011;68(2):* **2.** *Livingston G et al. Lancet 2017;390(10113):2673–734*

Treatment Options

- Non-invasive
  - Traditional amplification
    - Hearing Aids
    - Contralateral Routing of Signals (CROS)

- Invasive
  - Cochlear Implants
  - Bone-Anchored Hearing Devices

Candidacy Determination

- How do we determine a hearing aid is unsuccessful?
- How do we determine when to transition from non-invasive to an invasive treatment option

Utilization of Hearing Aids

- Current estimates suggest utilization rates are as low as 21% for those who could benefit from hearing aid

- Reasons for low utilization
  - Cost
  - Stigma
  - Denial
  - **Lack of perceived benefit**

Nassiri et al., 2021

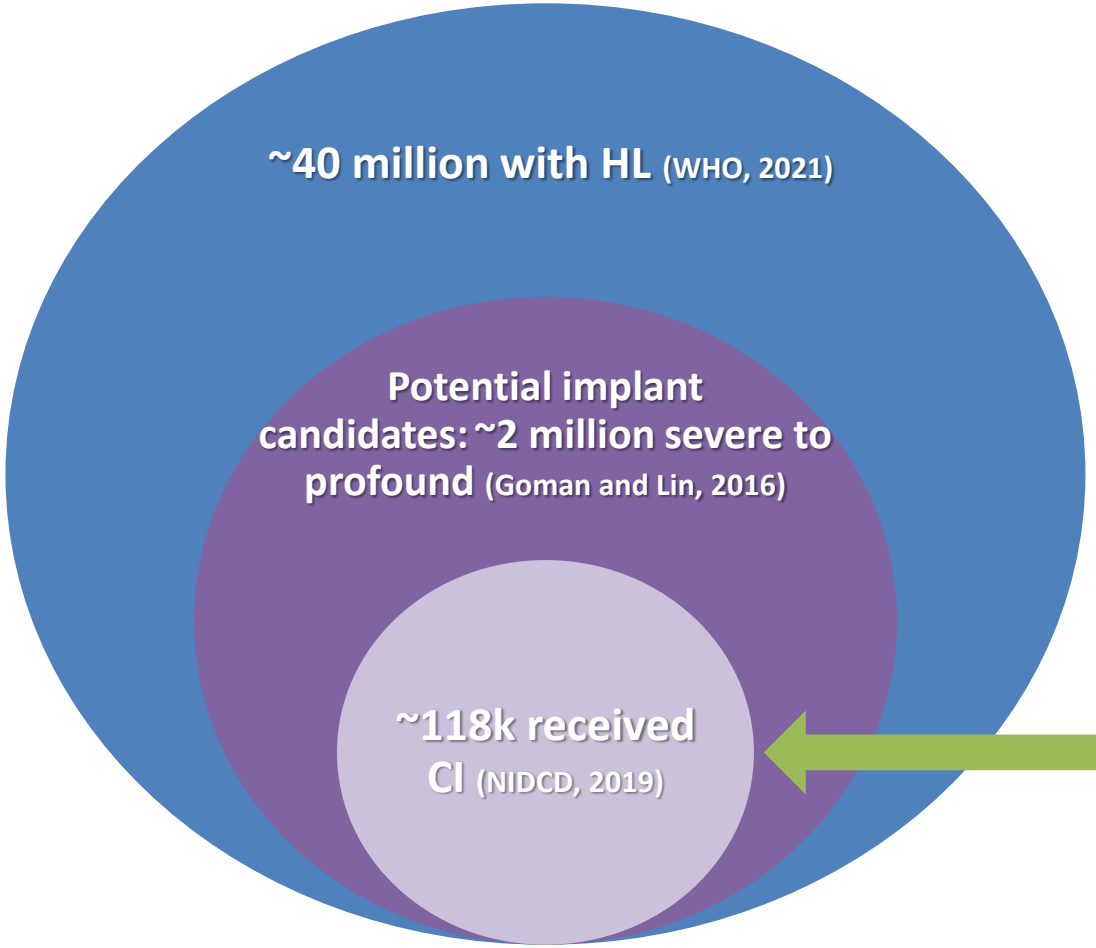
Benefits of Cochlear Implants

- 2020 study of Medicare patients who received a CI:
  - Median improvement of 53% for speech recognition in the implanted ear over the hearing aid only condition

- 2021 study of >400 CI cases:
  - 85% improved word recognition
  - 88% improved sentence score in quiet
  - 79% improved sentence score in noise

Zwolan et al., 2020; Dornhoffer et al., 2021

Utilization of Cochlear Implants in the US



<10% penetration

Reasons for Low Utilization

- Low referral rates
- Lack of a clear referral pathway to a cochlear implant center
- Lack of familiarity with guidelines among clinicians and consumers
  - Physician is the #1 influencer on HHC decisions*

Kochkin et al, 2012

Common Misconceptions

- Insurance does not cover the surgery
- The surgery involves complicated brain surgery
- Cochlear implants are only for patients with profound hearing loss
- Age is a factor in determining candidacy
- Patient will lose all of their hearing following surgery

Zeitler and Holcomb, 2021

Criteria	1985	1990	1998	2000	2014	2019	2020	2022
AGE of implantation	18 yrs +	2 yrs +	18 mos +	12 mos +	12 mos +	Adults & Children 5yrs+ (SSD, AHL) – Med EL	9mos+ - Cochlear	Adults and Children ≥5 yr (UHL/SSD) (Cochlear)
ONSET of hearing loss	Post-linguistic	Post-linguistic adults Pre- & post-linguistic children	Pre- & Post-linguistic	Pre- & Post-linguistic	Pre- & Post-linguistic	Pre- & Post-linguistic	Pre- & Post-linguistic	Pre- & Post-linguistic
DEGREE of hearing loss	Profound	Profound	Adults: Severe to profound SNHL Peds: Profound	Adults: Moderate to profound SNHL in both ears Peds: Sev to prof 2 yrs + Prof < 2 yrs	Adults - EAS & Hybrid: Normal to moderate SNHL in low to mid frequencies; severe to profound HL in high frequencies	SSD: Profound SNHL, one ear Normal or mild SNHL, other ear Asymmetrical HL: Profound SNHL, one ear Mild to mod severe SNHL, other ear 1 mo HA trial	Adults: Moderate to profound SNHL in both ears Peds: Sev to prof 2 yrs + Prof < 2 yrs	SSD: Severe to profound SNHL in one ear, normal or near normal hearing in contralateral ear; at least 2 wks to 1 mth wearing CROS device or suitable hearing device
Speech SCORES	0%	0%	Adults: ≤40%	Adults: Sentences score ≤ 50% in ear to be implanted, ≤ 60% in best aided condition Peds: ≤30% LNT/MLNT	EAS/Hybrid: CNC word score > 10% but < 60% in ear to be implanted; < 80% CNC words in contralateral ear	≤5% correct on CNC word score		≤5% on CNC word score

Expanded CI Criteria

Acoustic and Electric (A+E): acoustic and electrical hearing in *same* ear

- Typically uses a contralateral hearing aid
- Accomplished using:
  - Hearing preservation electrode
  - Standard length electrode

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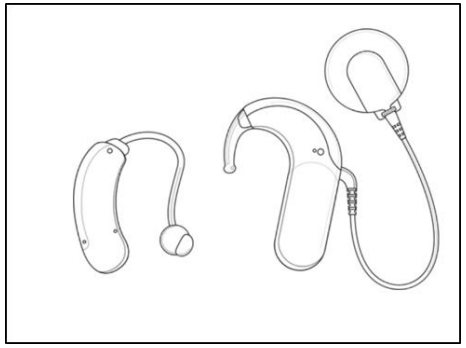
Expanded CI Criteria

Bimodal hearing: acoustic and electrical hearing in *opposite* ears

Cochlear™

Advanced Bionics

MED EL



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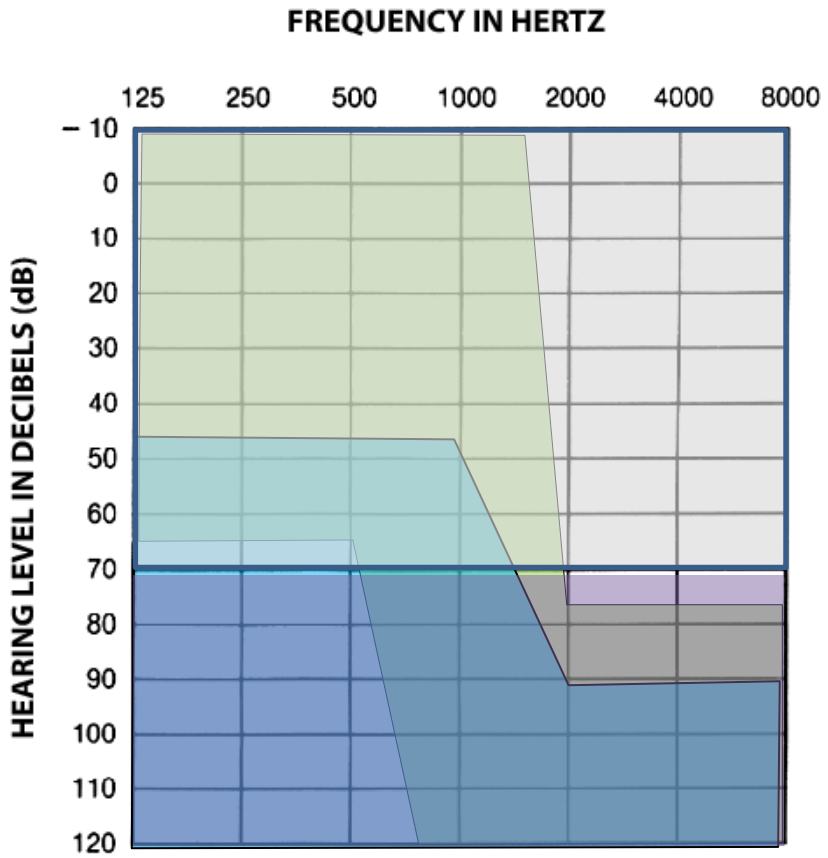
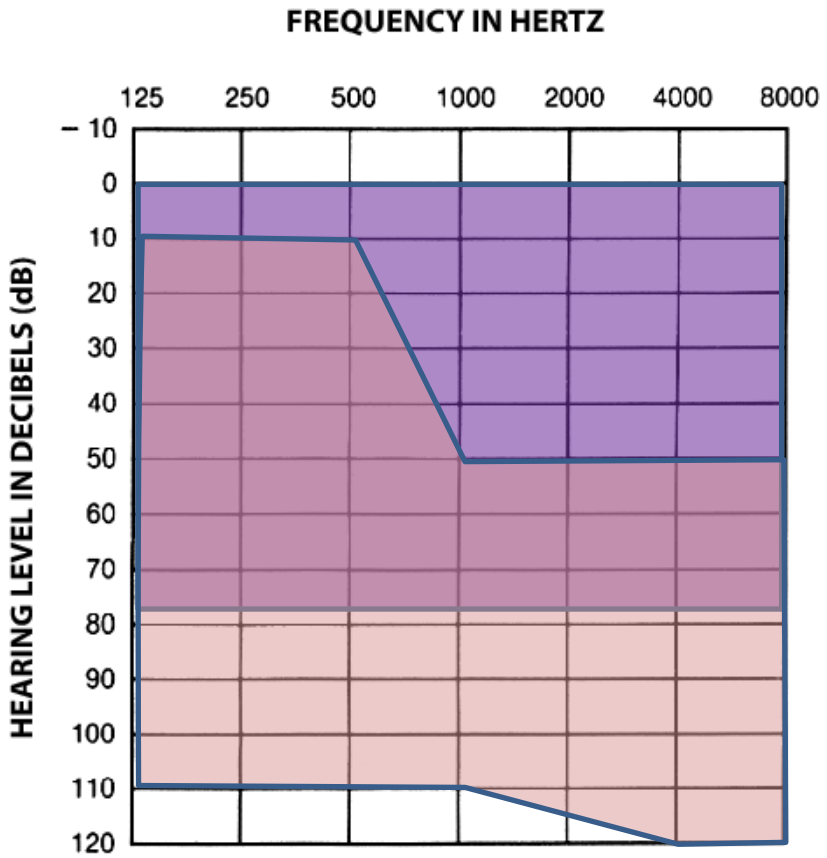
Cochlear Implants

Hearing Aids





The Audiogram

- No predictive value for post treatment benefit

  (Walden and Walden, 2004)

- No predictive value for post treatment speech in noise performance

  (Taylor, 2004, Nilsson, 2007, Snapp, 2010, 2012)

- No predictive value to speech outcomes in cochlear implant recipients

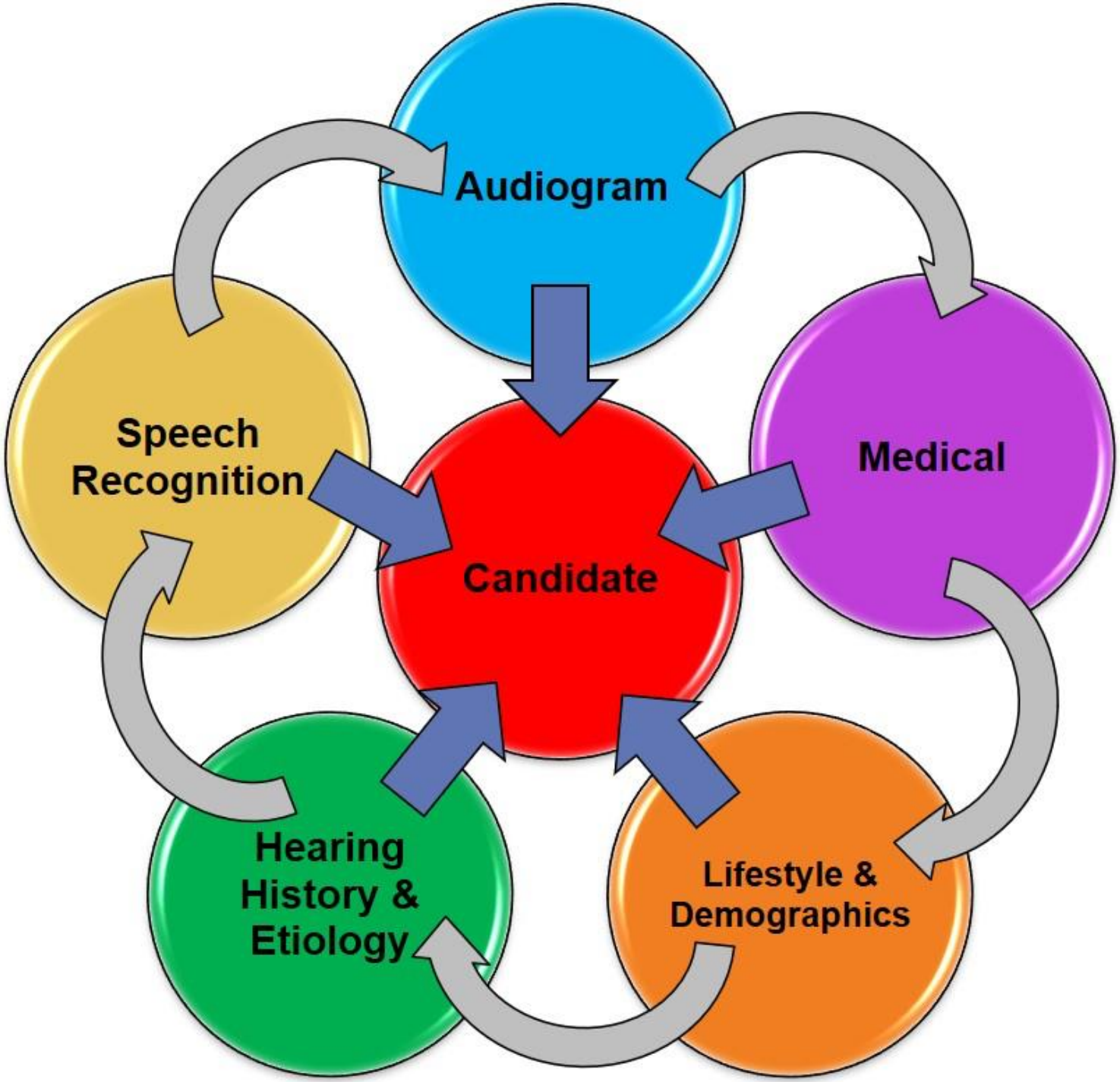
  (McRackan et al., 2018)

When to Refer for a Cochlear Implant Evaluation

60/60 Referral Criteria

When used, 96% detection rate and 34% false-positive rate for identifying adults qualifying for a cochlear implant

Zwolan et al, 2020


Audiogram
Speech Recognition
Medical
Candidate
Hearing History & Etiology
Lifestyle & Demographics

Cochlear Implant Evaluation

Past

- Medical Exam
- Imaging
- Audiology Exam

Present

- Medical Exam
- Imaging
- Audiology Exam
- Genetics
- Speech / Language Evaluation
- Cognitive Testing
- Psychology Exam
- Quality of Life
- Realistic Expectations
- Others

(Zeitler et al, *in review*)

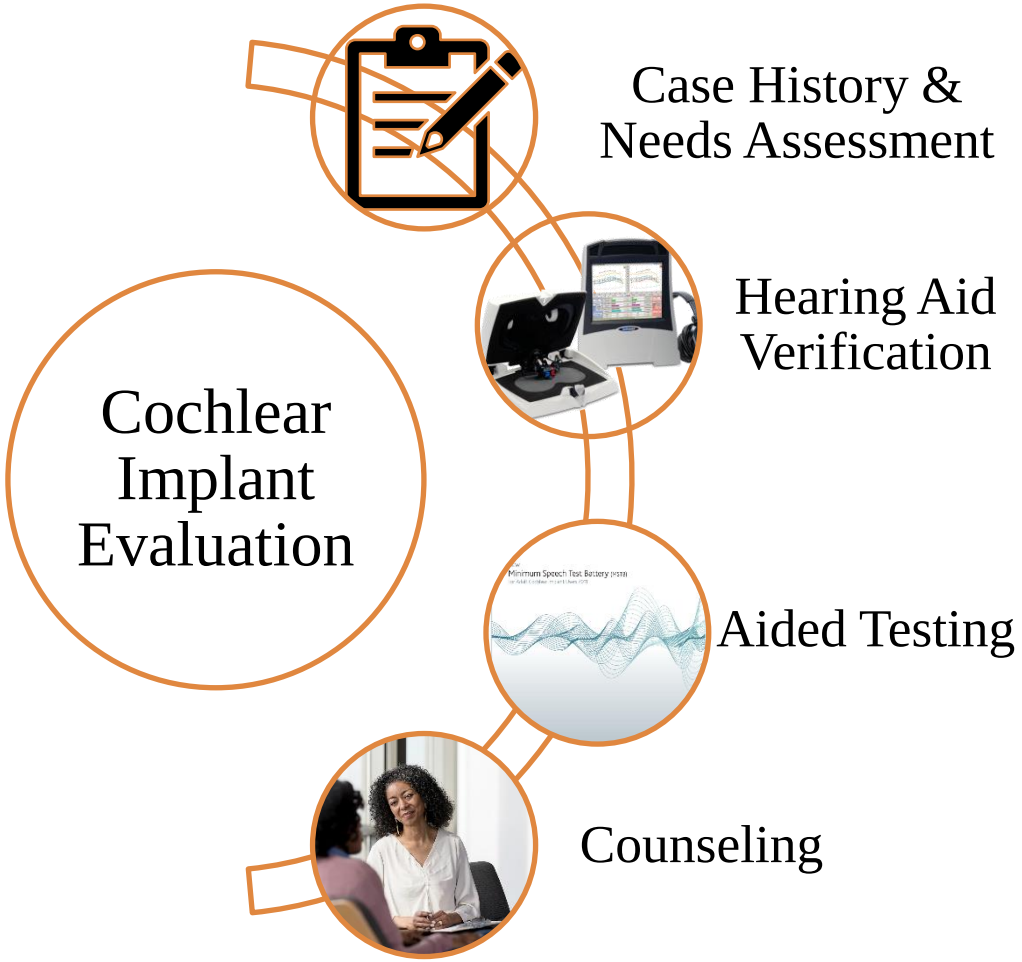
Cochlear Implant Team

- Audiologist
- Otologist
- Speech-Language Pathologists
- Rehabilitation Specialists
- Neuroradiologist
- Psychologist/Neuropsychologist
- Social Workers
- Previously implanted peers
- Family Members/Caregivers

American Cochlear Implant Alliance Task Force

- Sandra Prentiss, PhD., CCC-A
- Daniel Zeitler, MD, FACS
- Sarah Sydlowski, AuD, PhD, MBA
- Camille Dunn, PhD, CCC-A

What happens in a cochlear implant evaluation?



CI Evaluation Booth Set-up

Minimum Speech Test Battery (MSTB)

1. AzBio sentences (Quiet)
   - 4 voices (2 male 2 female)

2. AzBio sentences (Noise)

   +10 SNR vs. +5 SNR

   - Uses multi-talker babble (cocktail party)

AzBio Sentence Test
List 1
MSTB CD – Track 01
(Left Channel = Speech, Right Channel = Noise)

Sentence	Text	Poss	Score
1	I could hear ~~another~~ conversation through the ~~cordless~~ phone.	9	7
2	She relied on him for transportation.	6	
3	He was an ordinary person who did extraordinary things.	9	
4	How long has this been going on?	7	
5	His class was on Saturday.	5	
6	She was entitled to a bit of luxury occasionally.	9	
7	The vacation was cancelled on account of weather.	8	
8	The salon is not open on Mondays.	7	
9	She had a way to justify any of her wrongdoing.	10	
10	I feel sorry for my brother.	6	
11	On numerous occasions they left early.	6	
12	In private she let her hair down.	7	
13	A mother always has something better to do.	8	
14	You should be used to taking money from ladies.	9	
15	Who would lie about cancer for attention?	7	
16	Hang the air freshener from your rearview mirror.	8	
17	You can use your computer to make greeting cards.	9	
18	I guess you know what you're doing.	7	
19	You must live in a gingerbread house!	7	
20	The cat was born with six toes.	7	

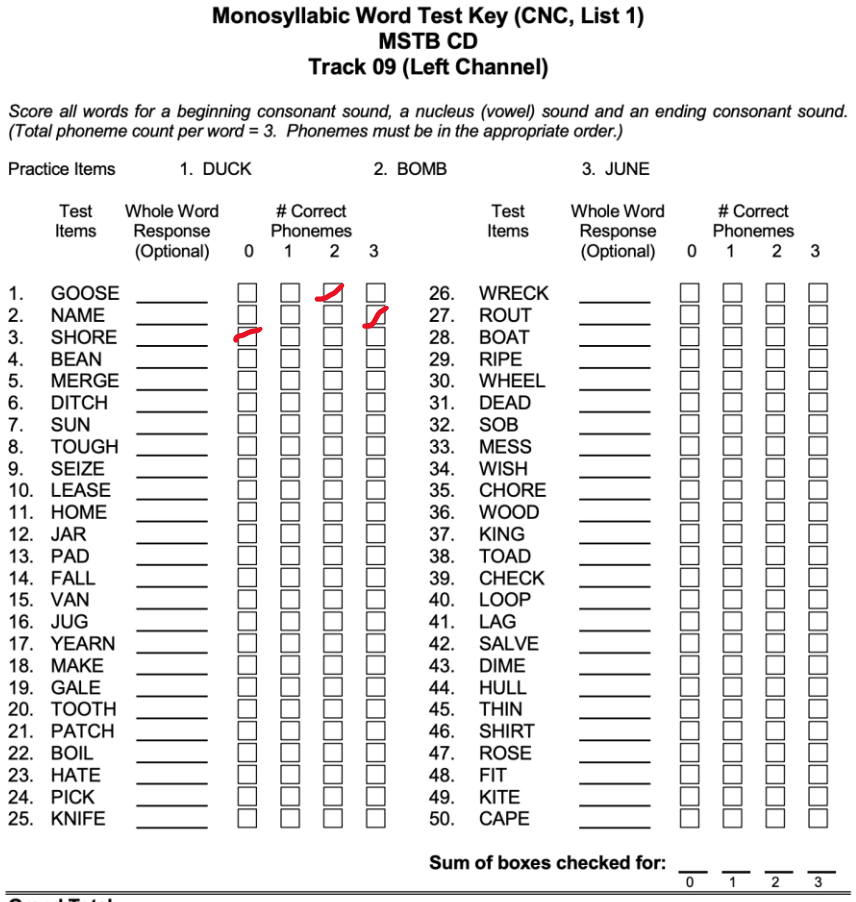
Words Correct _____
Words Possible 151
Percent Correct

Minimum Speech Test Battery (MSTB)

3. CNC Words

consonant – nucleus - consonant

- 50 words
- Phoneme and word scores



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

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

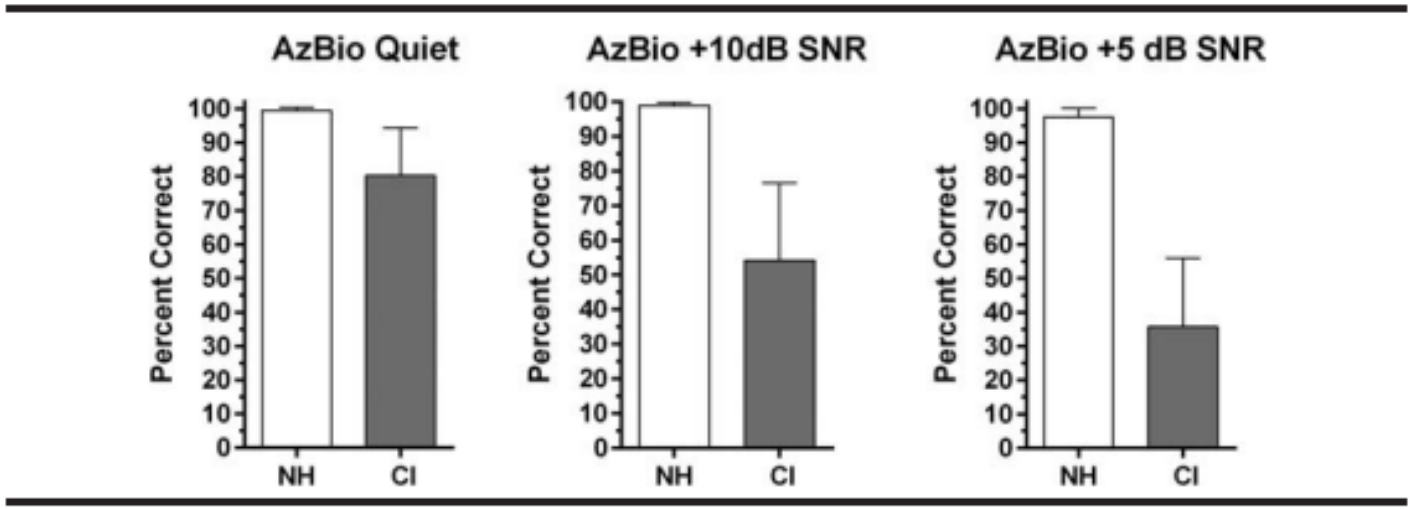
	Test Items	Whole Word Response (Optional)	# Correct Phonemes 0	1	2	3		Test Items	Whole Word Response (Optional)	# Correct Phonemes 0	1	2	3
1.	GOOSE				☑		26.	WRECK					
2.	NAME					☑	27.	ROUT					
3.	SHORE		☑				28.	BOAT					
4.	BEAN						29.	RIPE					
5.	MERGE						30.	WHEEL					
6.	DITCH						31.	DEAD					
7.	SUN						32.	SOB					
8.	TOUGH						33.	MESS					
9.	SEIZE						34.	WISH					
10.	LEASE						35.	CHORE					
11.	HOME						36.	WOOD					
12.	JAR						37.	KING					
13.	PAD						38.	TOAD					
14.	FALL						39.	CHECK					
15.	VAN						40.	LOOP					
16.	JUG						41.	LAG					
17.	YEARN						42.	SALVE					
18.	MAKE						43.	DIME					
19.	GALE						44.	HULL					
20.	TOOTH						45.	THIN					
21.	PATCH						46.	SHIRT					
22.	BOIL						47.	ROSE					
23.	HATE						48.	FIT					
24.	PICK						49.	KITE					
25.	KNIFE						50.	CAPE					

Sum of boxes checked for: ___ (0) ___ (1) ___ (2) ___ (3)

Grand Total:

Counseling

- Review realistic expectations relative to the patient's history and test results
  - Discuss current literature about expected CI outcomes
  - Lower expectations = high post-operative QOL



Dorman and Gifford, 2017; McRackan et al.,2021

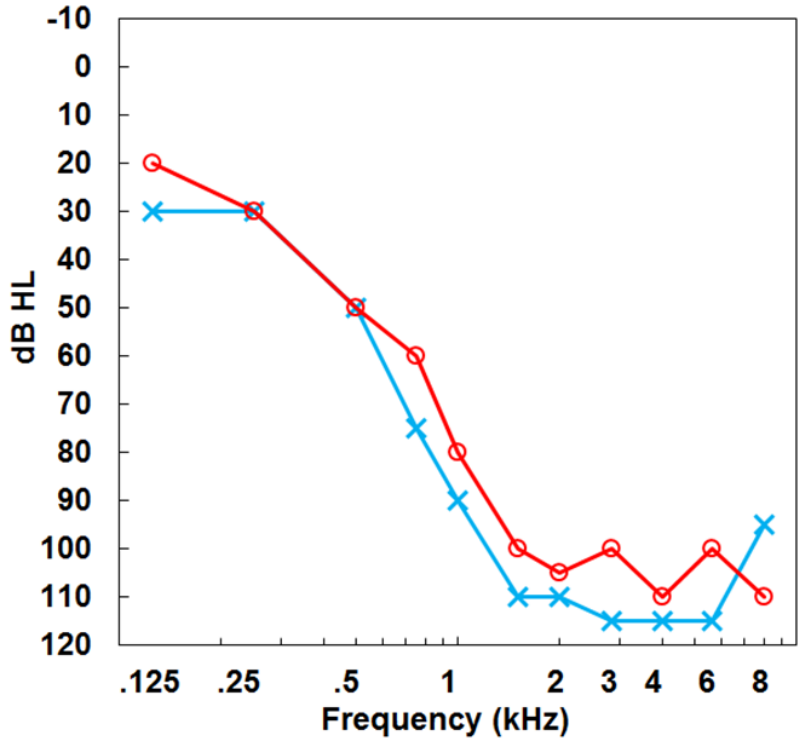
Expectations and Quality of Life

- Subjective questionnaires
  - Speech, Spatial and Qualities Questionnaire (SSQ) (Gatehouse et al, 2004)
  - Cochlear Implant Quality of Life Profile (CIQOL-35 Profile) (McRackan et al, 2019)
- Mental Health Screener
- Cognitive Screeners

EAS Case

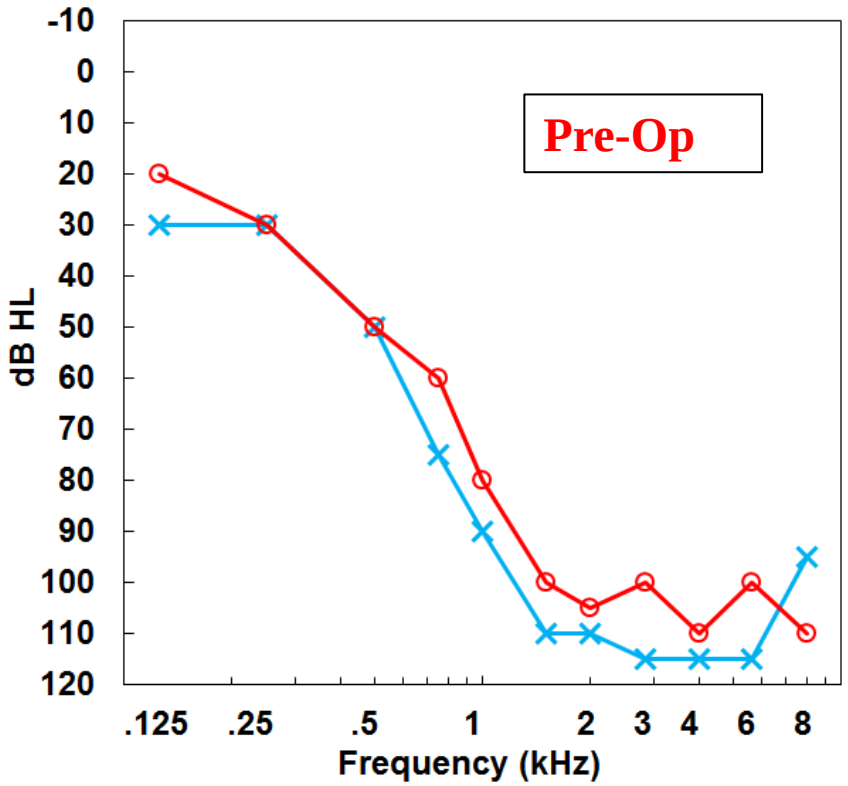
- Patient History
  - 58 yo male, long term SNHL
  - Bilateral HAs since 2000
  - Owns his company
  - HA audiologist said he hears too well for CI
  - Met at a social event, came for CIE 2x and scored too well
  - Now severely struggling at work, on the phone, in meetings

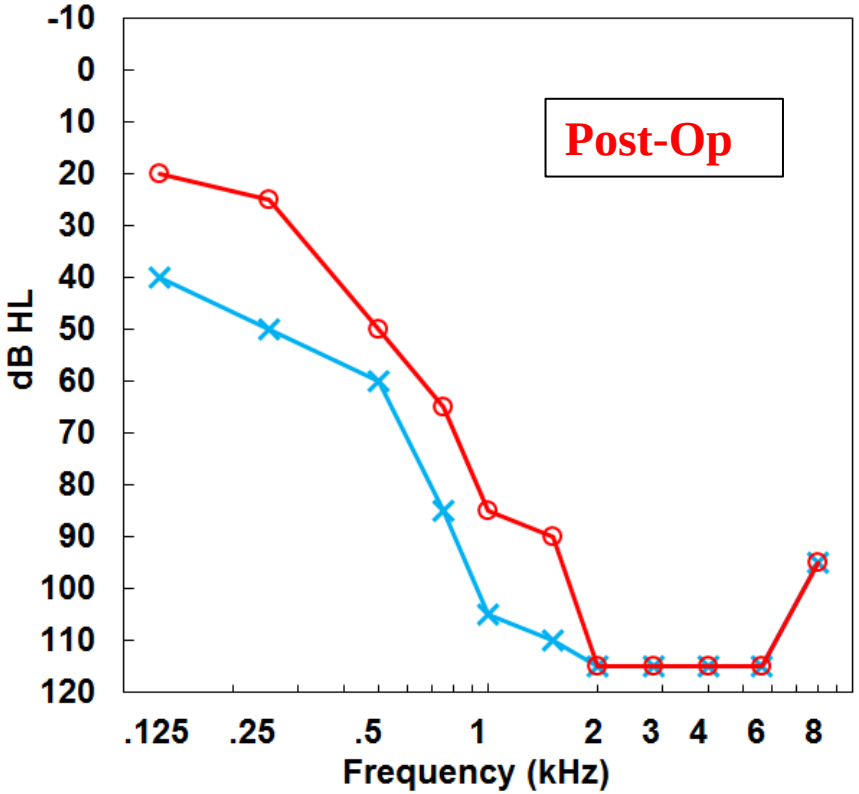
Case #1



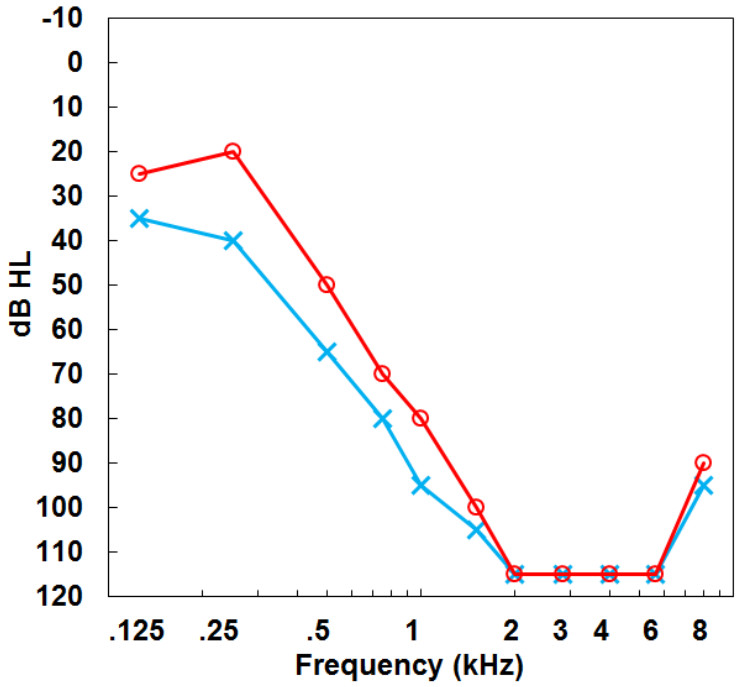
Test	Left Aided	Right Aided
CNC Words	38%	44%
CNC Phonemes	63%	67%
Az Bio Quiet	68%	81%
Az Bio +10 SNR	57%	61%
Az Bio +5 SNR	31%	45%

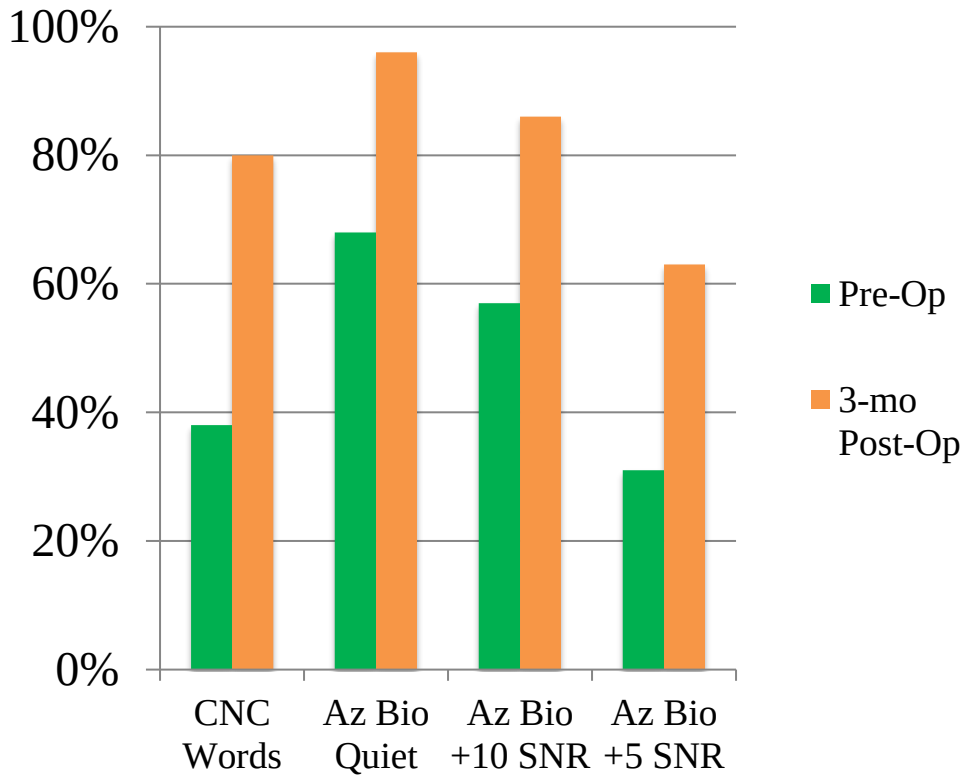
Case #1– Initial Activation





Case #1– 3 months post activation





Cochlear Implant for SSD

Improved listening in noise and localization

Improved tinnitus perception

Improved quality of life and subjective benefit

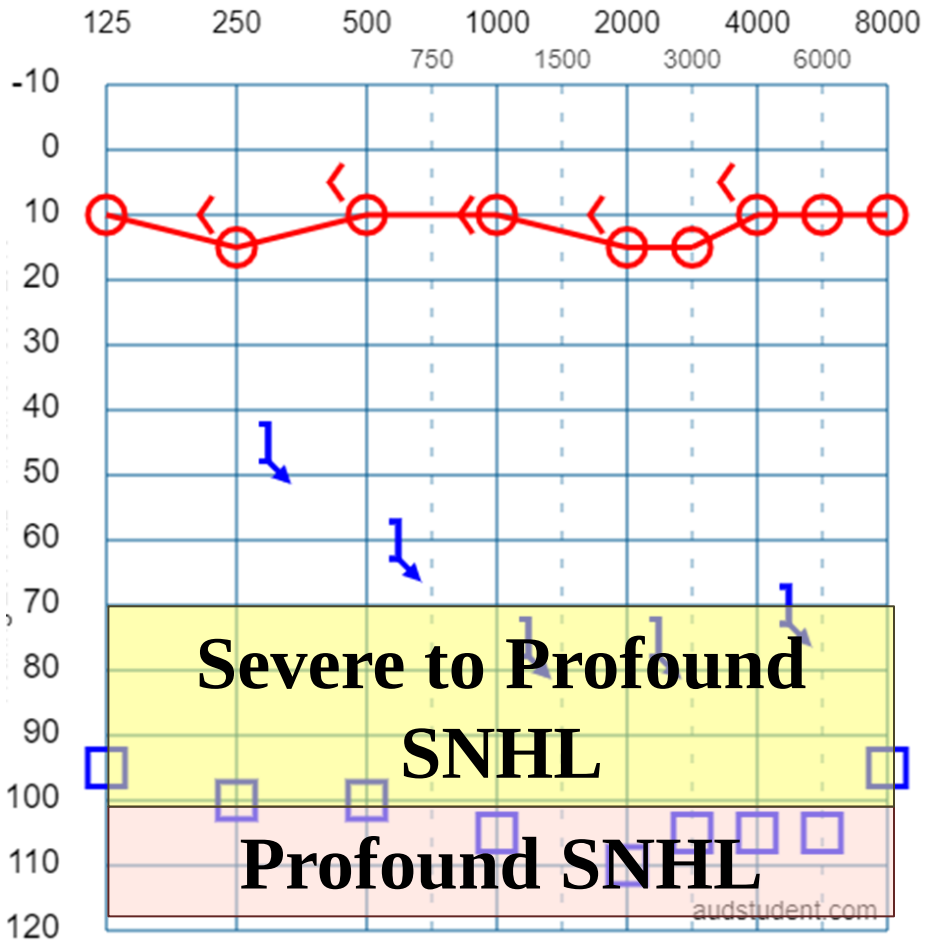
CI Candidacy Criteria for SSD

Med El FDA Indication:

- Ages 5 and older
- Less than 5% on CNC Word test
- Limited benefit from amplification trial

Cochlear FDA Indication:

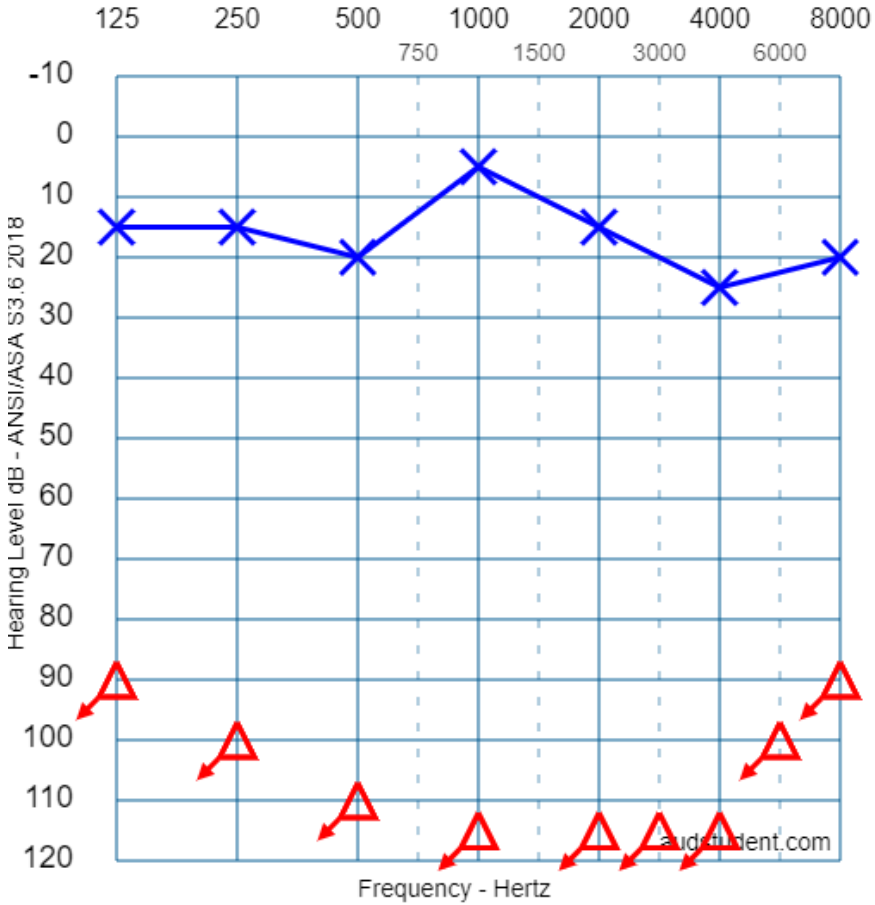
- Ages 5 and older
- Less than 5% on CNC Word test
- Limited benefit from amplification trial



Case #2

- 52-year-old male
- History of head trauma from MVA in the 1980s (~**40-year duration** of deafness in the right ear)
- Aetna insurance
- Works in the medical field

	SRT	WRS
Right Ear	NR	DNT
Left Ear	15 dB HL	100% at 60 dB HL



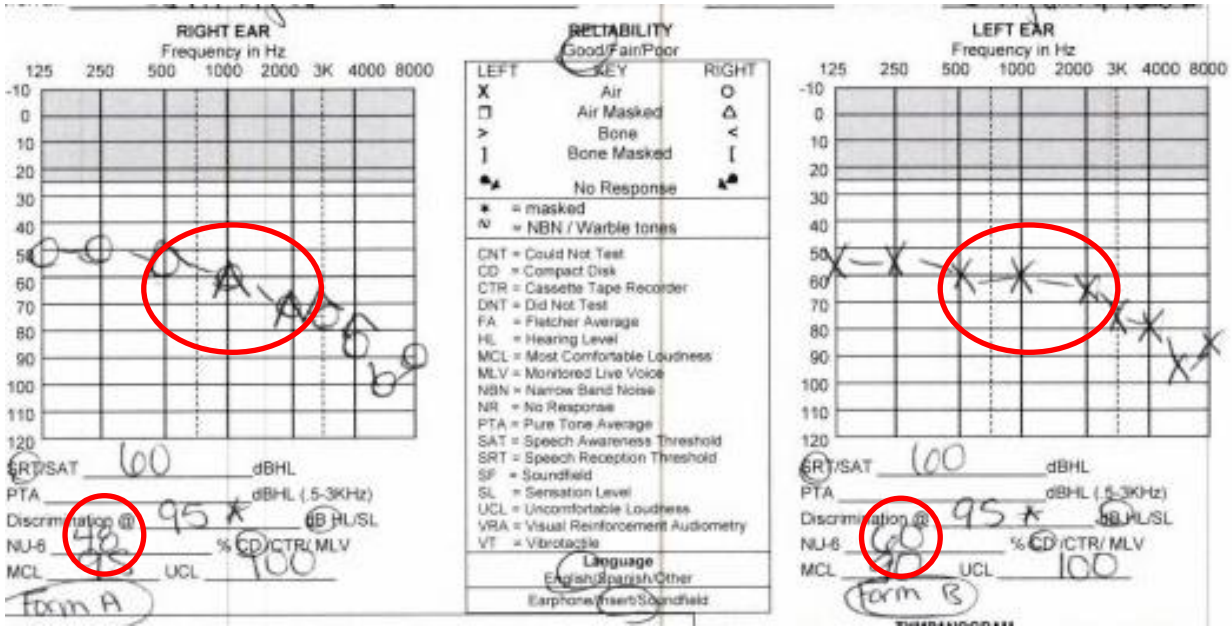
Case #2

- Pre-operative aided testing revealed 0% on all measures with a right hearing aid
  - Promontory stimulation test suggested right nerve activity
- Patient chose to proceed despite expectations with longer duration of deafness

Test Condition	AzBio (Quiet)	CNC Words & Phonemes	CNC Words & Phonemes (60 dB HL)
Right Cochlear Implant (LE Masked)	26% List 3	12% Words & 26% Phonemes List 9 (1-25)	24% Words & 52% Phonemes List 9 (26-50)

Case #3

- 81 yo male
- Etiology – congenital and noise exposure
- Difficulty with television and telephone and in small groups



Case #3

Test Condition	CNC Words & Phonemes	AzBio Sentences in quiet	AzBio Sentences +10 dB SNR
Right Hearing Aid	26% Words & 51% Phonemes List 1	52% List 1	50% List 2
Left Hearing Aid	38% Words & 63% Phonemes List 10	61% List 4	42% List 3

- Chose not to proceed after counseling
- Reported he would not adhere to listening exercises
- Main goal: improve hearing with television
- Rarely encounters group settings
- Referred back to managing audiologist for HA accessories

Referral Takeaways

1. No referral is a bad referral!
   i. A CI evaluation allows patients to learn about devices and obtain aided testing with hearing aids

2. Referring does not mean you need to know that they meet candidacy

3. Referral does not commit a patient to surgery

What if my patient is NOT a candidate?

- Most patients find a CI evaluation appointment helpful, regardless of if they meet candidacy

- Audiologist can refer to managing provider for hearing aids or assistive devices

Zwolan, 2018

What NOT To Do

- Tell patients to try hearing aids “to see if they work”
- Refer to CI as a “last resort” treatment option
- Wait until a patient is a clear-cut candidate to refer
  - Ask a CI team if unsure!
- Assume the patient is too medically involved for CI
- Assume the patient is too old for CI

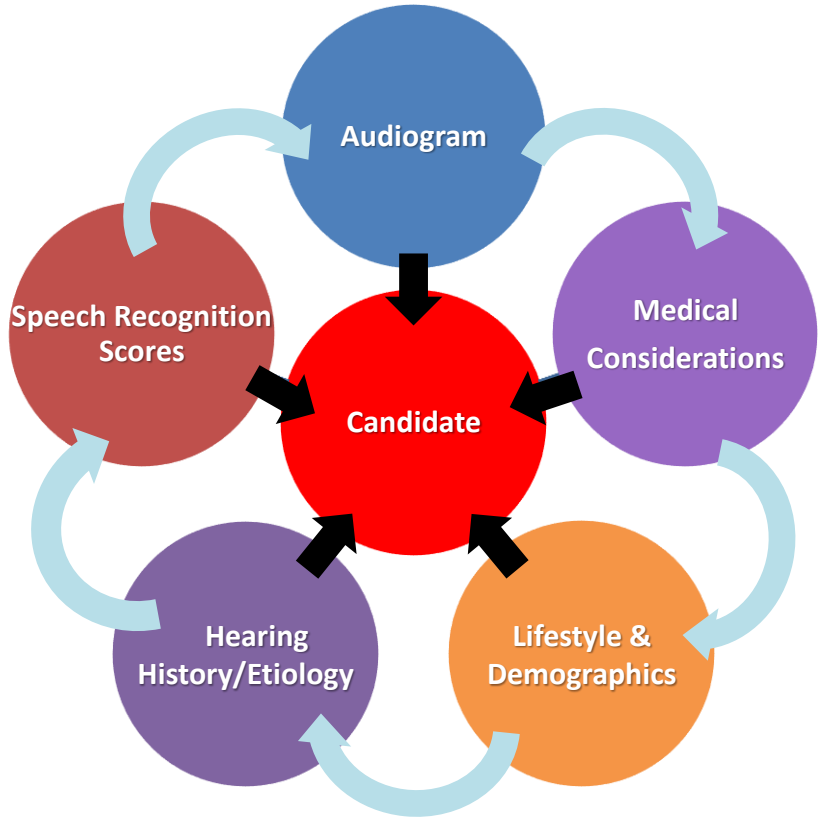
Zwolan, 2018

Expanded CI Criteria

- More residual hearing
- Shorter duration of deafness
- Younger age at implantation
- Testing in noise for candidacy
- Single sided deafness
- Asymmetrical SNHL
- Fluctuating HL

Conclusion

- CI evaluations are complex.
- CI candidacy is more than an audiogram.
- A skilled CI TEAM is necessary to appropriately manage the whole patient.
- CIs are an excellent treatment option for adults and children with hearing loss that negatively impacts their communication abilities and quality of life.



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THANK

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