

## Background



Children with hearing loss have greater difficulties processing speech in background noise and soft speech than children with typical hearing (e.g. 2). This is problematic, because learning environments are typically noisy and teachers often speak at a distance, which results in a reduced signal-to-noise ratio. Assistive listening devices, such as the Phonak Roger DM system, can be used to reduce the adverse effect of noise and soft speech. The goal of the current study is to evaluate how much benefit children with hearing aids (HAs) and cochlear implants (CIs) gain from using the Phonak Roger DM system in different adverse listening conditions.

## Research Questions

- 1) Do speech perception scores differ by test and test condition?
- 2) Within each speech perception test, do scores differ by hearing device, age and test condition?
- 3) Are speech perception scores related to auditory memory skills?
- 4) Does use of the Phonak Roger DM system improve speech perception scores in challenging listening environments?

## Subjects

Analysis based on 33 3- to 5-year-old children with bilateral hearing losses ranging in degree from mild to profound (22 hearing aids (HAs), 11 bilateral cochlear implants (CIs)).

Inclusion criteria:

- Passing tympanometry screening on each test day
- English as the primary language
- Enrolled in a specialized Listening and Spoken Language preschool program
- No additional diagnoses
- No cochlear malformations

	Mean age at amplification (range)	Mean chronological age at 1 <sup>st</sup> test (range)	Mean listening age at 1 <sup>st</sup> test (range)
<b>CIs</b>	17.73 mos (11 - 31 mos)	53.27 mos (42 - 65 mos)	37.55 mos (20 - 56 mos)
<b>HAs</b>	15.59 mos (2 - 46 mos)	51.64 mos (38 - 66 mos)	36.05 mos (8 - 63 mos)

## Methods

- Functional assessments of speech perception and auditory memory administered annually.
- All testing performed with personal hearing devices in typical everyday listening settings.
- Appropriateness of hearing device fit verified at least annually (3)

### Speech perception assessment:

- Loudspeaker positioned ~ 1 m at 0 degrees azimuth
- Test selection (NU-CHIPS, WIPI, or PBK-50) based on age and language level

Test conditions:

- 1) 50dB HL quiet
- 2) 50dB HL multi-talker babble (+5dB SNR)
- 3) 50dB HL multi-talker babble (+5dB SNR) + DM
- 4) 35dB HL quiet
- 5) 35dB HL quiet + DM
- 6) 35dB HL multi-talker babble (+0dB SNR)
- 7) 35dB HL multi-talker babble (+0dB SNR) + DM



### Auditory Memory assessment:

- Recalling sentences subtest from the Clinical Evaluation of Language Fundamentals
- z-transformed raw scores

## Summary and Conclusions

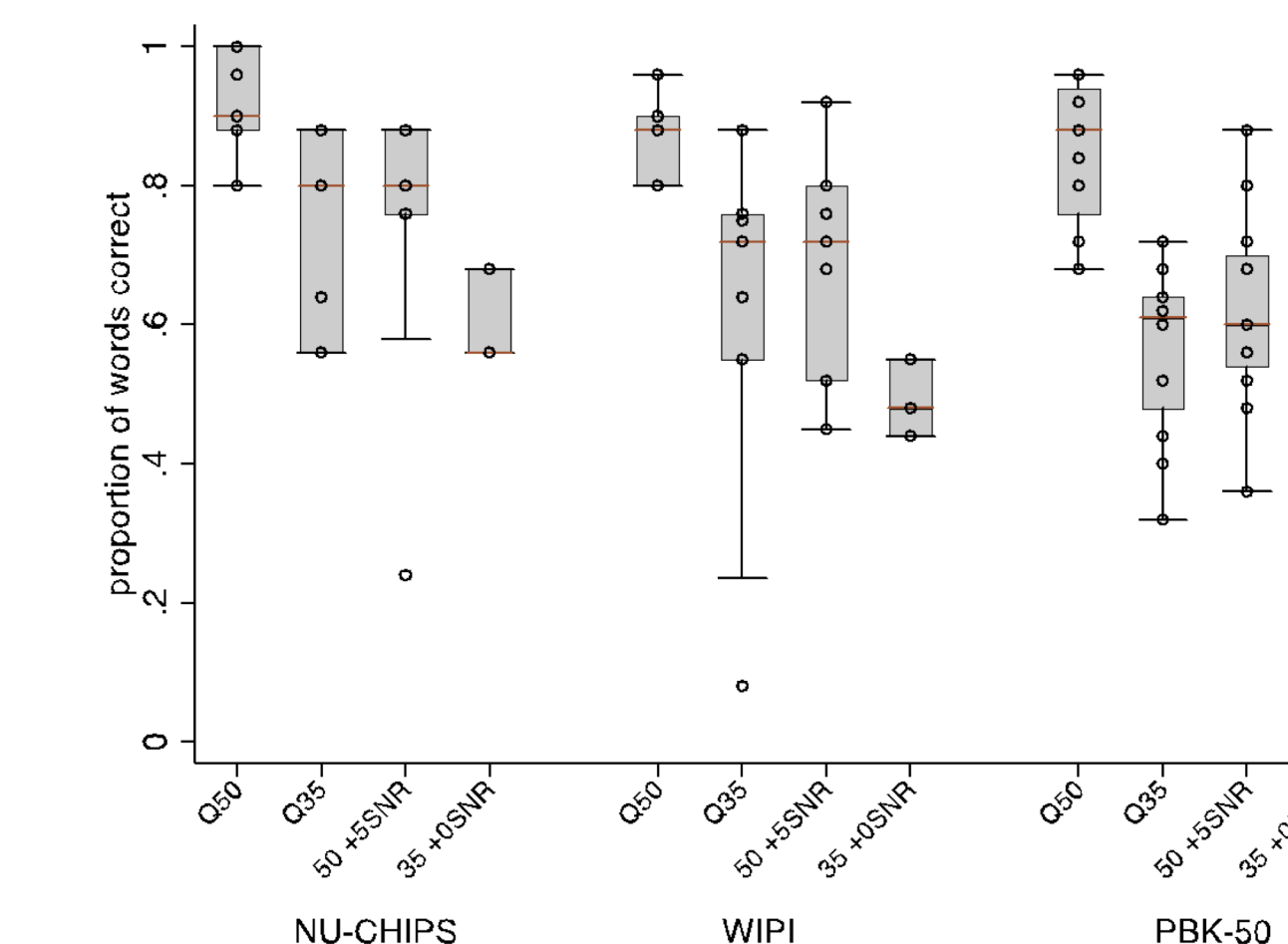
A full analysis will require a larger data set and data collection is ongoing.

Preliminary analysis suggests:

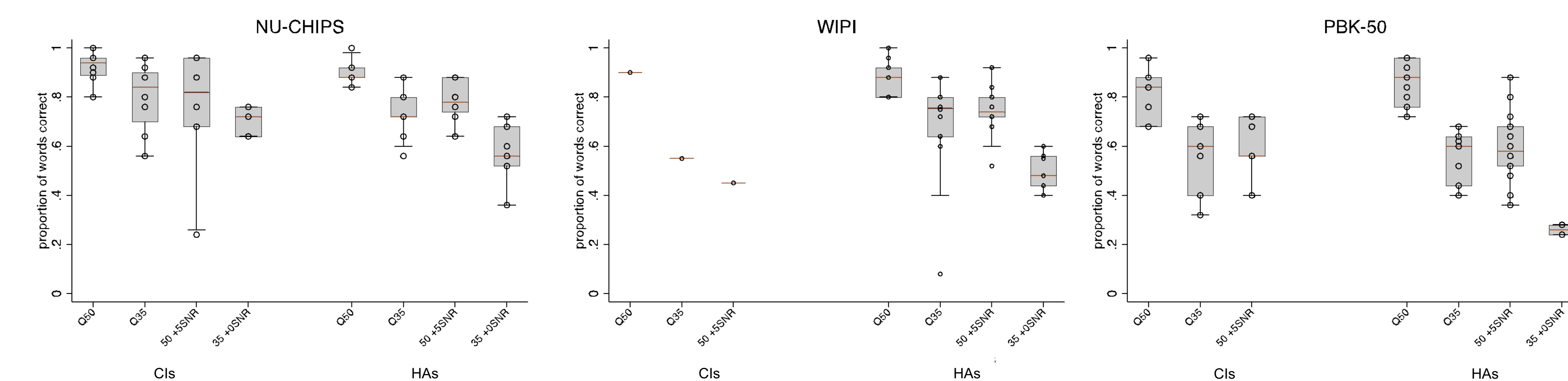
1. Speech perception scores are influenced by the speech perception test used and the test condition.
2. The hearing device used does not influence speech perception scores.
3. Auditory memory skills relate to speech perception skills. Children completing more complex speech perception tasks have average to above average auditory memory skills; children completing the least complex speech perception task have below average to average auditory memory skills.
4. The Phonak Roger DM system provides a benefit in all conditions.

## Results

- 1) In 4-year-old children, average speech perception scores differ significantly by test and test condition

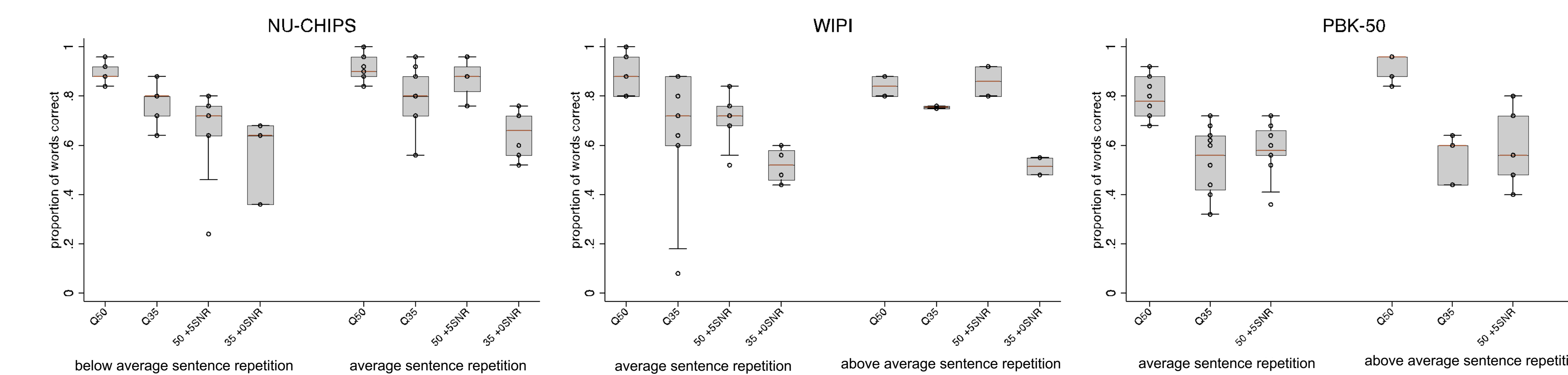


- 2) Preliminary analysis suggests that for all three tests, speech perception scores are significantly higher when presented at 50dB in quiet than in any other condition. Hearing device and age do not appear to impact speech perception scores.

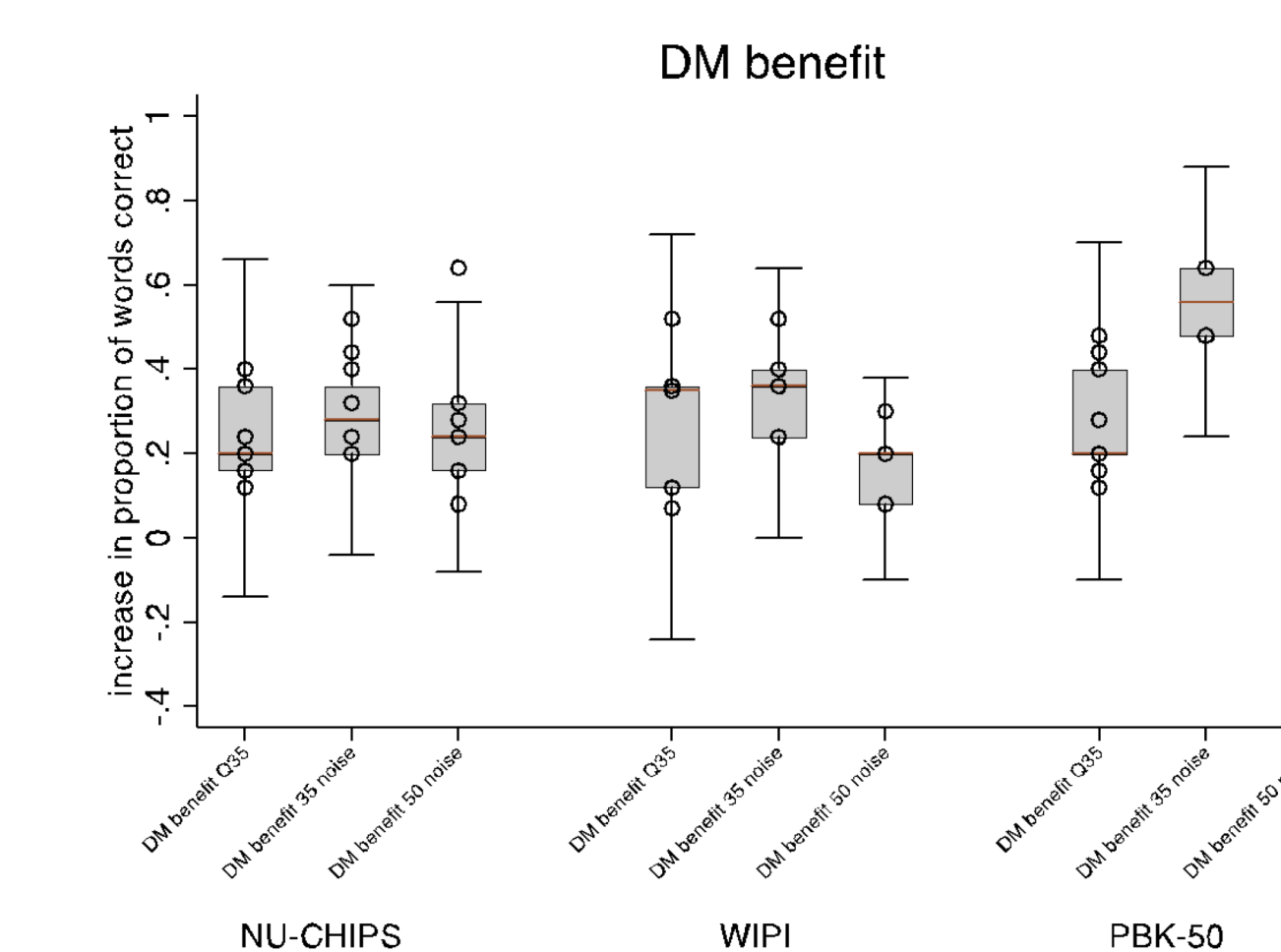


- 3) Preliminary analysis suggests a trend for better speech perception scores with better sentence repetition scores for children tested with the Nu-Chips.

Nu-Chips: all scores in the below average or average range. WIPI and PBK: all scores in the average or above average range.



- 4) Preliminary analysis suggests a significant benefit, on average, from use of the Phonak Roger DM system in all conditions.



Study data were collected and managed using REDCap electronic data capture tools hosted at OPTION Schools, Inc. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.