THE UNIVERSITY OF MELBOURNE

3 - 4 MARCH 2023 | HOTEL GRAND CHANCELLOR HOBART

2023 Australasian Newborn Hearing Screening Conference

'20 Years of Newborn Hearing Screening: Looking Back and Building the Future'

Bilateral simultaneous, bilateral sequential and unilateral cochlear implantation:

Prevalence and relationships with receptive language outcomes in 34 matched triads.

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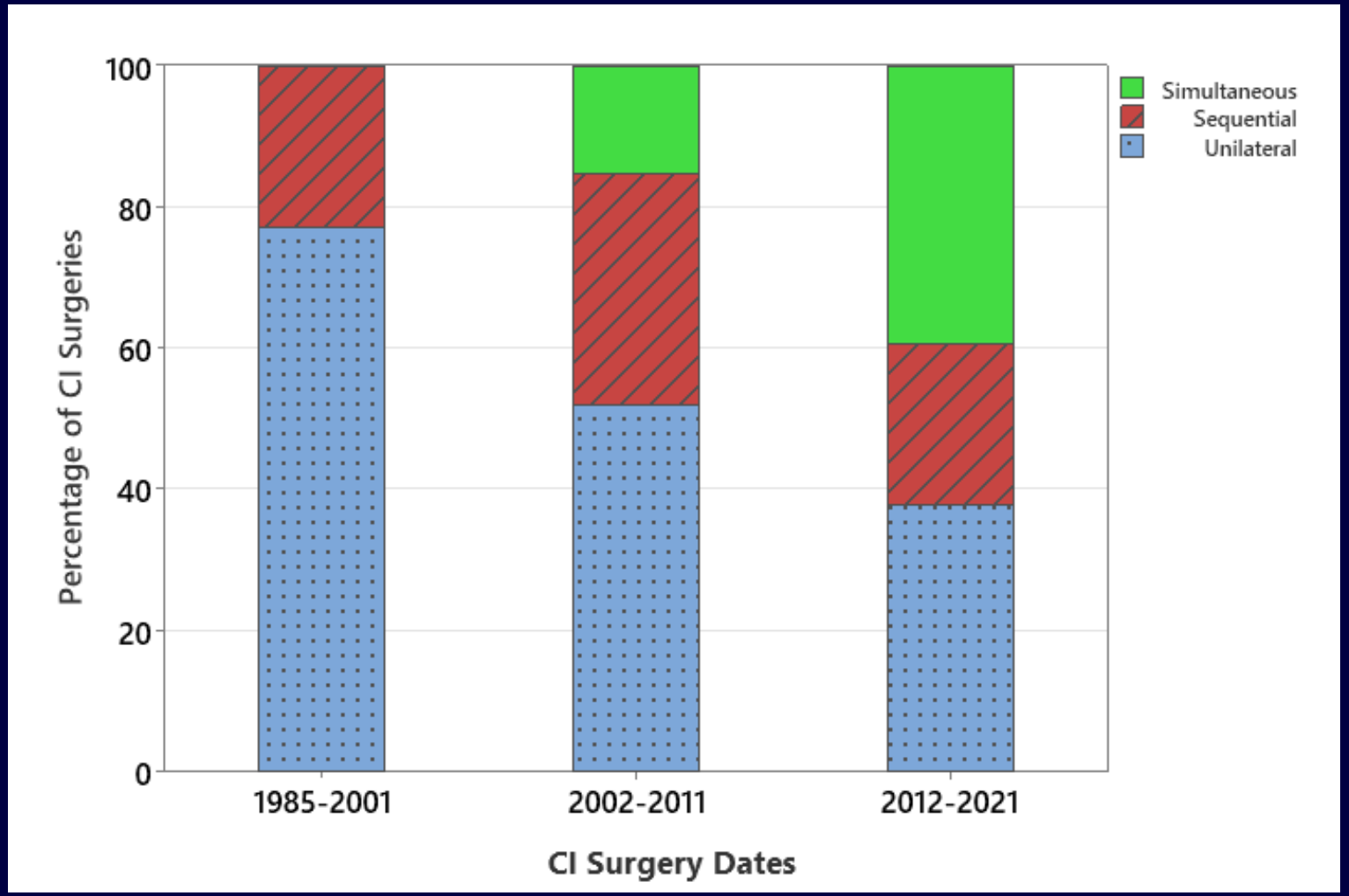
Wang, K.,
Brown, S.,
Singh, S., and
Carew, P.

Prevalence

- over the past three decades in the Melbourne program (RVEEH) the prevalence of **simultaneous bilateral** CIs has increased

X^2 (4, N = 1079) = 188, p < .001

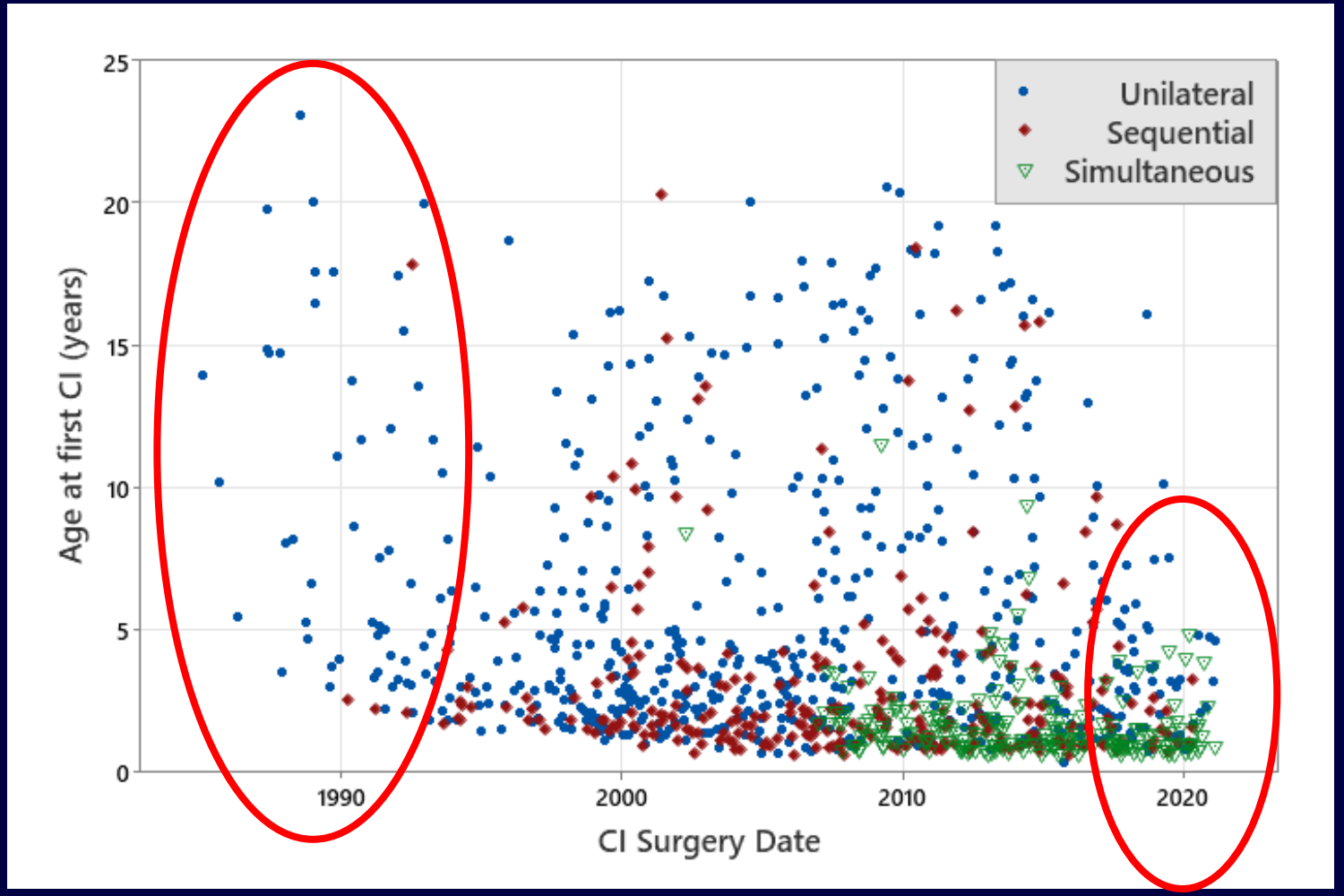


Prevalence

- weak but significant negative correlation age-at-first CI and year of surgery

$r(1105) = -.23, p < .001$

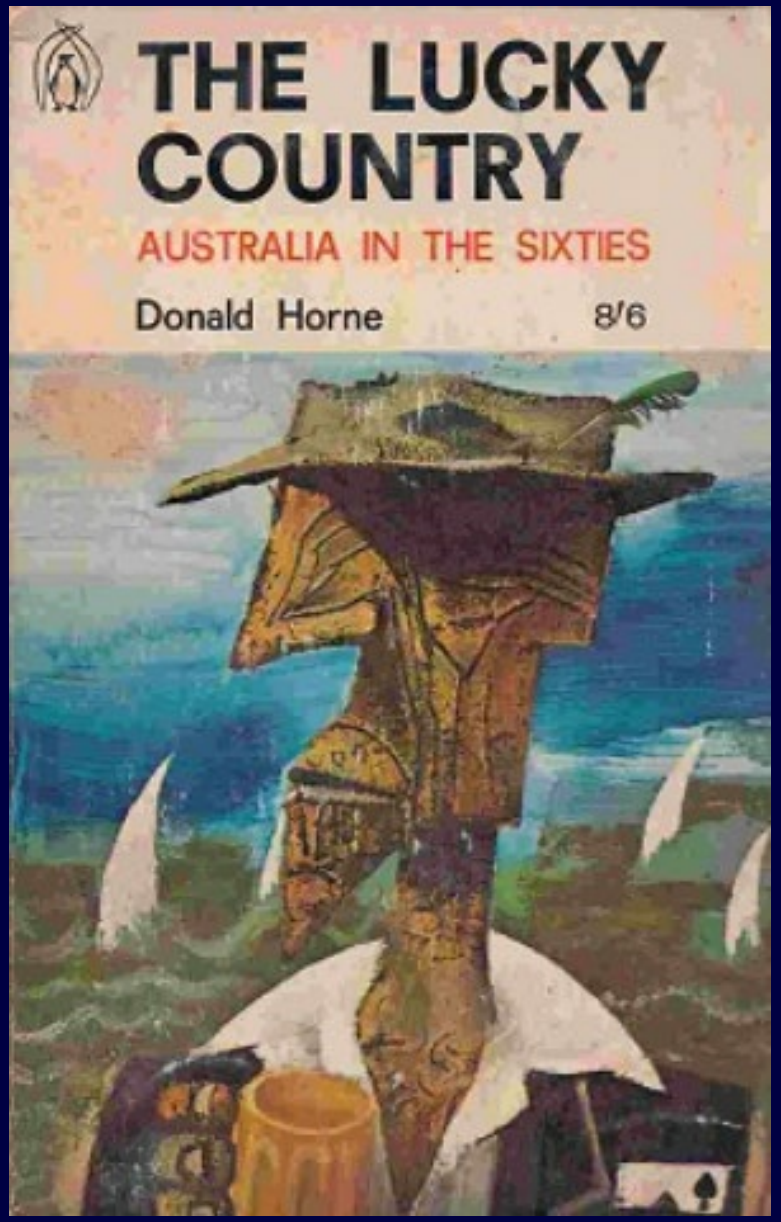
- currently children tend to go ahead younger and may have bilateral simultaneous surgery



The problem

- Children in Australia who meet audiological and medical criteria presently go ahead with ONE or TWO CIs (e.g., depending on parental informed choice, pure tone average, medical imaging, etc.)

- What advice would we give if resources for ONE versus TWO CIs were less available?



The problem

Many factors affect our assessment of whether ONE CI or TWO CIs are;

Sufficient for speech perception and language development to occur

Cost effective

The problem; how to assess efficacy?

e.g., FACTORS

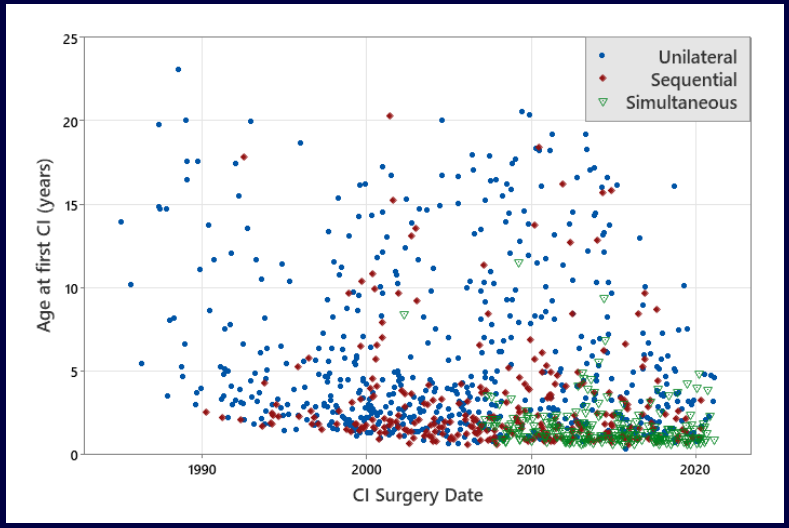
- Age at first CI
- Duration between CI1 and CI2, i.e., inter-device interval
- Communication skills
- Gender
- Relative Socio-economic advantage

The problem; how to assess efficacy?

For example;

Children with **unilateral** CIs have had their CIs for longer

Children with bilateral **sequential** and **simultaneous** have received their CIs at a younger age



What is known

well known benefits of paediatric bilateral CI on **speech perception**

(Eskridge et al., 2021;; Forli et al., 2011; Kocdor et al., 2016; Scheperle & Abbas, 2015; Wenrich et al., 2019)

some evidence regarding specific advantages of **unilateral** versus bilateral **simultaneous** and bilateral **sequential** CIs on **language outcomes** but many child, device and family factors make interpretation of results challenging

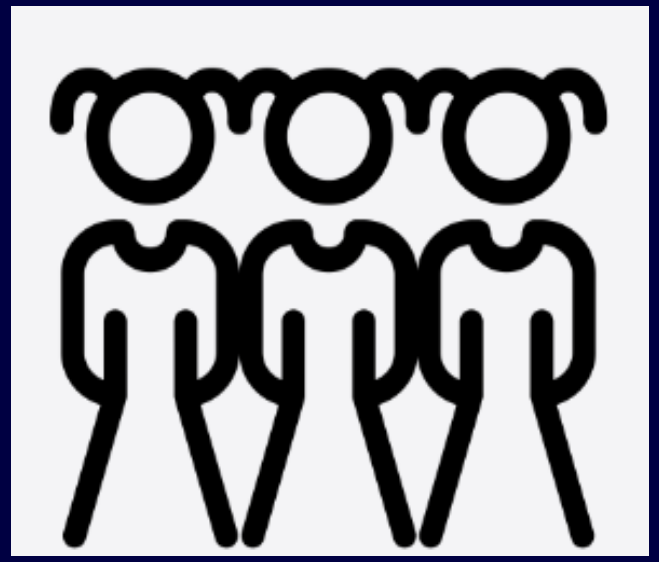
(Boons et al., 2012a and 2012b; Eskridge et al., 2021; Sarant et al., 2014; Wenrich et al., 2019)

What is known regarding LANGUAGE outcomes

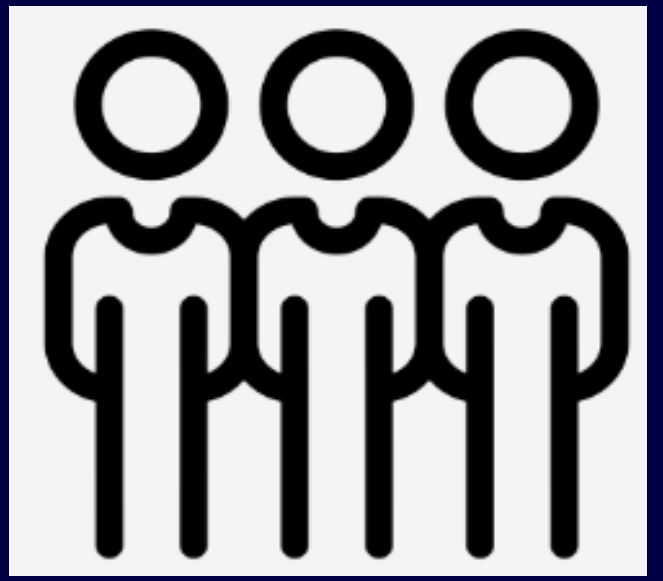
Who	Approach / Result	BUT
Boons et al., 2012	• matched 25 unilateral with 25 **bilateral** CIs on 10 auditory, child and family factors • bilateral superior semantic and syntactic skills for receptive and expressive language • simultaneous better than sequential	• did not control for socioeconomic status (SES) which may influence language • excluded children with comorbid intellectual disability
Sarant et al., 2014	• prospectively recruited 67 bilateral and 24 unilateral, aged 5- 8 years • bilateral faster language dev rates	• moderated by age at implant • language outcomes also predicted by parenting style and family factors • unequal group sizes • did not explicitly examine simultaneous vs sequential • IQ within normal range
Eskridge et al., 2021	• 104 **bilateral** and 99 unilateral • bilateral better receptive and expressive language after controlling for age at first implant, age at test and SES • children implanted young age who depended on Medicaid had poorer pre-school language regardless of age at first implant, inter-device interval, and bilateral device use	• retrospective • grouped bimodal (hearing-aid and CI) users in with the unilateral • different CI brands

The problem; how to assess efficacy?

We wanted to know if a different statistical approach (matched triads) would support /complement these previous studies



unilateral sequential simultaneous



unilateral sequential simultaneous

In each triad, one child had received one **unilateral CI**, one child had received **sequential bilateral CIs**, and one child had received **simultaneous bilateral CIs**

Triad icons created by abeld from Noun Project

A different approach...

1300 records

blind to outcome data

34 Matched triads

CI < 3.5 years

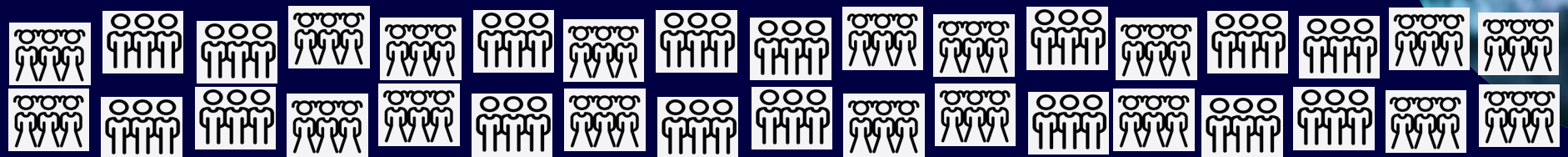
age at CI1

gender

co-morbid diagnosis

age at assess

current speech processor



METHOD

34 matched triads – no significant differences between the unilateral, sequential, simultaneous groups for;

- child characteristics (gender, cognitive ability, comorbidity),
- device characteristics (age at H-aid, pre-implant 3Freq PTA, age at implant), and
- environmental characteristics (relative socio-economic advantage [SEIFA] and communication mode)

MATERIALS

- Pre-school Language Scale-4 or -5 (n = 93) or Peabody Picture Vocabulary Test-4 (n = 9)
- mean age at test 3.6 yrs (2 years device experience)

RESULTS Matched Triads

unilateral mean receptive standard score **76.88** (range 39 – 113; SD 18.23)

sequential bilateral standard score **77.38** (range 50 – 117; SD 21.29)

simultaneous bilateral standard score **75.62** (range 50 – 130; SD 22.95)

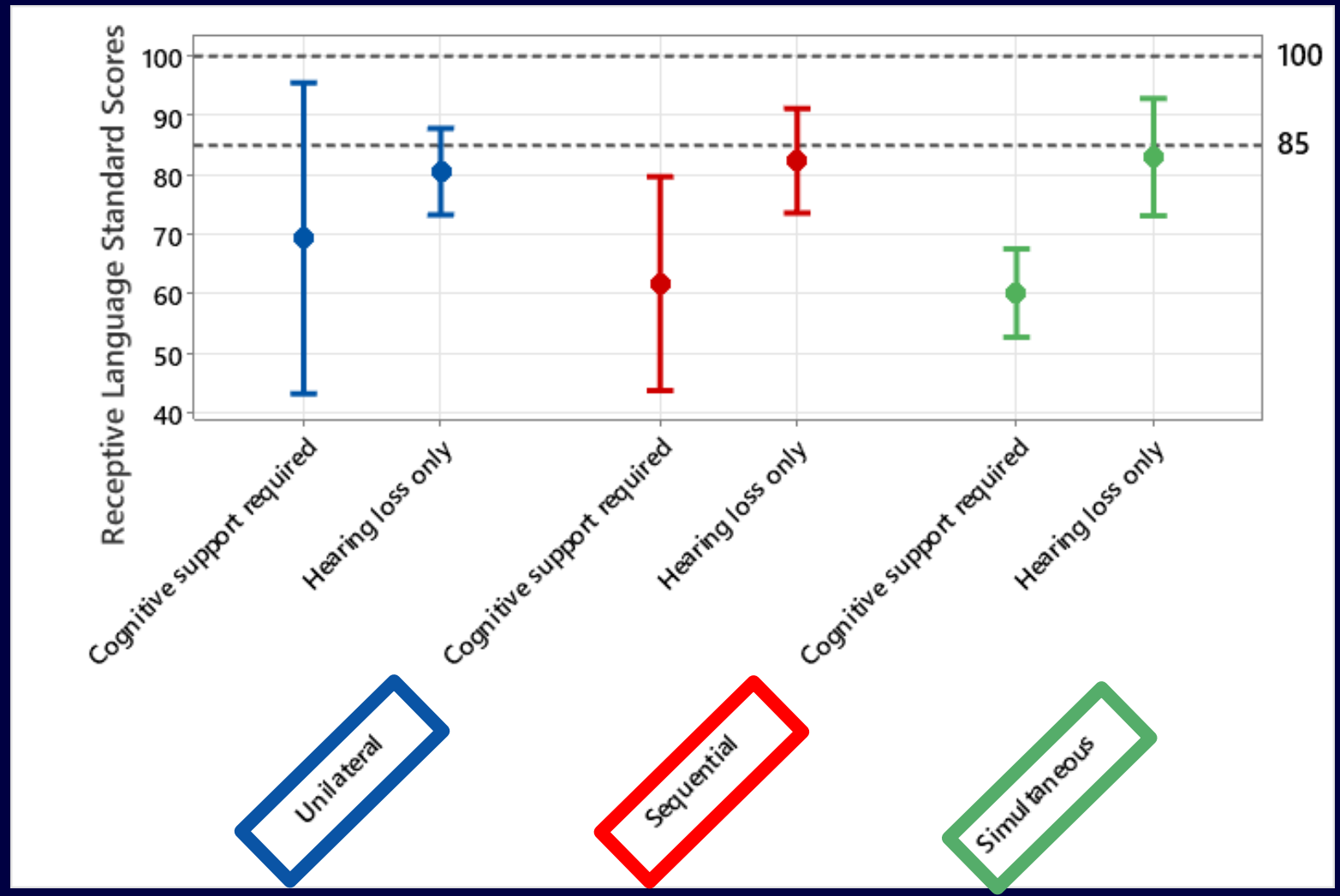
ANOVA indicated **no significant difference in standard scores**

$F(2, 99) = .06$, $p = .94$

RESULTS Matched Triads

… and divided into groups based on device **unilateral** **sequential** **simultaneous**

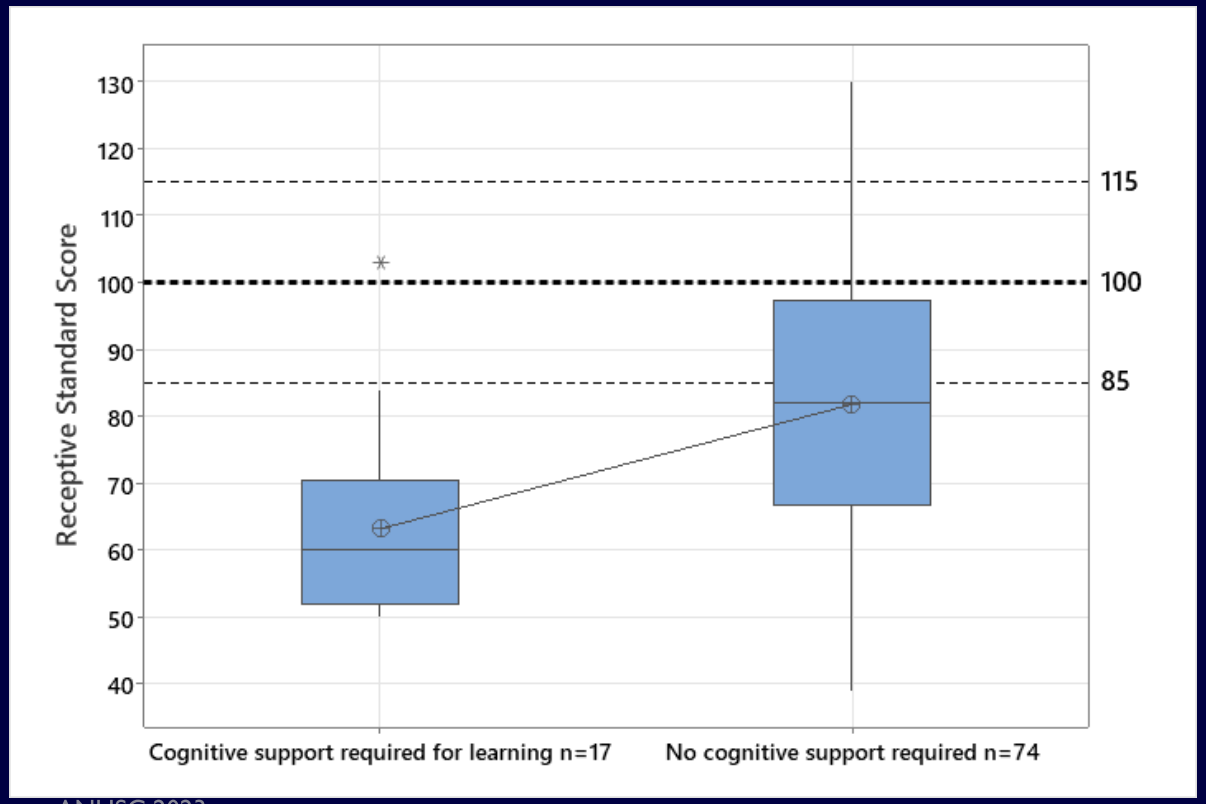
and cognition



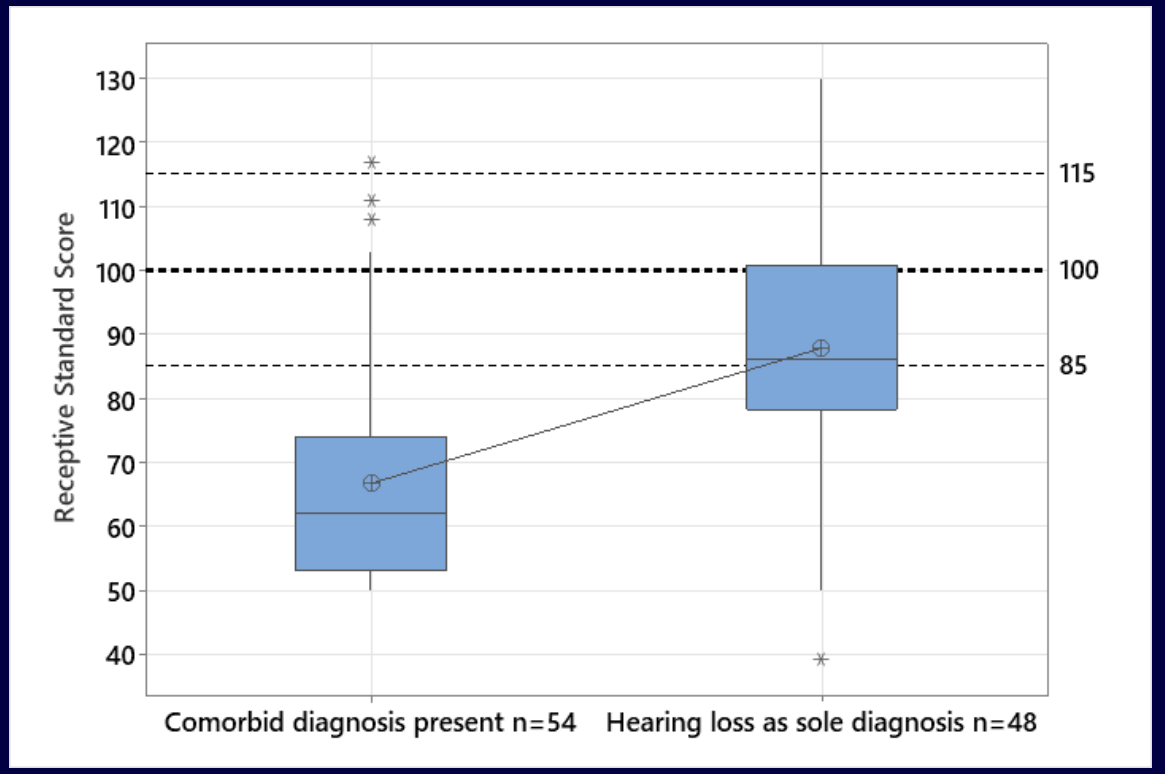
RESULTS Other variables

When data for the 34 triads were collapsed, t-tests indicated **significant differences ($p < 0.001$)** in receptive SS for N = 102 divided for;

COGNITIVE SUPPORT REQUIRED (N = 17) VERSUS NO COGNITIVE SUPPORT REQUIRED (N = 74)



COMORBID DIAGNOSES PRESENT (N = 54) VERSUS HEARING LOSS AS SOLE DIAGNOSIS (N=48)



RESULTS Other variables

When data for the 34 triads were **collapsed**, t-tests / ANOVA indicated **no significant differences** in receptive SS for the 102 children for;

- Communication approach; Parent's choice of Oral versus Sign emphasis communication used at home
- Gender; boys versus girls
- Socio-economic advantage; family's relative socio-economic advantage using postcode (SEIFA)

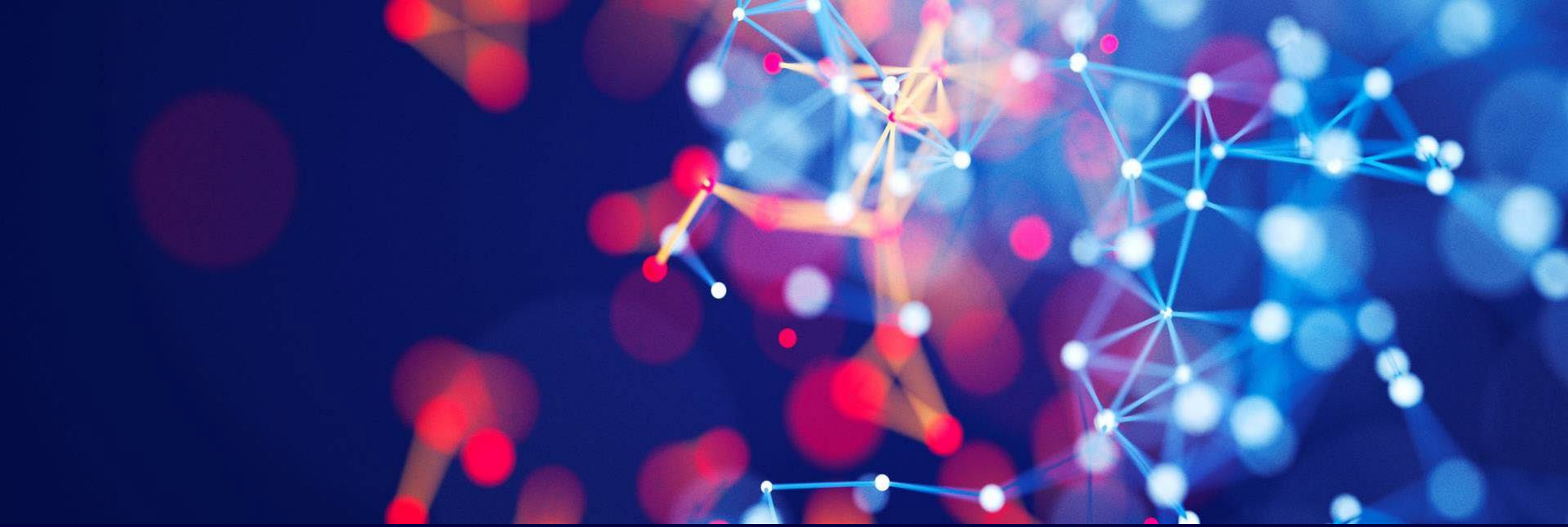
LIMITATIONS

We did not measure

- speech perception
  - binaural advantages (e.g. head shadow, benefits in noise, localisation)
  - short versus long inter-device intervals
  - degree of contralateral hearing loss/ h-aid use

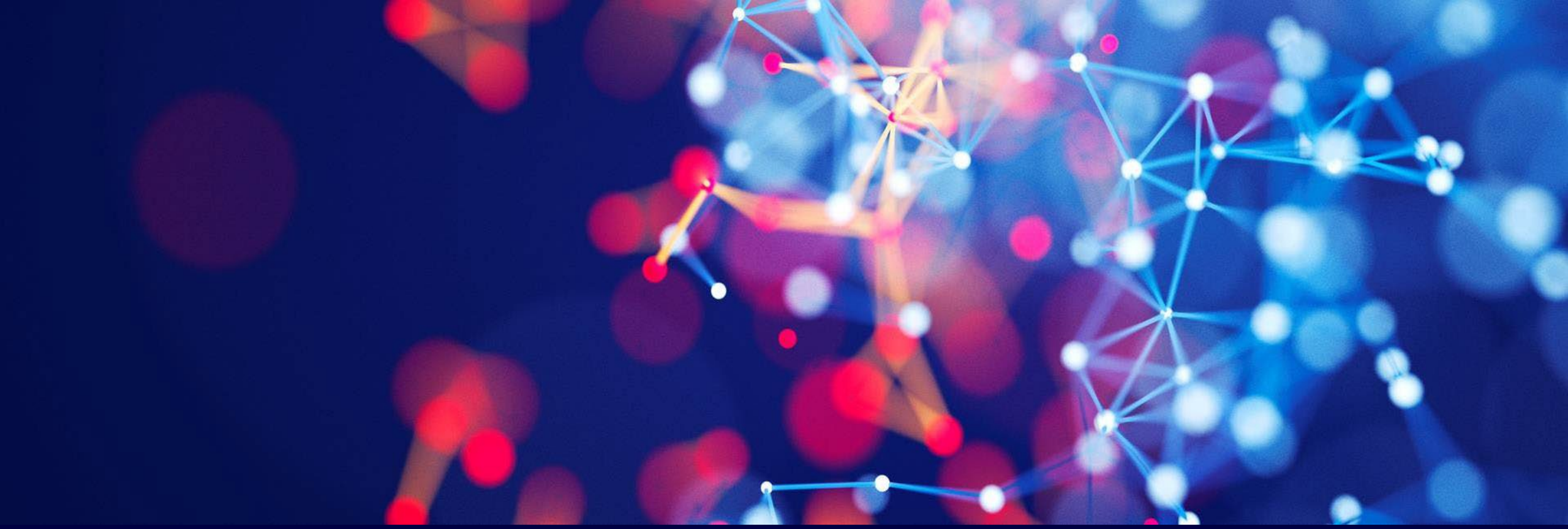
- quality of life
- subjective benefits of having ‘another ear’
- parental satisfaction of having ‘another ear’ in case of breakdowns

- expressive language
- speech production



CONCLUSIONS

When **triads were matched** on key child, device and family/environmental criteria (gender, age of first implant, socio-economic status, parental choice of communication approach at home, comorbidity, and cognitive ability) we found no statistically significant difference in receptive language outcomes for children using **unilateral**, **sequential** **and** **simultaneous** CIs



CONCLUSIONS

Findings suggested that when children received a CI prior to 3.5 years of age, **other child factors** (cognition, comorbid diagnoses) may have a greater impact on receptive language outcomes than unilateral or bilateral implantation

Thank You

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