Bilateral cochlear implantation in children identified in newborn hearing screening: Why the rush?

7th Australasian Newborn Hearing Screening Conference

Rendezous Grand Hotel
17th—18th May 2013

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SCIC Australia's Largest Cochlear Implant Program

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What is SCIC?

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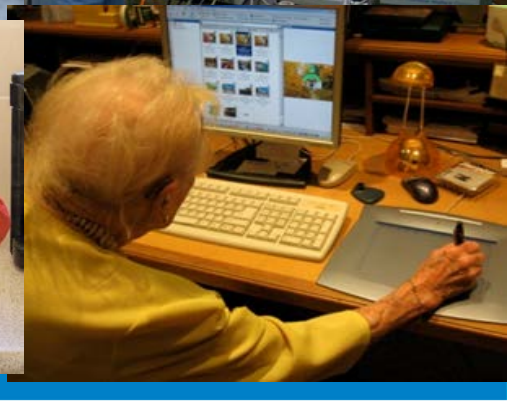
A clinical program providing cochlear and hearing implantation services for all age groups. Established in 1984, by Professor William Gibson.

Multidisciplinary team:

- 9 ENT surgeons
- 2 Biomedical Engineers
- 21 Audiologists
- 7 Speech Pathologists
- 3 Teachers of the Deaf
- 2 Family Counsellors

Supported by:

- 2 Clinical Support staff
- Management
- 10 Administration team
- Board of Directors



Background: European Consensus Statement

European Bilateral Pediatric Cochlear Implant Forum Consensus Statement
Undertook a review of current scientific literature to identify areas of scientific & clinical agreement of current understanding of bilateral cochlear implantation.

JD Ramsden, K Gordon, A Aschendorff, L Borucki, M Bunne, S Burdo, N Garabedian, W Grolman, R Irving, A Lesinski-Schiedat, N Loundon, M Manrique, J Martin, C Raine, J Wouters, & BC Papsin
Otology & Neurotology (2012), 33 (4)

"Currently we feel that the infant or child with unambiguous cochlear implant candidacy should receive bilateral cochlear implants simultaneously as soon as possible after definitive diagnosis of deafness to permit optimal auditory development; an atraumatic surgical technique designed to preserve cochlear function, minimize cochlear damage, and allow easy, possibly repeated re-implantation is recommended."

Background:

European Consensus Statement cont'd

Benefits of bilateral CI in children

- Improved speech understanding in background noise
- Improved listening in the "real world" even when audiological test results suggest minimal improvement
- Speech & language can develop more rapidly

Risks of delaying bilateral CI

In the early stages of bilateral CI use:

- Asymmetries have been noted in bilateral brainstem and cortical function
- Poorer speech perception and detection of speech in noise in the 2nd implanted ear compared to the 1st

Questions still to be answered:

- In cases of sequential cochlear implantation, do patients who have a short delay between the 1st and 2nd CI do better than those with a long delay (is there a critical window)?

AIM:

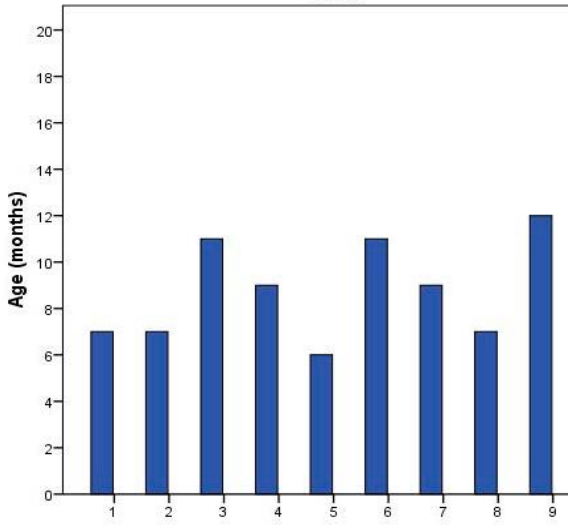
This study aims to investigate:

- The impact of receiving one or two cochlear implants on speech & language development, and functional auditory behaviour.

- If bilateral implantation has a positive impact on speech & language development, is there any difference between children who receive their 2nd implant sequentially vs. simultaneously?

Methods: Participants

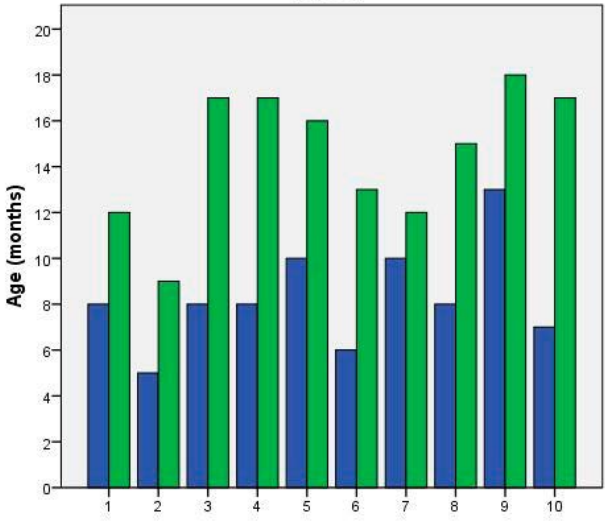
Group 1
Unilateral
Cochlear Implant
N = 9
(bimodal in 2 subjects, 2 intermittent HA users)



Mean age: 9m

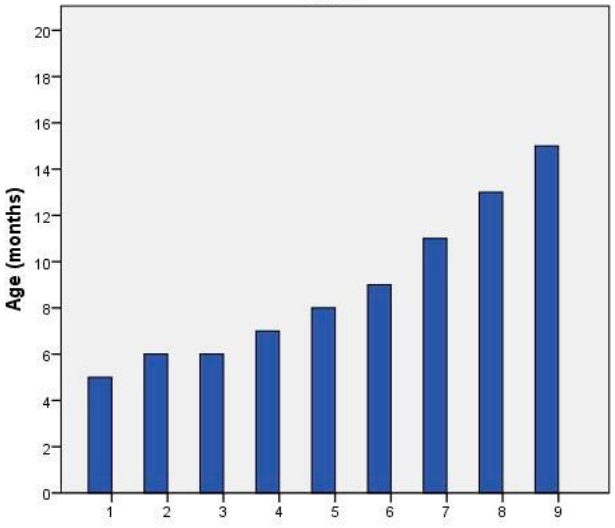
Group 2
Bilateral **sequential**
Cochlear Implant
N = 10

< 18 months



Mean age CI1: 8m
Mean age CI2: 15m

Group 3
Bilateral **simultaneous**
Cochlear Implant
N = 9



Mean age: 9m

Methods: - Assessments

- Moeller Family Rating
- PLS-4 Expressive & Receptive Language
- Expressive Vocabulary growth
- Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS)

Test intervals:

Methods: - Moeller Family Rating

Moeller Rating

(Rated retrospectively by early interventionists)

1 = limited participation

2 = below average participation

3 = average participation

4 = good participation

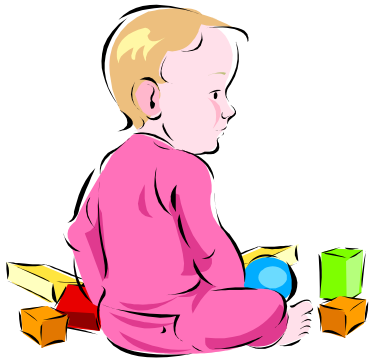
5 = ideal participation

Methods: - Assessments

IT-MAIS (Questionnaire)

- Vocal behavior affected while wearing hearing aids?
- Production of syllables & syllable-sequences recognized as speech?
- Spontaneous alerting to name in quiet with auditory cues only?
- Spontaneous alerting to name in noise with auditory cues only?
- Spontaneous alerting to environmental sounds with auditory cues only?
- Spontaneous alerting to sounds in new environments with auditory cues only?
- Spontaneous recognition of sounds with auditory cues only?
- Discriminates between two speakers' voices with auditory cues only?
- Discriminates between speech & non-speech stimuli with auditory cues only?
- Responses to intonation (motherese) with auditory cues only?

0 = Never **1** = Rarely **2** = Occasionally
3 = Frequently **4** = Always



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Results: Moeller family rating

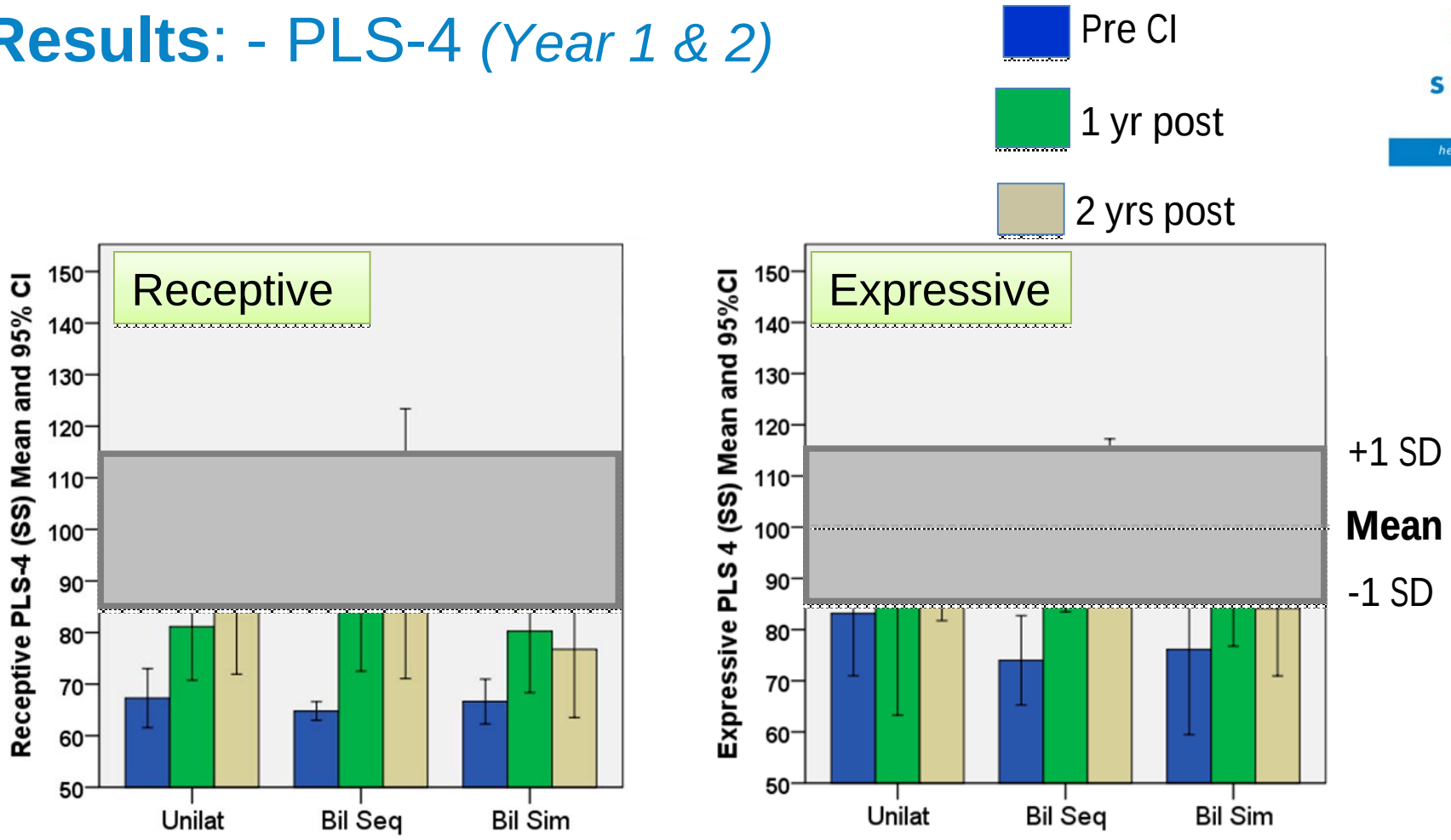
Unilateral	Sequential bilateral	Simultaneous bilateral
1y: m= 4.2 SD= .83	1y: m= 4.3 SD= .82	1y: m= 3.8 SD= 1.30
2y: m= 3.4 SD= 1.51	2y: m= 3.7 SD= 1.7	2y: m= 3.4 SD= 1.51

While parental engagement may be a contributor to outcomes, in this study the family ratings were not significantly different across groups.

1y: F= 0.73, p= 0.49

2y: F= 0.11, p= 0.90

Results: - PLS-4 *(Year 1 & 2)*

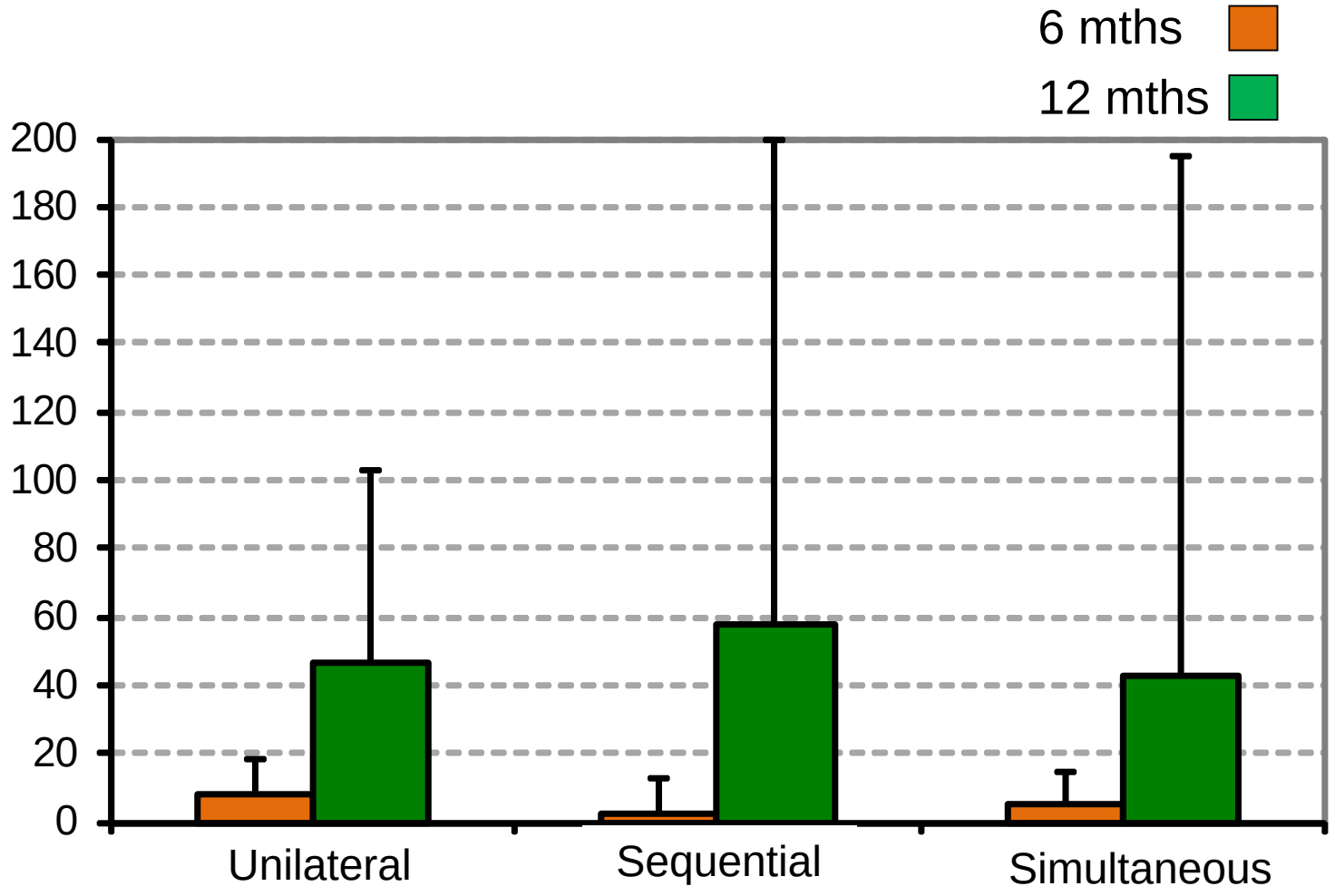


Repeated measure ANOVA:
- **Significant improvement over time for the 3 groups (F=15.92, p<.001)**
- **No significant difference between groups (F=.94, p=.41)**

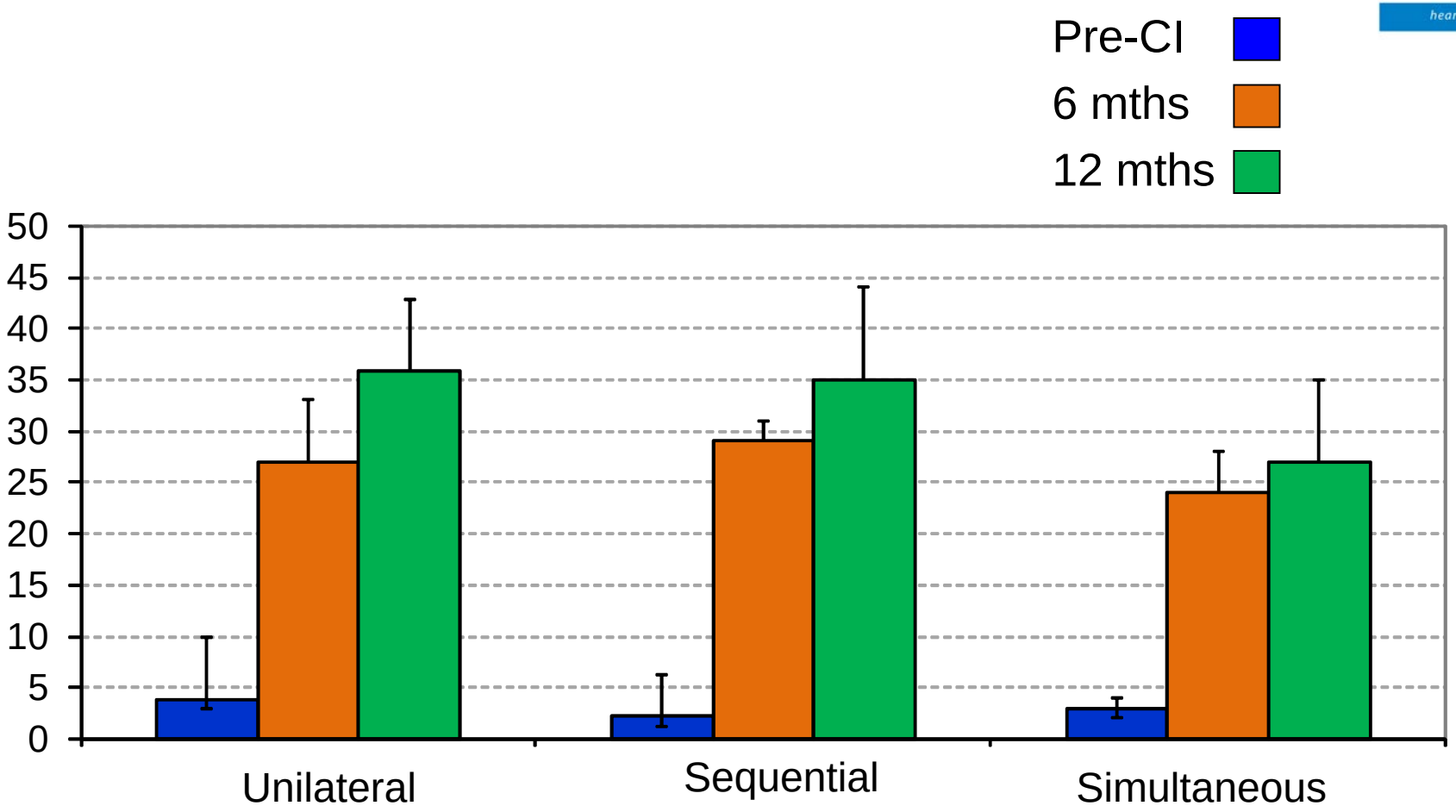
Repeated measure ANOVA:
- **Significant improvement over time for the 3 groups (F=8.1, p=.02)**
- **No significant difference between groups (F=.85, p=.44)**

Results: - Expressive Vocabulary Growth

(6-12mths post-SO)



Results: - Functional benefit – IT-MAIS



Pre: F= .27, p= .77

6m: F= 1.53, p= .24

1y: F= 3.68, p= .04

Conclusion & Discussion:

Question 1:
What is the impact on speech & language development, and functional auditory behaviour of bilateral cochlear implantation (compared to unilateral CI)?

- Children implanted unilaterally did not appear to be disadvantaged in their speech, language & functional outcomes when assessed at 1 and 2 years post-CI
(NB all received their 1st CI <12 months of age)

- Ongoing monitoring of performance is needed to investigate whether children implanted bilaterally show greater long-term gains than those implanted unilaterally.

Conclusion & Discussion:

Question 2:

Is there any difference in those who receive their 2nd implant sequentially or simultaneously?

- Children who were implanted bilaterally did not appear to be disadvantaged in their speech, language & functional outcomes if their second cochlear implant was delayed .

These findings are consistent with the European Consensus Statement :

"There is no evidence to date to suggest that children undergoing sequential procedures with **short** inter-implant delays of less than 1 year perform any differently to children receiving simultaneous implants"

Conclusion & Discussion:

It is important to note that:

- All sequential subjects in this study received their 2nd CI at <18 months of age, which is still relatively early
- Higher level binaural processing skills were not evaluated in this study, which is an area for future research.

Practical clinical considerations:

Benefits of simultaneous bilateral CI:

- **One anaesthetic & surgical session**: reduces parental stress & financial cost of a 2nd hospital stay)
- **One acute period for switch-on and familiarization with the signals from both ears** : easier for families and reduces cost associated with a second series of switch-on & mapping appointments
- **One series of acute habilitation sessions** : easier for families and reduces costs associated with habilitation

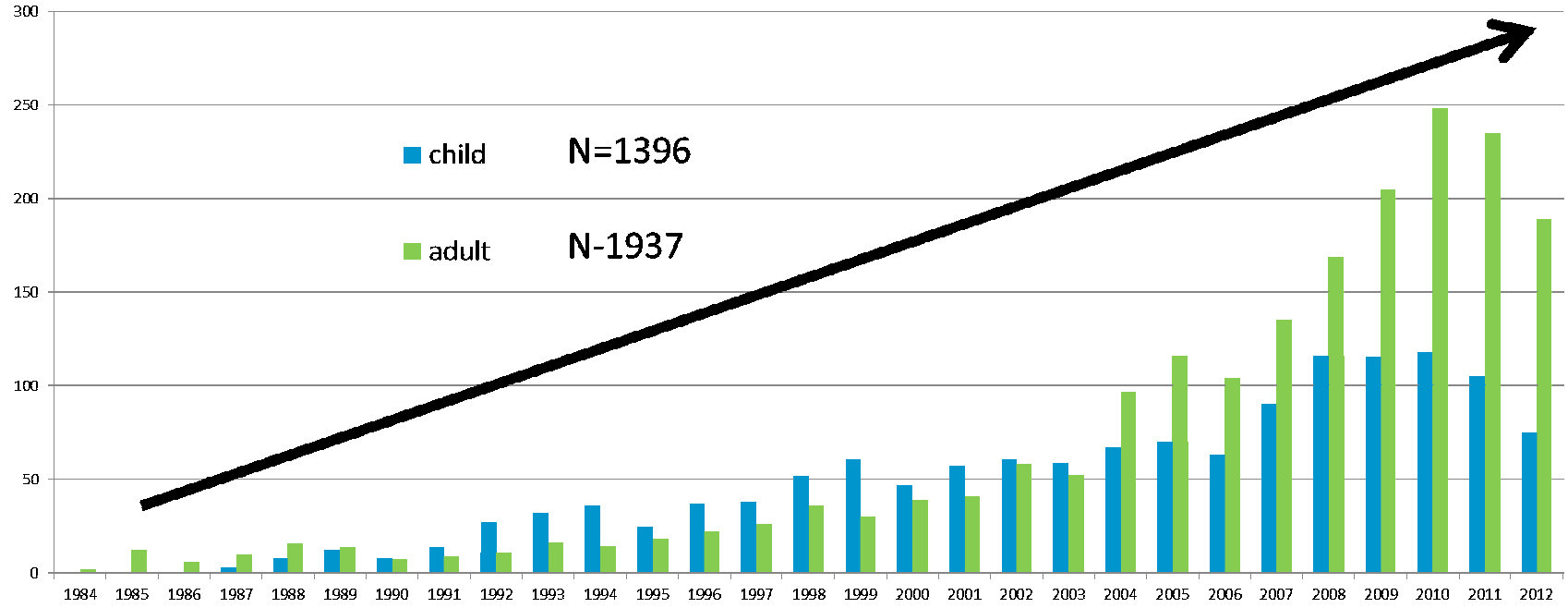
All of the above are particularly relevant for families who have to travel long distances to access services.

Further practical clinical considerations:

Potential challenges associated with sequential bilateral CI:

Encouraging the child to practice wearing their new implant alone when they are already very comfortable and reliant on the first.

Number of surgeries over the years



Total surgeries: 3343 (including bilaterals)

Active install base: 2670 recipients

For further information:

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