

Language development of children with cochlear implants: early vs later identified

Teresa YC Ching¹, Harvey Dillon¹, Carina Law¹,
Julia Day¹, Emma Rushbrooke²

¹National Acoustic Laboratories, ²Hear & Say Centre

NHS 2008



Background

- ◆ Prevalence (Russ et al, 2003; Ching et al, 2006)
 - ≥ 40 dB HL: 1.05/1000
 - 36 % have 3FA ≥ 70 dB HL
- ◆ CI more effective than HA for severe or profound hearing loss (Blamey et al, 2001; Boothroyd et al, 1991; Stacey et al, 2006; Ching et al, 2007)

With UNHS,

- ◆ Early detection and intervention is possible
- ◆ Alleviate negative impact of childhood hearing loss
 - Auditory skills (Sininger et al, 1999; Ruben, 1997)
 - Language (US Agency for Healthcare Research and Quality, 2001).
 - Reading (US AHRQ, 2004).
 - Academic achievement (Punch et al, 2004)
 - Psychosocial development (Watson et al, 1990)

But, evidence is inconclusive

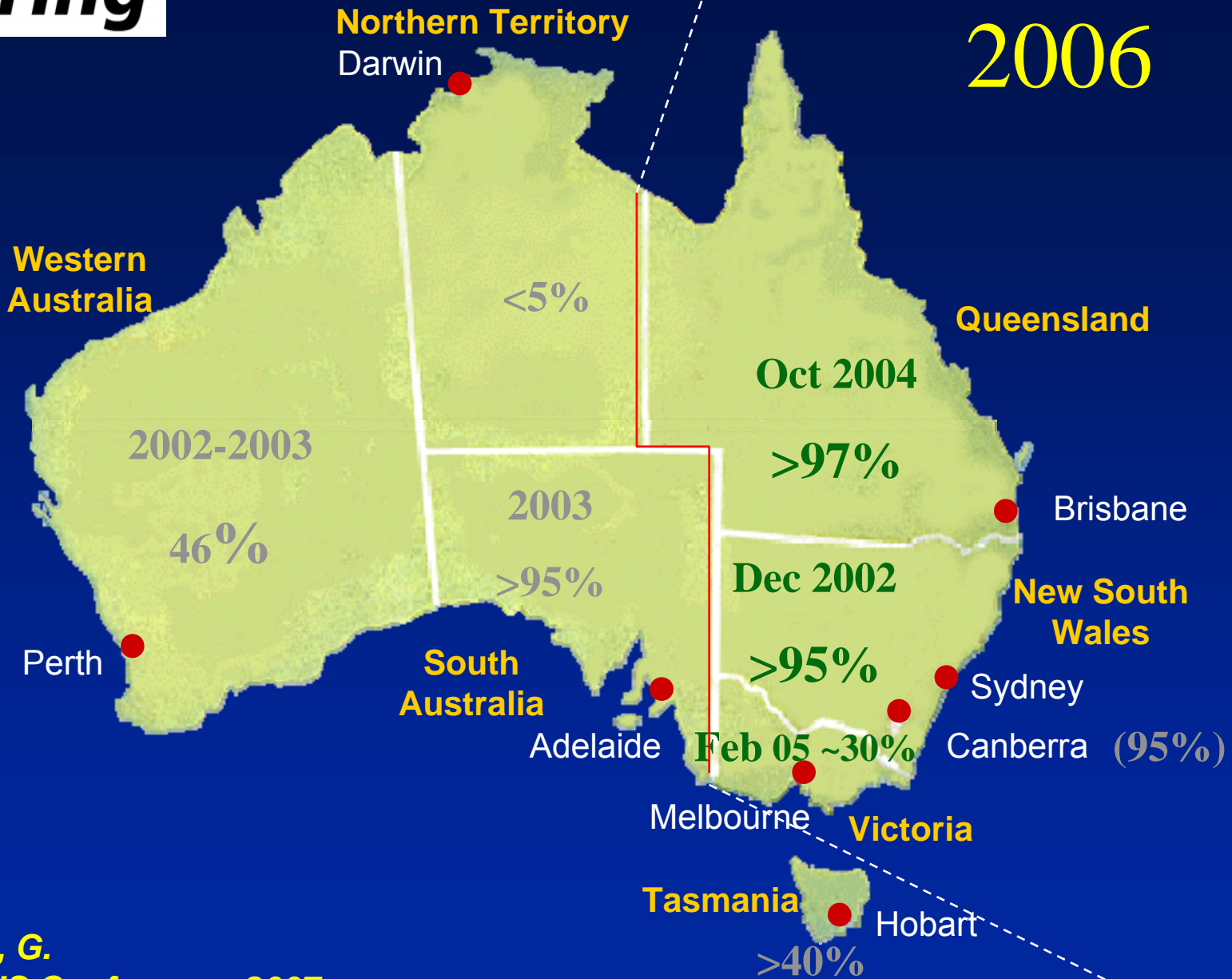
- ◆ Program-based studies showed retrospective association between early detection and better language at 3 or 5 years of age (Yoshinaga-Itano et al, 1998; Moeller, 2000).
- ◆ Recent studies showed that age of intervention was not a significant factor affecting speech performance (Kennedy et al, 2006; Fitzpatrick et al, 2007)

The lack of strong evidence puts even well-accepted programs at risk of their funders.

Does early intervention improve long-term outcomes?

A prospective study that directly examines whether newborn hearing screening and earlier intervention result in improved speech, language, or educational development

2006



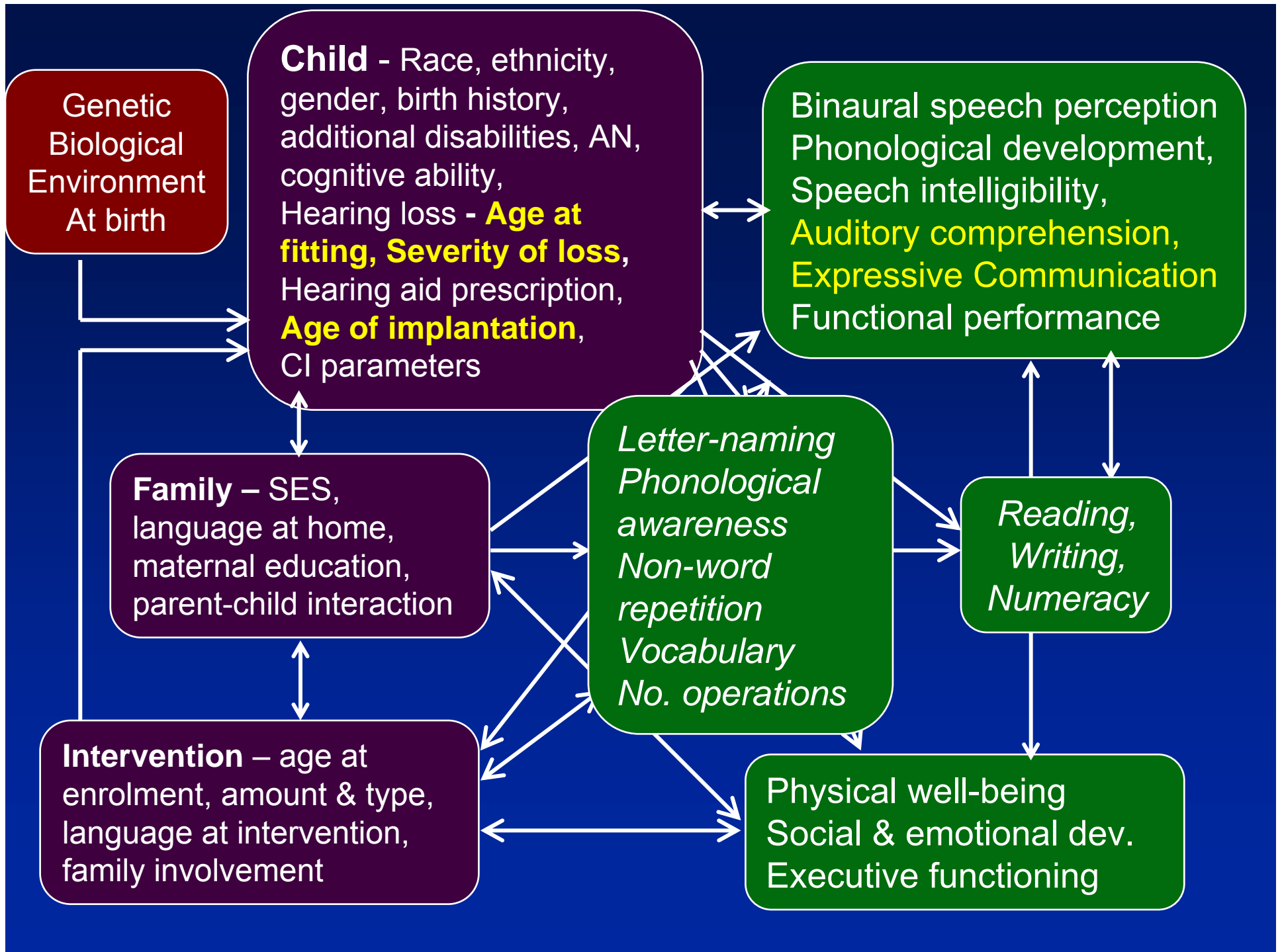
Leigh, G.
4th NHS Conference, 2007.

In 2005, we commenced a study on
Longitudinal
Outcomes of
Children with
Hearing
Impairment ...



Aims

- ◆ To establish an evidence base for the speech, language, functional, psycho-social and educational outcomes of children who use hearing aids and/or cochlear implants;
- ◆ To quantify the effect of a range of factors, including age of intervention, on different outcomes.
- ◆ To relate etiology to outcomes
- ◆ To relate early performance to later outcomes



Participants

- ◆ 440 children who first received amplification under 3 years of age
 - All children who first presented for hearing aids at Australian Hearing paediatric centres in NSW, Queensland and Victoria after April 2005 are invited to participate.
 - All children diagnosed via SWISH in NSW

Method

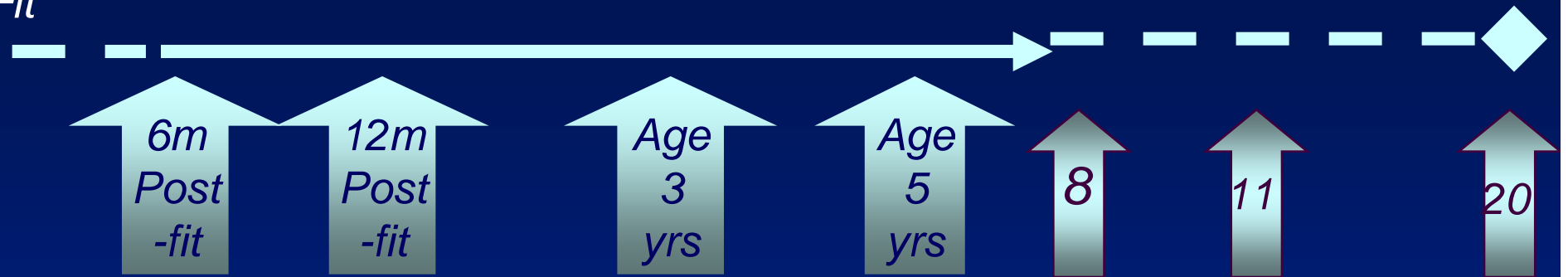
- ◆ Randomised trial of prescription
- ◆ Collect demographic, audiological information and information about non-device intervention for each participant.
- ◆ Assess non-verbal cognitive ability at 5 years of age

Method (etiology)

- ◆ Parental questions
- ◆ Tests of newborn blood spots
 - CMV ~ 25% (Morton & Nance, 2006)
 - mutations in GJB2 (Cx 26) ~ 15-21%
 - mutations in SLC26A4 (Pendred) ~3-7%
 - A1555G mutations (aminoglycosides ototoxicity) ~ 1%

Method

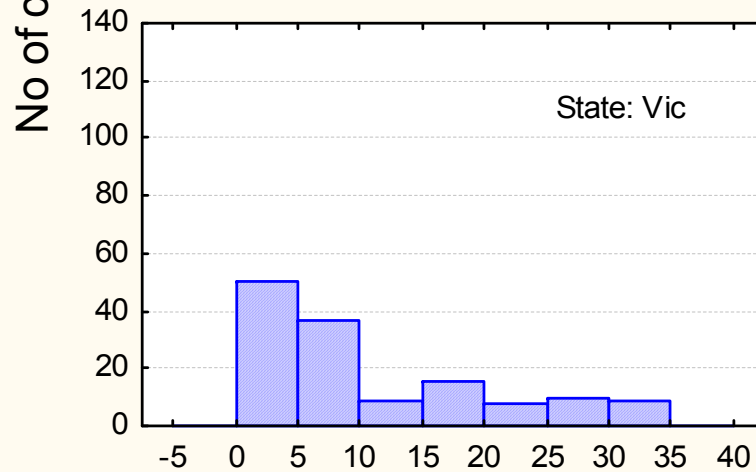
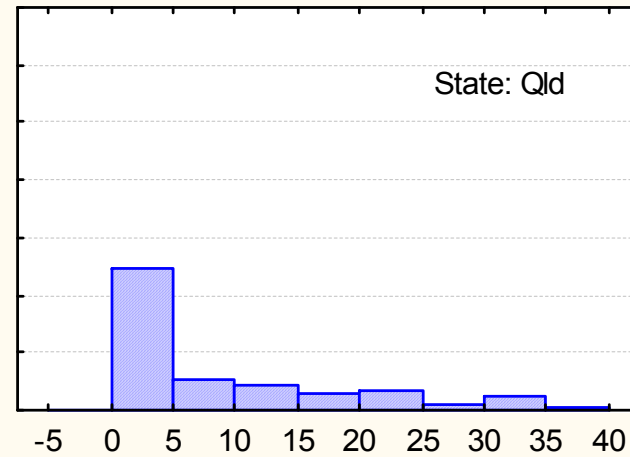
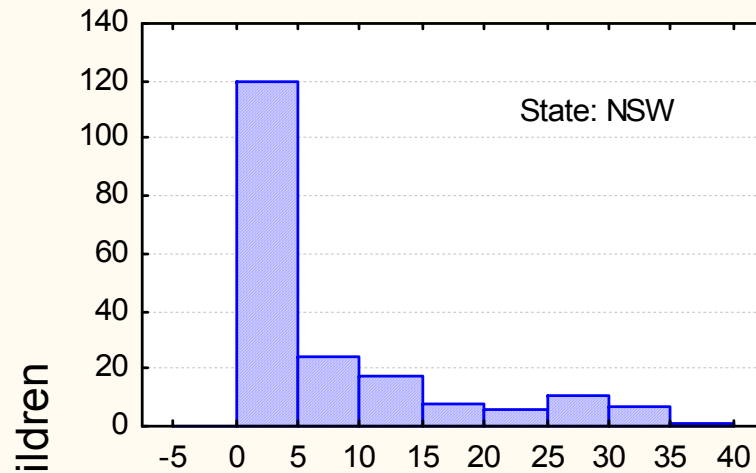
*First
Fit*



- ◆ Multiple assessments over time
 - to track rate of development
 - To assess relative impact of different factors at different age

Progress to date

Participants

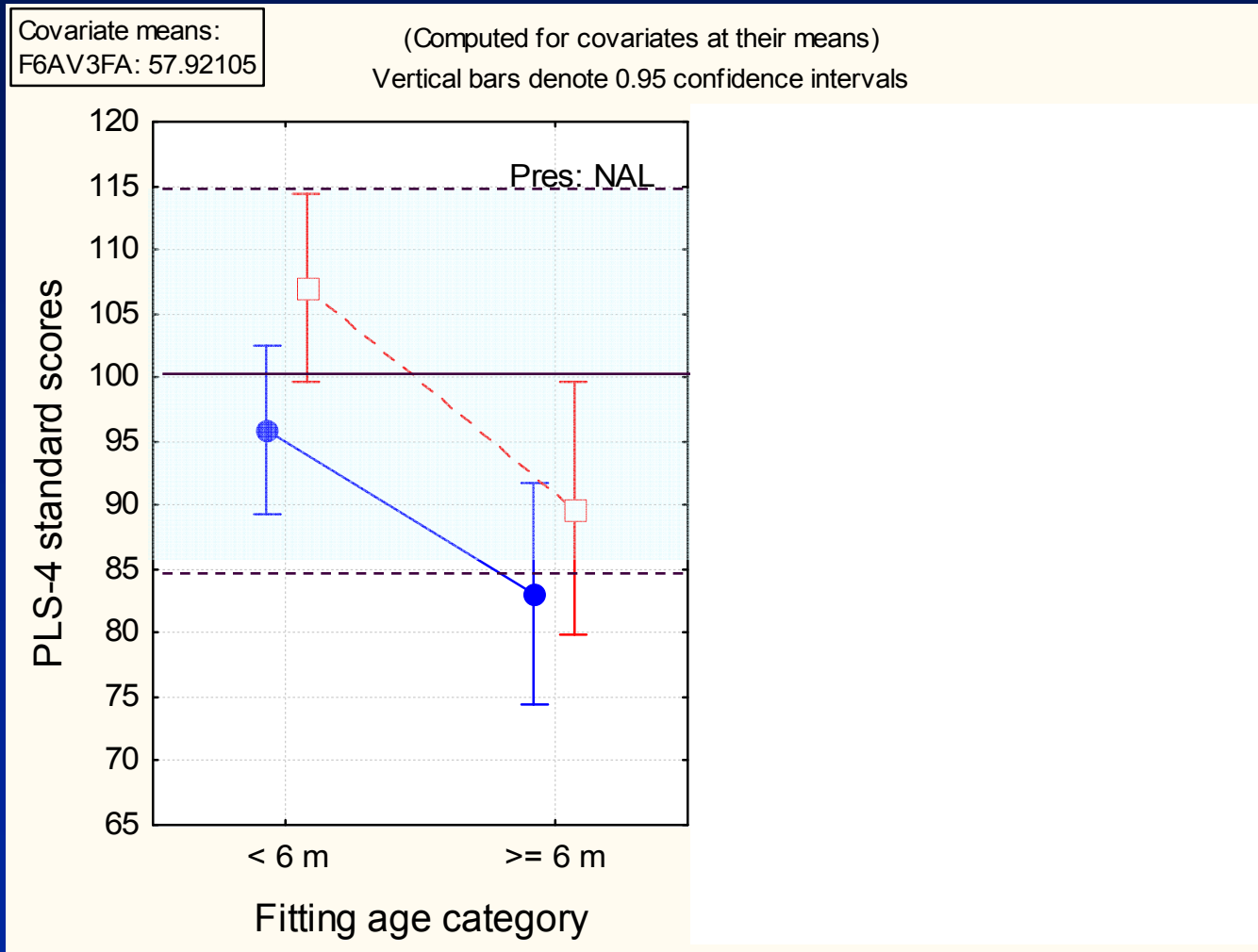


Fitted <6m: 55%
Fitted =>6m: 45%

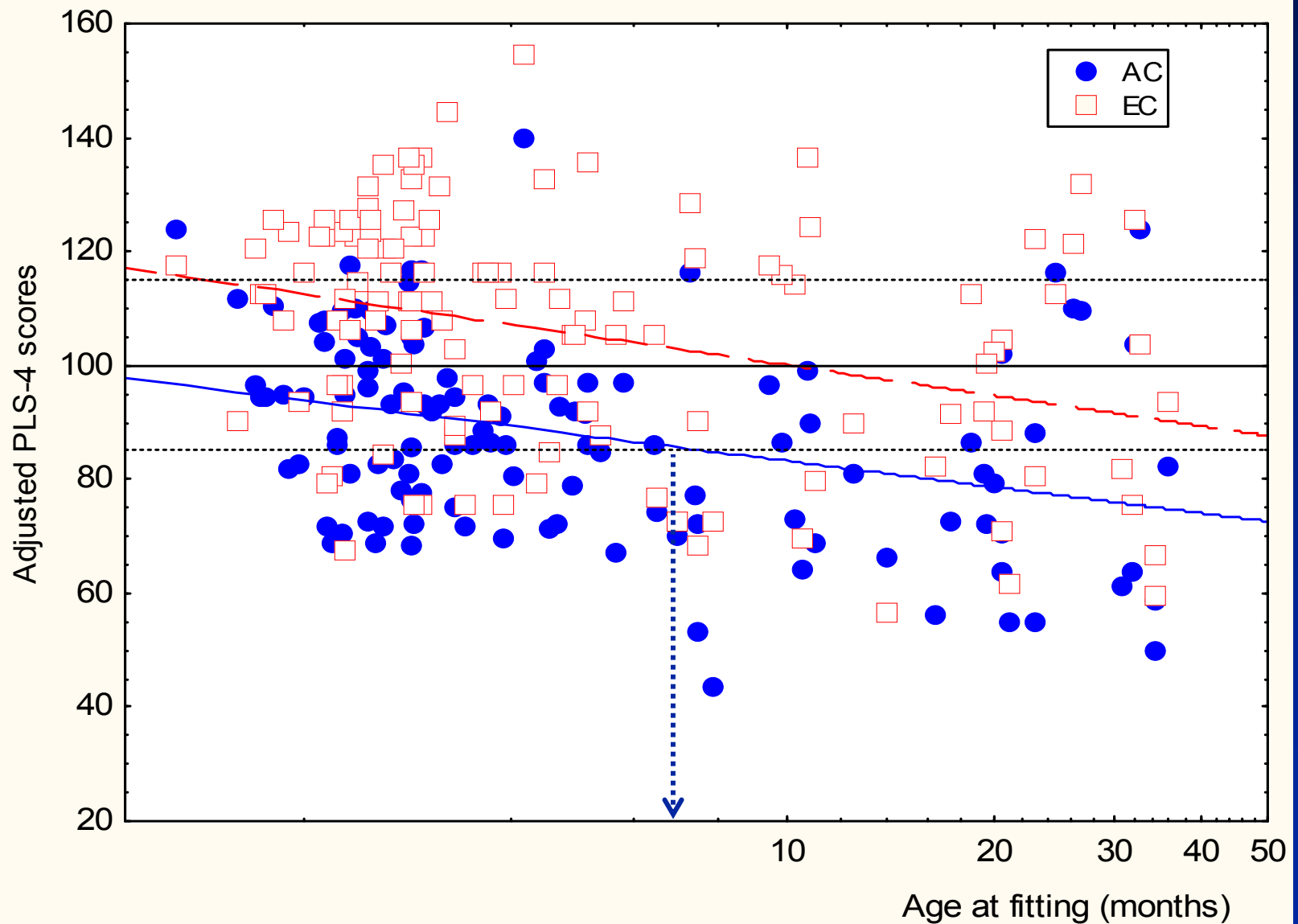
Age at fitting (months)

Six months after fitting

- *Effect of age of fitting: $p = 0.0004^*$*
- *Effect of hearing loss: $p = 0.006^*$*
- *Effect of prescription: $p = 0.1$*

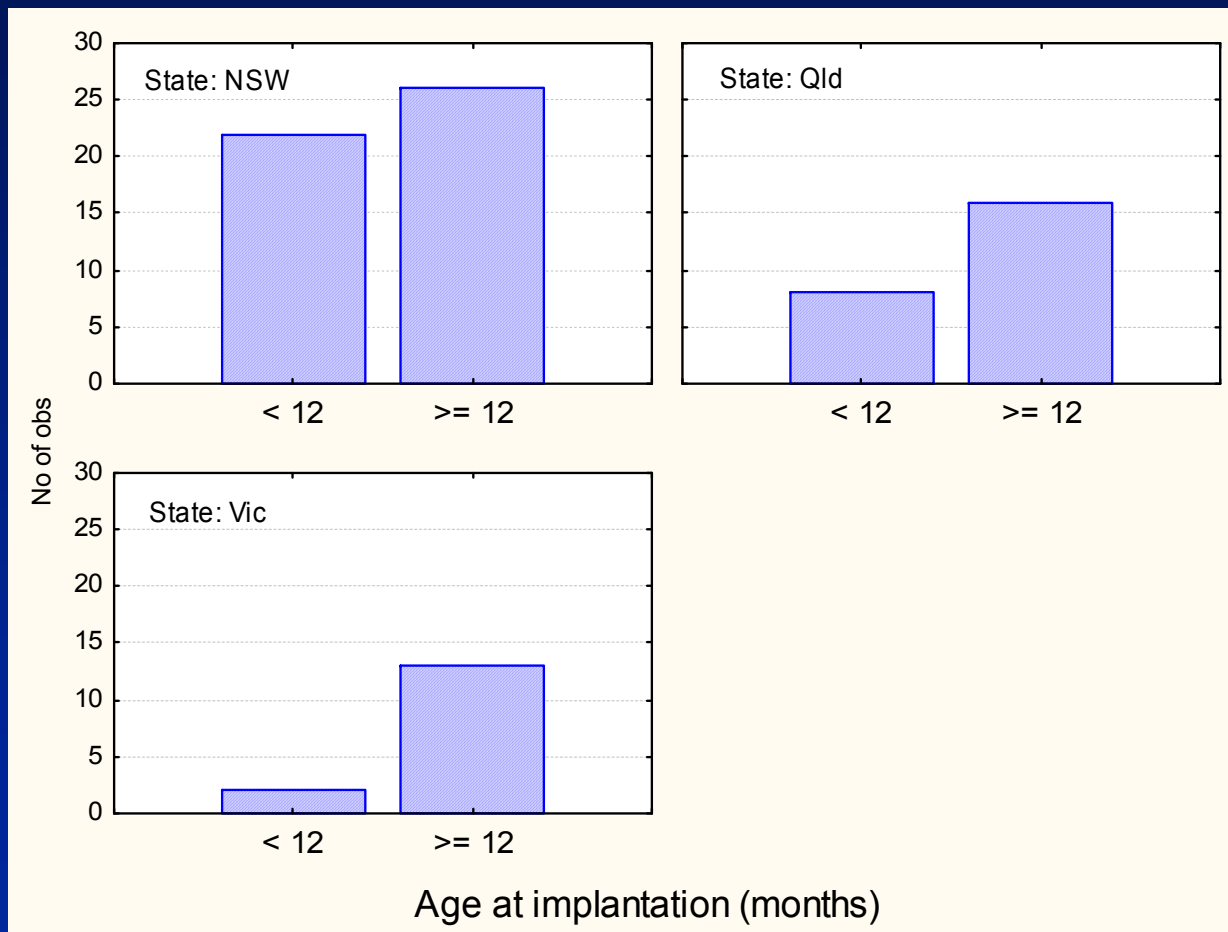


Language development of children with hearing aids

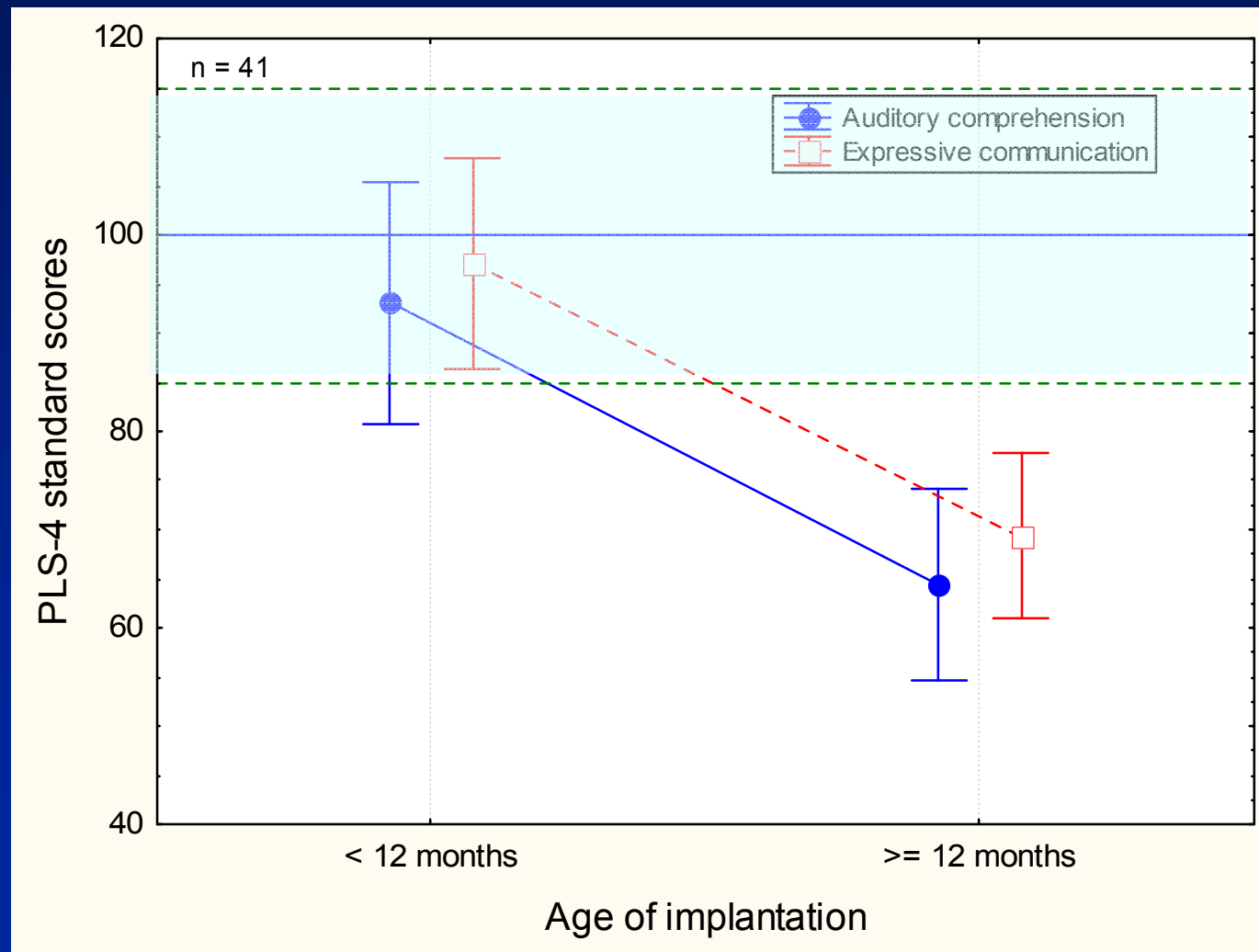




Age at implantation



At 6 months after implantation



ANOVA/ MANOVA

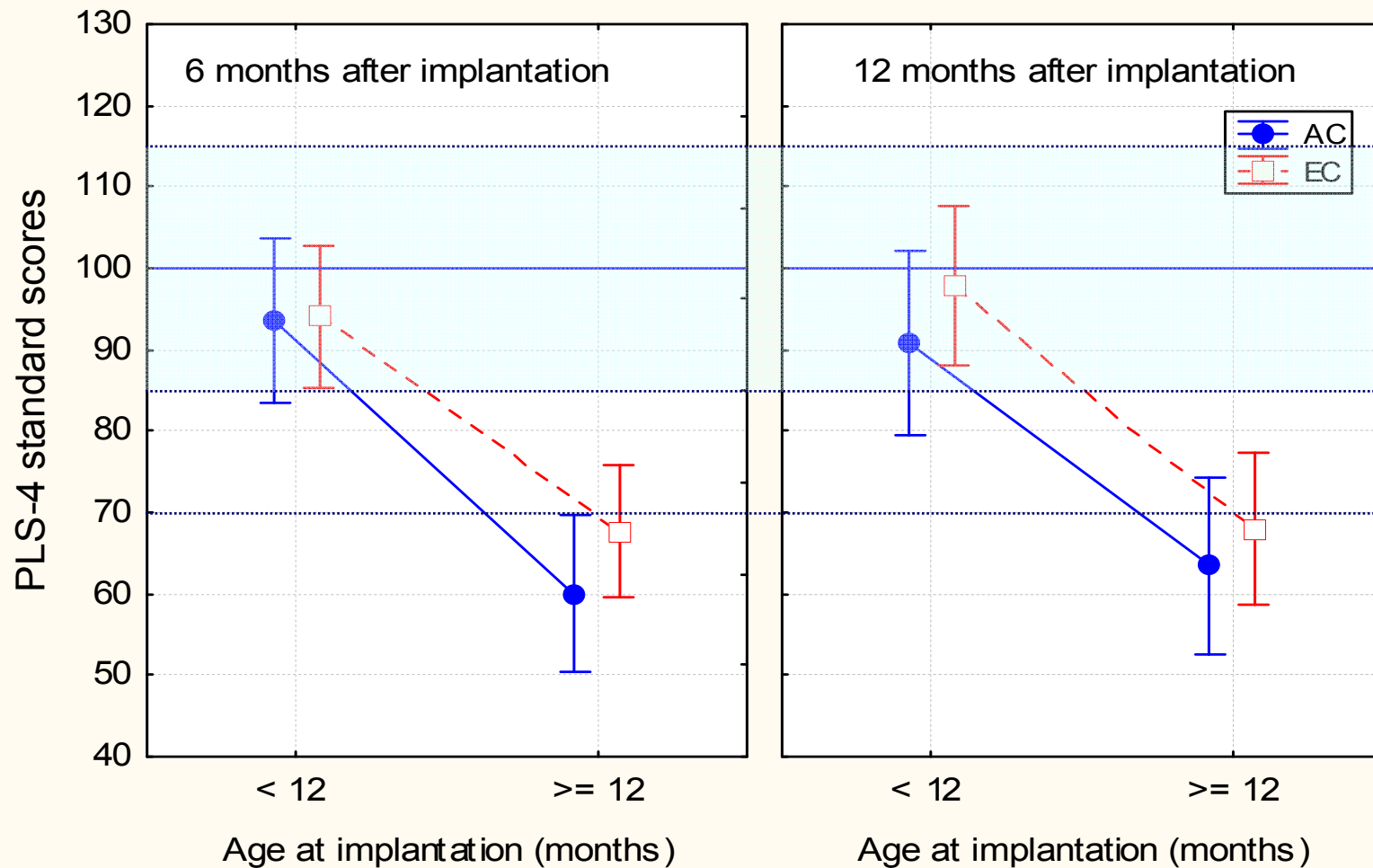
- ◆ Dependent variable
 - Auditory comprehension
 - Expressive communication
- ◆ Predictor variables
 - Implant age
 - Subscale
 - Test interval

At 6 and 12 months after implantation

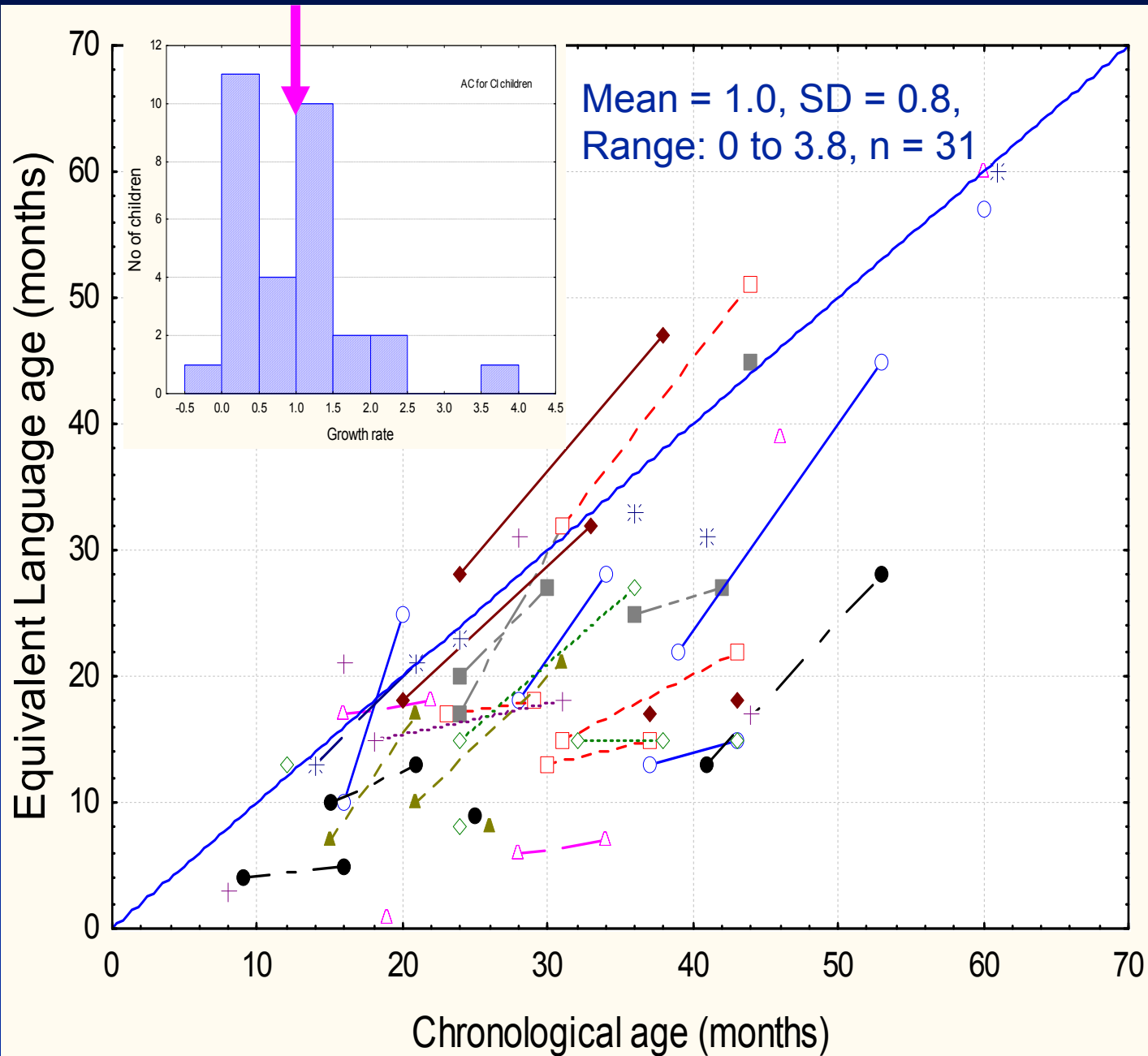
Effect of implant age: $p < 0.001^{**}$

Effect of scale: $p = 0.03^*$

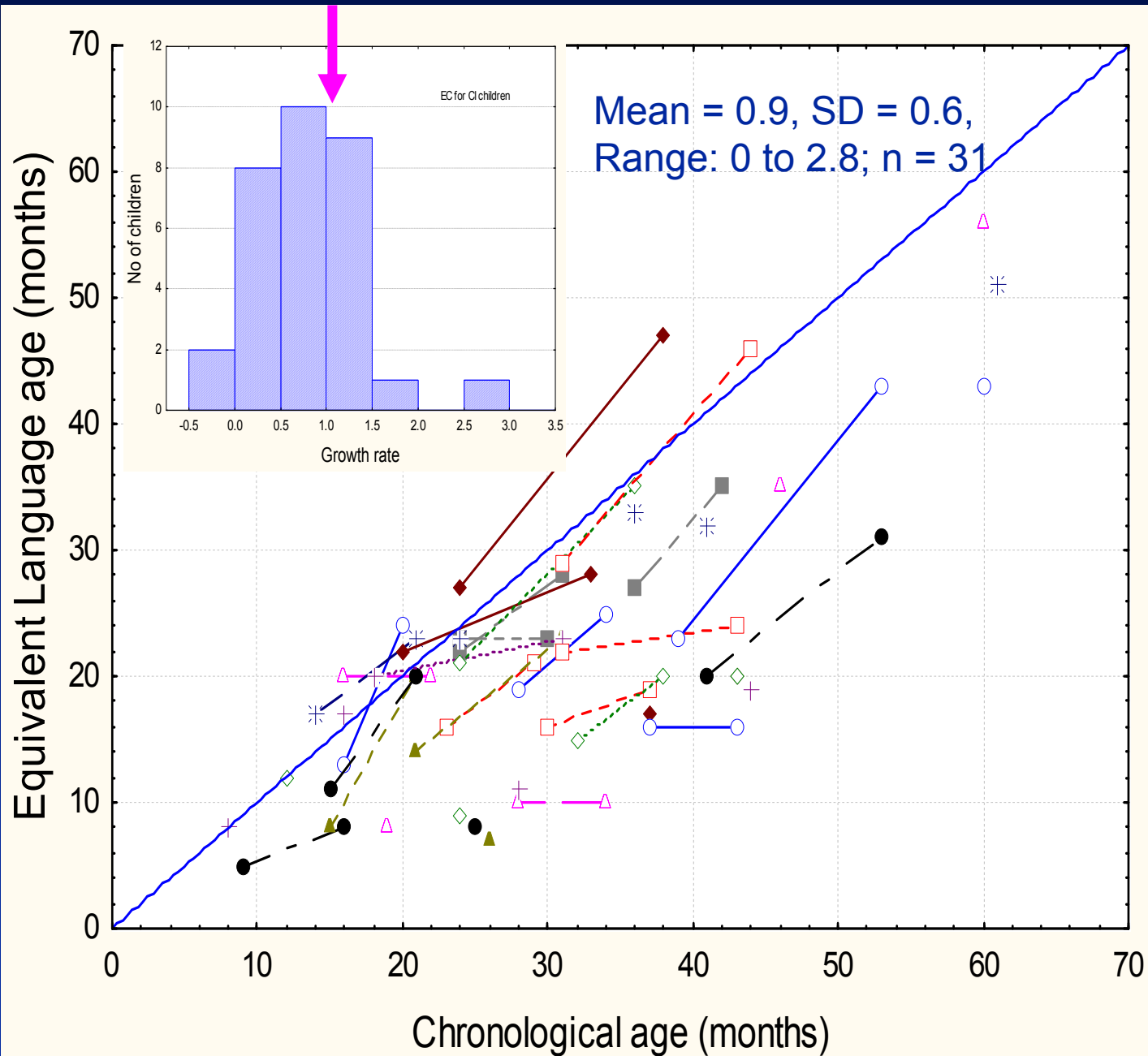
Test interval: $p = 0.7$ n.s.



Growth rate: Auditory comprehension

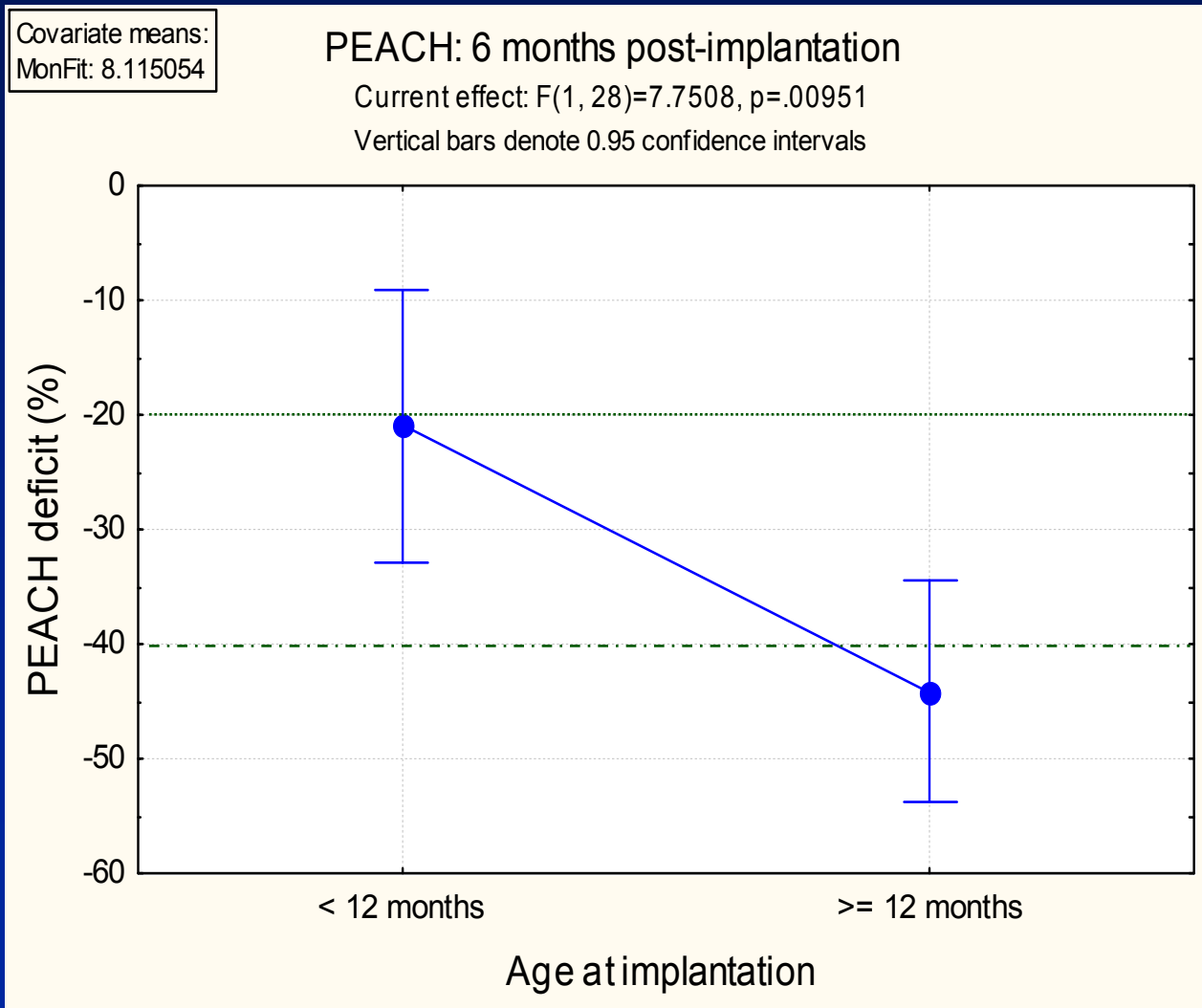


Growth rate – Expressive communication



Functional performance

Effect of age of implantation ($p = 0.009$)*



Interim findings

- ◆ When measured at 6 and 12 months after implantation, children who received CI prior to 12 months of age developed language within normal levels, on average.
- ◆ Children who received CI after 12 months of age performed at 2 SD below the mean.
- ◆ Growth rate near normal on average, but considerable variability.

Reasons for variability

- ◆ Non-verbal cognitive ability
- ◆ Aetiology
- ◆ Ethnicity
- ◆ Language used at home
- ◆ SES
- ◆ Maternal education
- ◆ Amount and nature of intervention
- ◆ Parent involvement in intervention

When all data become available ...

- ◆ Investigate the effect of multiple factors on performance in different dimensions;
- ◆ If early-identified children continue to develop normal-language ability
- ◆ If later-identified children “catch-up”
- ◆ Impact of age of intervention on speech, language, functional, psychosocial, educational attainment in the longer term.

Message for clinicians

- ◆ Fit early by using a prescription ~ 8 months
- ◆ Implant early, ~ 12 months
- ◆ Monitor rate of development

We thank the support, in kind or in cash, from:

- ◆ NIH/NIDCD Grant: 1R01DC008080-01A1
- ◆ CRC for CI and HA Innovation
- ◆ OHS, Department of Health
- ◆ Australian Hearing
- ◆ NSW Department of Health
- ◆ Oticon Foundation
- ◆ Cochlear Implant Clinic, Royal Victorian Eye & Ear Hospital
- ◆ Hear and Say Centre
- ◆ Matilda Rose Early Intervention Centre
- ◆ Royal Institute for Deaf and Blind Children
- ◆ St Gabriel's School for Hearing impaired children
- ◆ The Shepherd Centre
- ◆ Strathfield Catholic Centre for hearing impaired children
- ◆ Sydney Cochlear Implant Centre

Our team at NAL & participating programs

- ◆ Emma van Wanrooy, Patricia van Buynder, Robyn Massie, Leanne Skinner, Joanne Maritz, Lauren Burns, Carina Law, Alison Baker, Irma Sardic, Gerrie Krynder, Angela Wong
- ◆ Julia Day, Kathryn Crowe, Nicole Mahler-Thompson, Vivienne Martin, Sonya Cornick, Laura Street
- ◆ Samantha Youn
- ◆ Emma Rushbrooke, Lynda Close (Hear & Say Centre)
- ◆ Greg Leigh, Robyn Smith (Royal Institute for Deaf and Blind Children)
- ◆ Lynne Paul (St Gabriel's School for Hearing impaired children,
- ◆ Strathfield Catholic Centre for hearing impaired children)
- ◆ Tracy Hopkins, Maree Doble (The Shepherd Centre)
- ◆ Kylie Rankine, Colleen Psarros, Sharan Westcott (Sydney Cochlear Implant Centre)
- ◆ Jamie Leigh, Cochlear Implant Clinic, Royal Victorian Eye and Ear Hospital
- ◆ Matilda Rose Early Intervention Centre

Others who have helped: Gillian Zavos, Lisa Nailand, Alison Jagger, Ineke Woodhill, Andrew Geyl,, Anne Fulcher, Isabelle Rousseau, Lyndal Carter

We are very grateful to

All participants, their families, and
their teachers



Outcomes of Children with Hearing Impairment



Home

What is the Outcomes Study?

Who runs the study?

Assessments

FAQ

Where is the study up to?

Resources

Contact



Hi, I'm LOCHI the lion from the Longitudinal **O**utcomes of **C**hildren with **H**earing **I**mpairment study.

This study is conducted by the National Acoustic Laboratories (NAL) to examine the long-term speech, language, psychosocial and educational outcomes of children with hearing impairment.

Children who wear hearing aids and/or cochlear implants are included.



To review information on outcomes study:

www.outcomes.nal.gov.au

www.nal.gov.au

For more information:

Teresa Ching, PhD

National Acoustic Laboratories

Teresa.Ching@nal.gov.au