



The Performance and Outcomes of the National University Hospital Universal Newborn Hearing Screening Programme: A Retrospective Study

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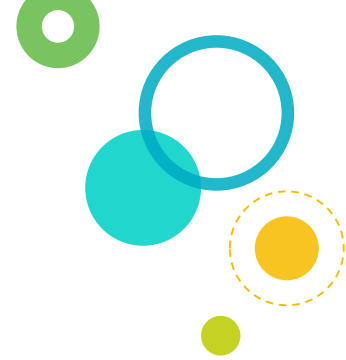
Study Team

Primary Investigator

- Dr Jenny Loo

Co-investigators/Advisors

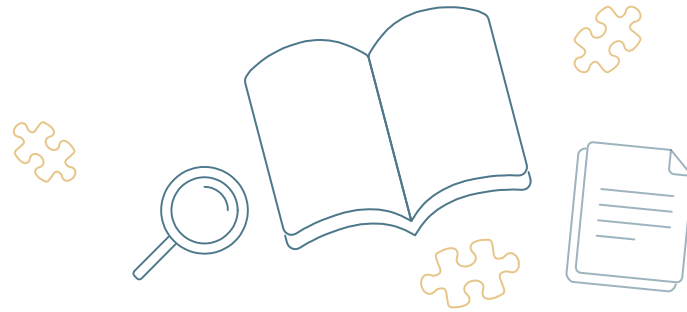
- Prof. Roy Joseph
- A/Prof. Loh Woei-Shyang
- Mdm Ng Pick Gate (Angie)
- Ms Guo Tong



Presentation Overview

- Study background and aims
- Methodology
- Results and discussion
- Limitations
- Conclusion and future studies





Study Background

Introduction and study aims

Congenital Hearing Loss

- One of the most prevalent chronic childhood conditions (Korver et al., 2017).
- Local prevalence (Low et al., 2005):
 - 4 in 1000 born with CHL
 - 1.7 in 1000 with severe to profound CHL
- Crucial in the first 3.5 years for speech and language development (Dorman et al., 2007; Sharma et al., 2015).



The Need for UNHS

- Early diagnosis → reading and communication abilities
(McCann et al., 2009; Pimperton et al., 2016; Worsfold et al., 2010).
- Early intervention → speech and language
(Ching et al, 2013; Cupples et al., 2018; Yoshinaga-Itano et al., 2018).
- Joint Committee on Infant Hearing (2007):
 - 1-3-6 rule
 - Important challenge: Lost to follow-up



Study Aims



Aim

1

**Performance
Assessment**

UNHS and
subsequent
stages



Aim

2

**CHL
Prevalence**

Audiological
profiles



Aim

3

**Lost to
Follow-up**

Rates and
possible
reasons



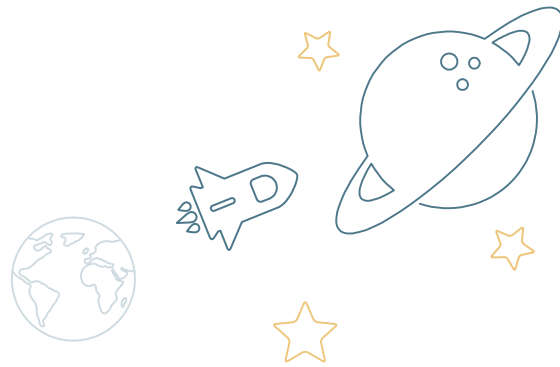
Aim

4

**Intervention
Outcomes**

Language
and
education





Methodology

Retrospective Study

NUH-born infants: 2004-2014

UNHS information

Hi-Track database and SAP software



UNHS-referred Infants

Hearing Diagnosis and Intervention

CPSS and Noah software system



Intervened Infants

Language Outcomes (1.5 – 7 yrs old) and
Education Pathway

CPSS and physical records of routine
language assessments

LTF data from
CPSS!



The background features a large, light blue dashed circle that frames the central content. Scattered around this circle are various solid-colored circles in shades of green, blue, orange, yellow, and pink. In the center, there are several line-art icons: a bar chart with four bars of increasing height, a lightbulb, a presentation board on a stand showing a line graph with an upward-pointing arrow, another lightbulb, a pie chart with one slice separated, and a third lightbulb.

Results and Discussion

Figures: 2004 to 2014

434,105 live births in Singapore
(Registry of Births and Deaths)

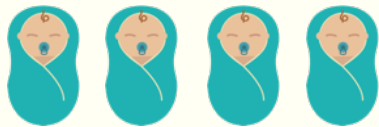
29,972 (6.9%) infants
born in NUH

29,671 (99.0%) infants
eligible for UNHS

Aim 1: Performance Assessment

Performance criteria	Number of infants (%)	JCIH Recommendations	
		Criteria	Met
Coverage rate	29,489 of 29,671 (99.4)	-	-
Referral rate Similar to reported literature (Low et al., 2005)	157 of 29,671 (0.5)	Less than 4%	✓
Screened by 1 month of age	Estimated ~90.0% of 29,671	More than 95%	✗
Diagnosed by 3 months of age	48 of 127 (37.8)	At least 90%	✗
Intervened by 6 months of age	15 of 74 (20.3)	-	-
Follow-up rate	763 of 886 (86.1)	At least 70%	✓

Prevalence of CHL
4 per 1000 newborns

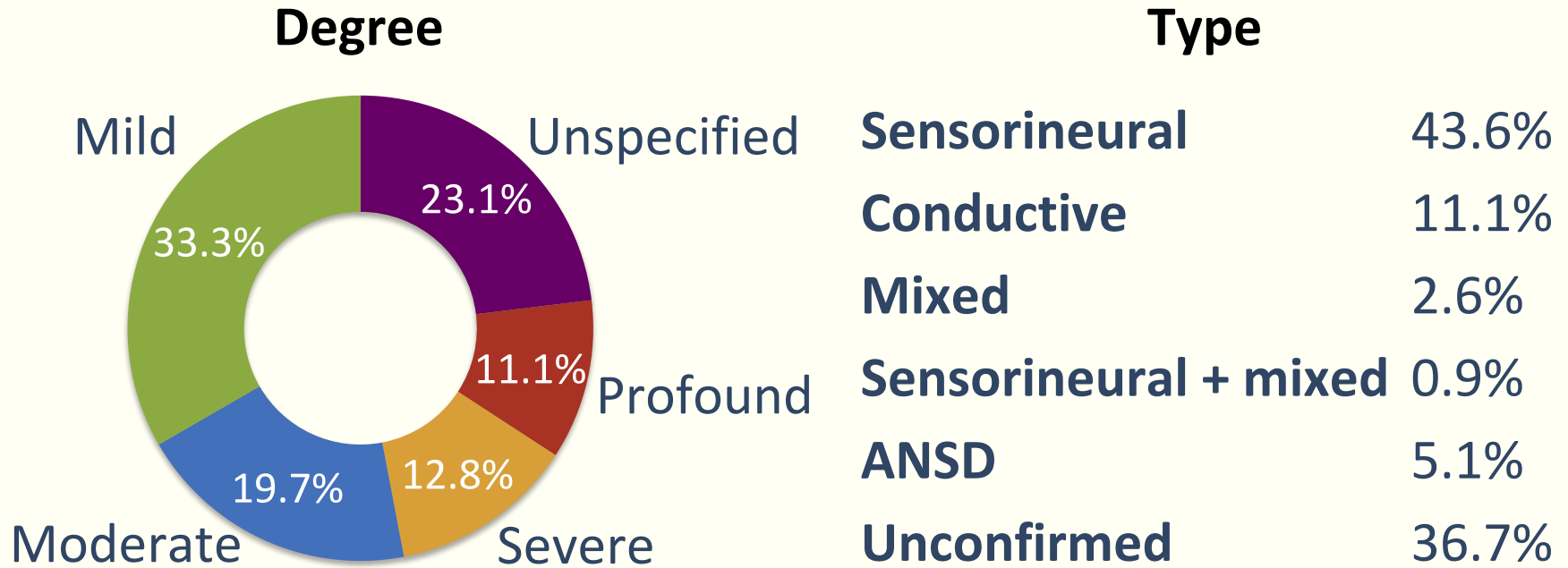


Similar to reported
studies

(Low et al., 2005;
Wroblewska-Seniuk et al., 2018)



Hearing Profiles (n = 117)

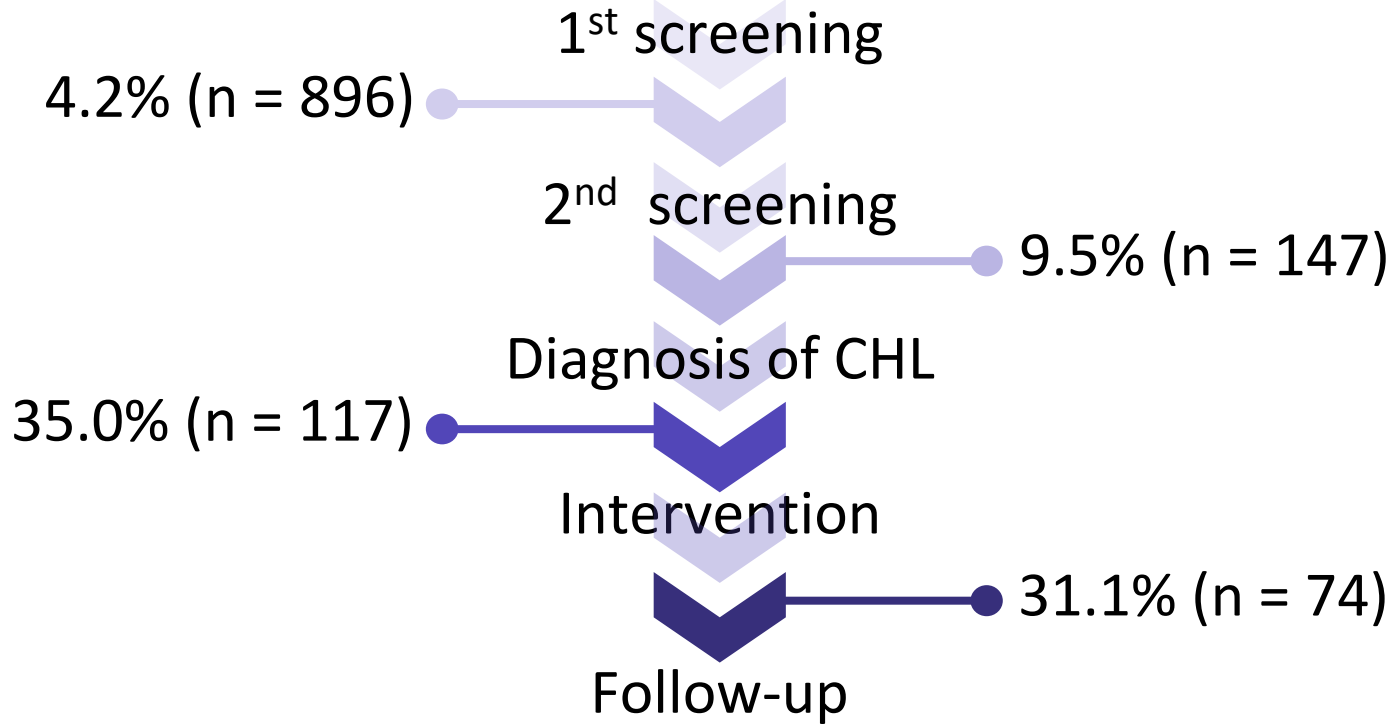


Degree of Hearing Loss on Early Diagnosis/Intervention?

Via Logistic Regression:

- ✓ Degree of HL was a significant predictor of early intervention (p-value = 0.0023)
 - In line with other studies (Ching et al., 2013) though some contradict as well (Holte et al., 2012; Spivak et al., 2009)
- ✗ But not for early diagnosis (p-value = 0.13)

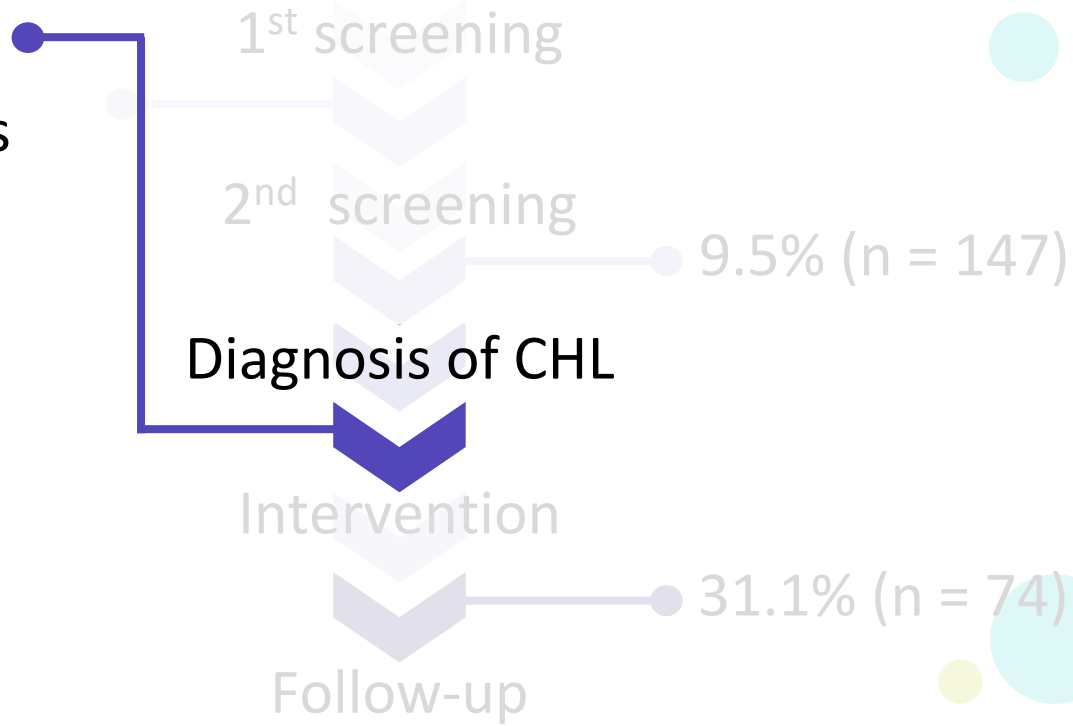
Aim 3: Lost to Follow-up



Aim 3: Lost to Follow-up

Observed reasons:

- Pressing medical conditions
- Additional disabilities
- Complicated family dynamics
- Parents: no concerns with their child's hearing
- Seeking intervention elsewhere

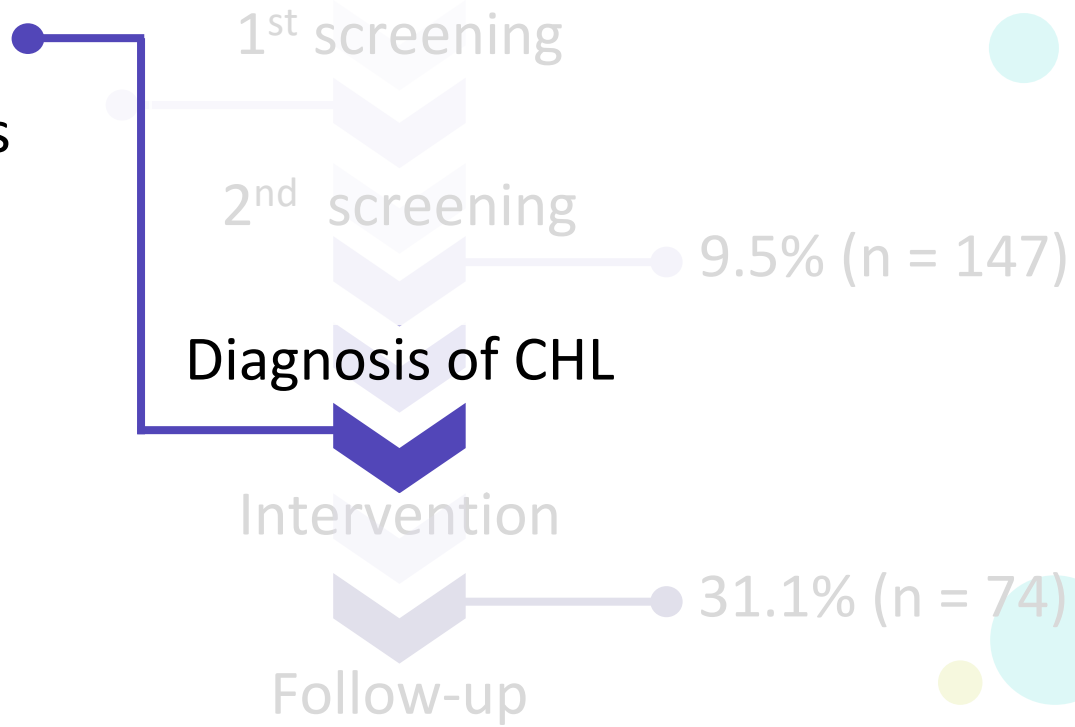


Aim 3: Lost to Follow-up

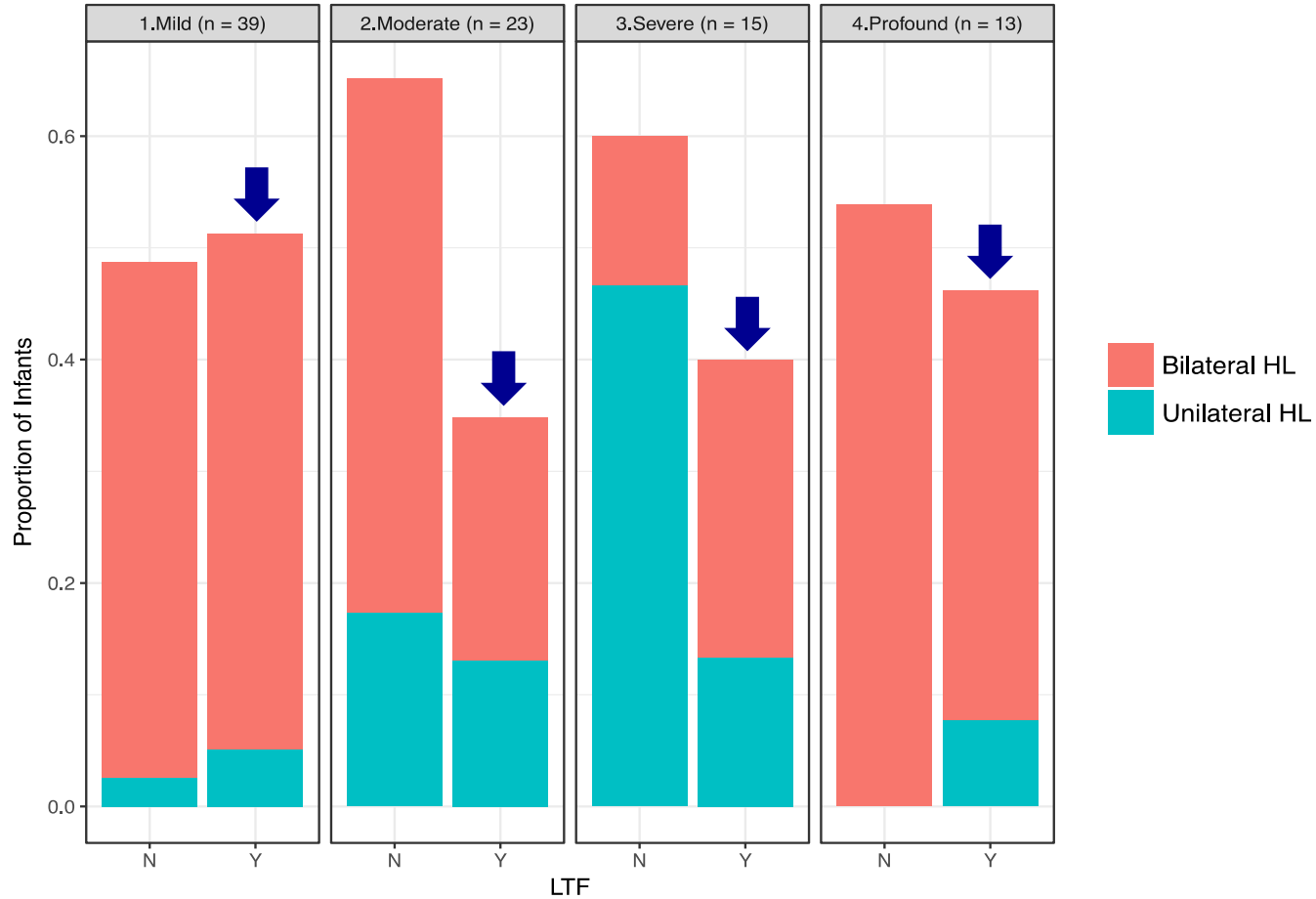
Observed reasons:

- Pressing medical conditions
- Parents: no concerns with their child's hearing

Also reported in other literature (Lam et al., 2018; Ravi et al., 2016; Barker et al., 2013).



Degree of Hearing Loss on LTF?



Degree of Hearing Loss on LTF?

- Trend was not observed: LTF rates did not increase with lesser degrees of hearing loss.
- Logistic regression: degree of hearing loss was not a predictor of LTF (p-value = 0.573).
- Unilateral CHL (n = 20): minority (40%) were LTF cases

Aim 4: Language and Education Outcomes

Case study of 3 infants:



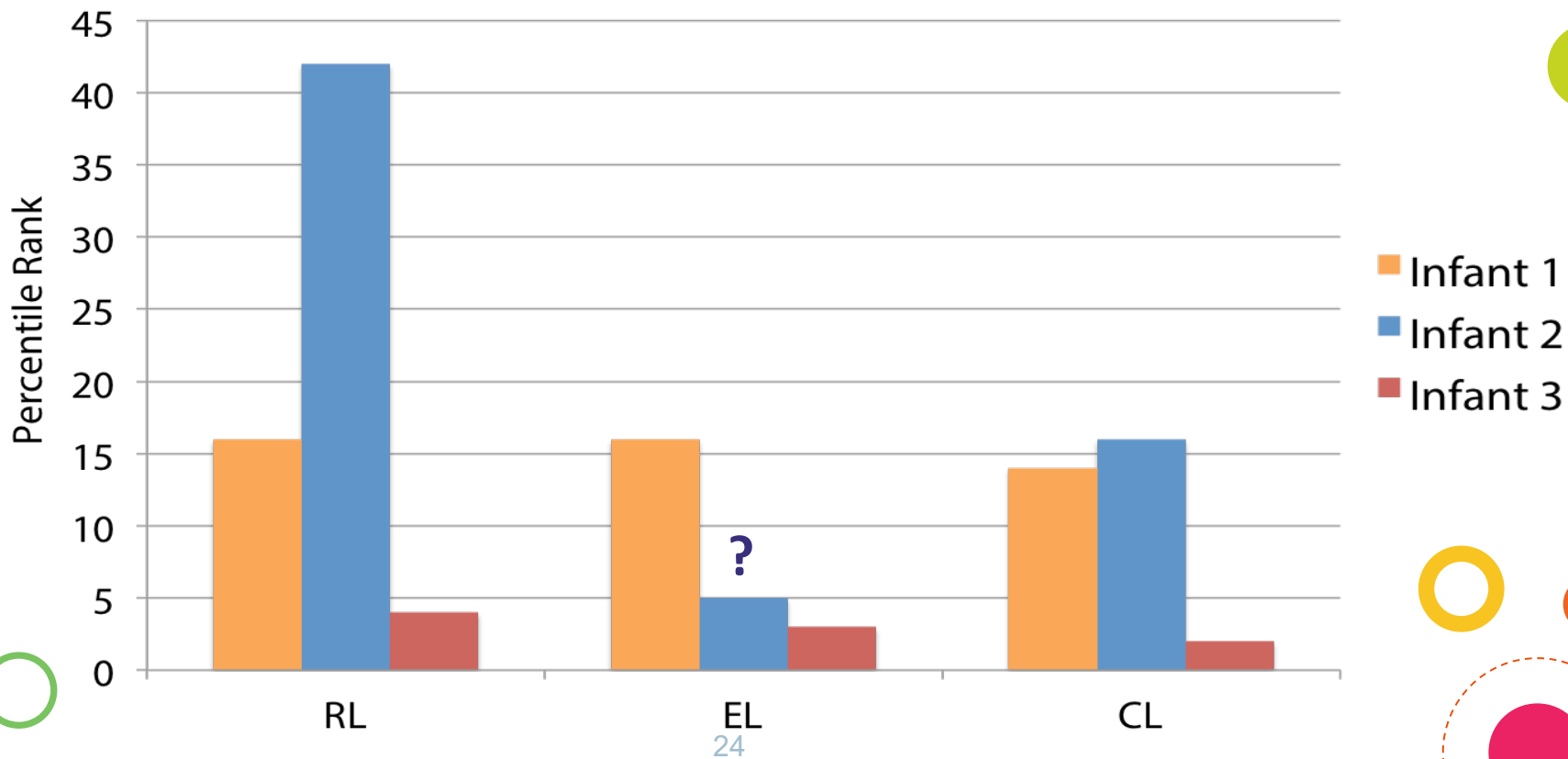
Controlled for:

- age
- gender
- audiological profile
- audiological intervention
- no additional disabilities
- All went to mainstream primary schools

Aim 4: Language Outcomes

CELF P-2 scores	Infant 1	Infant 2	Infant 3
Age of HA fitting/CI switch-on (months)	<u>10.3/46.1</u>	<u>3.5/12.7</u>	<u>4.5/33.8</u>
Age of language assessment/ post CI switch-on (months)	79.8/33.4	75.3/62.6	86.9/53.2
Receptive Language	85 (mild)	97 (no delay)	73 (moderate)
Expressive Language	85 (mild)	75 (moderate)	71 (moderate)
Core Language	84 (mild)	85 (mild)	70 (severe)

CELF P-2 Percentile Ranks



Aim 4: Language Outcomes

Highlight:

- Infant 2: Better language results with earlier CI intervention vs Infant 3.
- CI implanted between 12-18 months: significantly better CELF assessment scores vs implant ages of Infants 1 and 3 (Dettman et al., 2016).
- Early diagnosis and intervention: optimal window for CI implantation.

Limitations

- Retrospective study:
 - incomplete data
 - unable to contact parents: LTF reasons, maternal education etc.
- Language assessments:
 - small sample
 - norms may not be appropriate
- Speech assessments not routinely done.

Conclusion and future studies

- Two of the JCIH recommendations were met:
focus on barriers to early diagnosis and intervention.
- Prevalence of CHL: 4 in 1000
- Degree of hearing loss: predictor of early intervention.



Conclusion and future studies

- LTF rates highest following diagnosis: further study of LTF reasons (via parental interviews).
- Early diagnosis and intervention play a role for early CI implantation.
- Future longitudinal studies: predictors for speech, language and education outcomes.





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- NUS Audiology Classmates

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Thank you!

Any questions?

