Studies of Early Language Development in High-Risk Populations

Betty Vohr MD, Melinda Caskey MD, Katharine Johnson MD, Deborah Topol, Nicole Girard, Lucille St.Pierre

Data Analyst: Richard Tucker

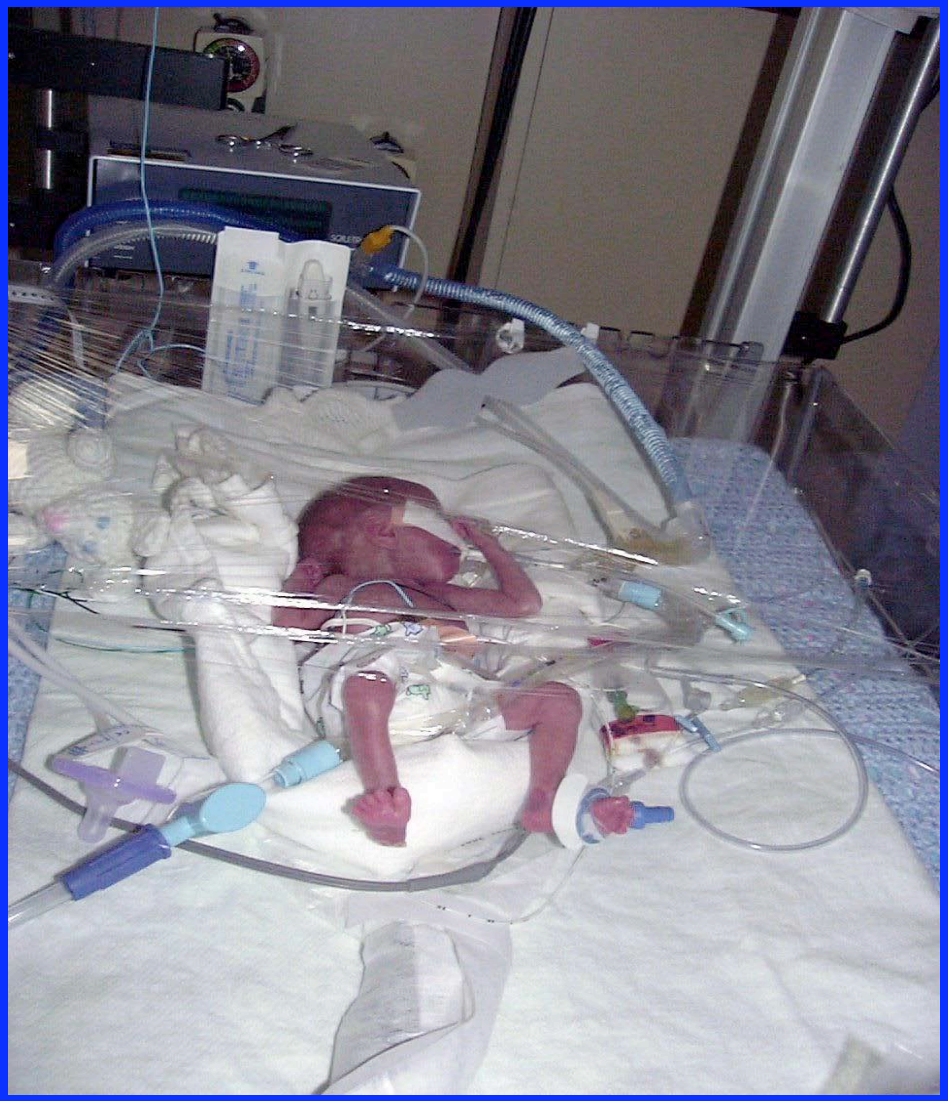
Women & Infants Hospital

Alpert Medical School of Brown University

Facts About Prematurity

- Preterm birth rates continue to ↑ in the US
- 62,000 VLBW infants < 1500 grams
- 30,000 ELBW infants < 1000 grams are born annually
- Survival of ELBW infants has increased to 66-88%

Why are VLBW at ↑ Risk of Developmental Morbidity?



VLBW Infants are Exposed to the Atypical Environment of the Typical NICU for Weeks to MS

- In addition to the risk of multiple neonatal morbidities and prolonged hospitalizations
- Prolonged exposure to noise levels > 45 dB
- Increased ambient light, often 24 hours per day
- Stressful manipulation
- Painful procedures
- Lack of soothing tactile stimulation
- Lack of developmentally appropriate stimulation

Preterm's and Language

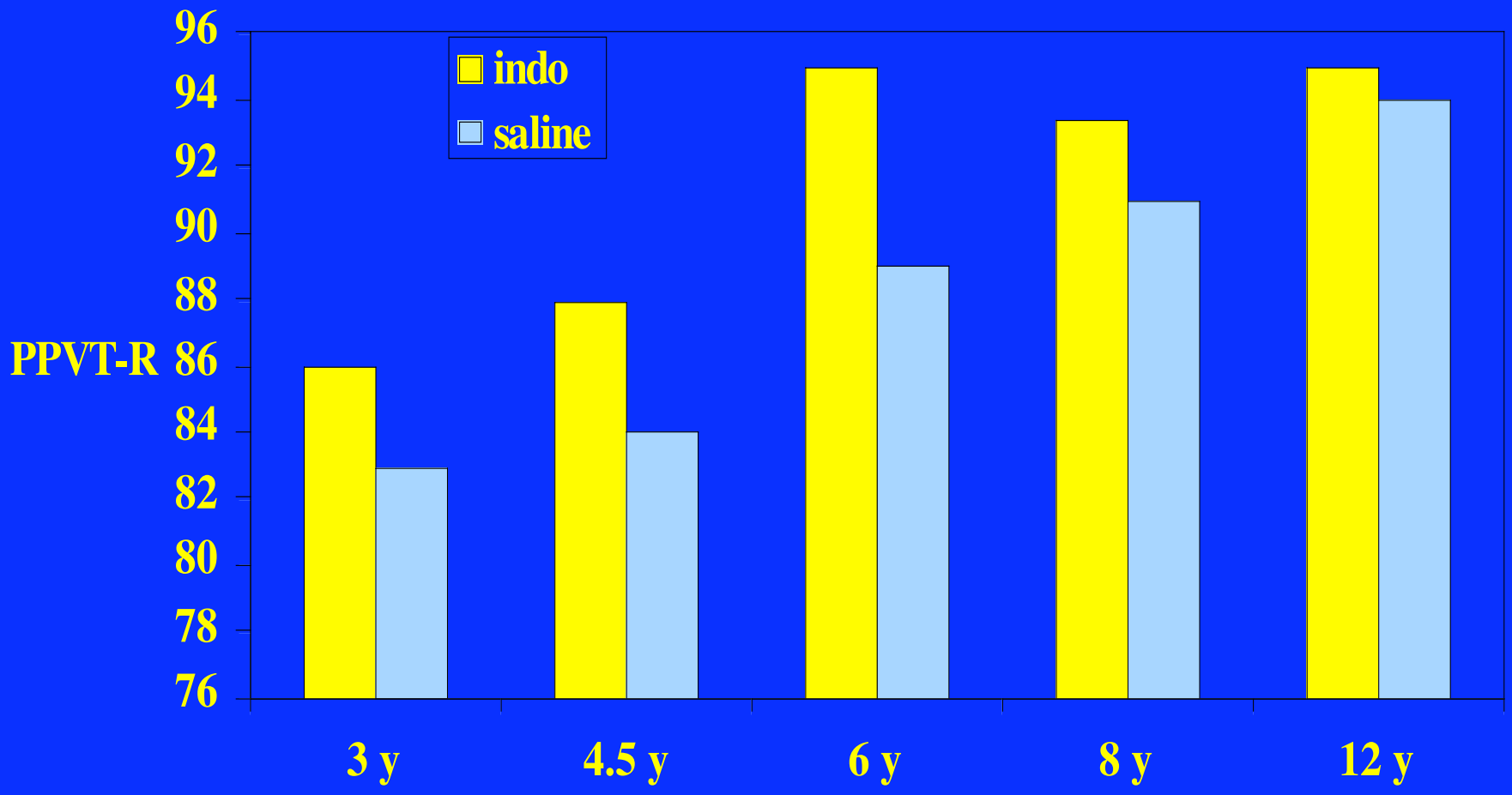
- VLBW infants often display slower rates of growth in vocabulary and grammar than do term infants

- Preterm infants may be at heightened risk for specific language impairments (Foster-Cohen, Edgin, Champion, & Woodward, 2007; Kern & Gayraud, 2007; Marston, Peacock, Calvert, Greenough, & Marlow, 2007; Ortiz-Mantilla, Choudhury, Leevers, & Benasich, 2008; Sansavini et al., 2007; Stolt et al., 2007; Vohr et al., 1988; Vohr et al., 1989; Vohr et al., 2000)

Preterm's and Language

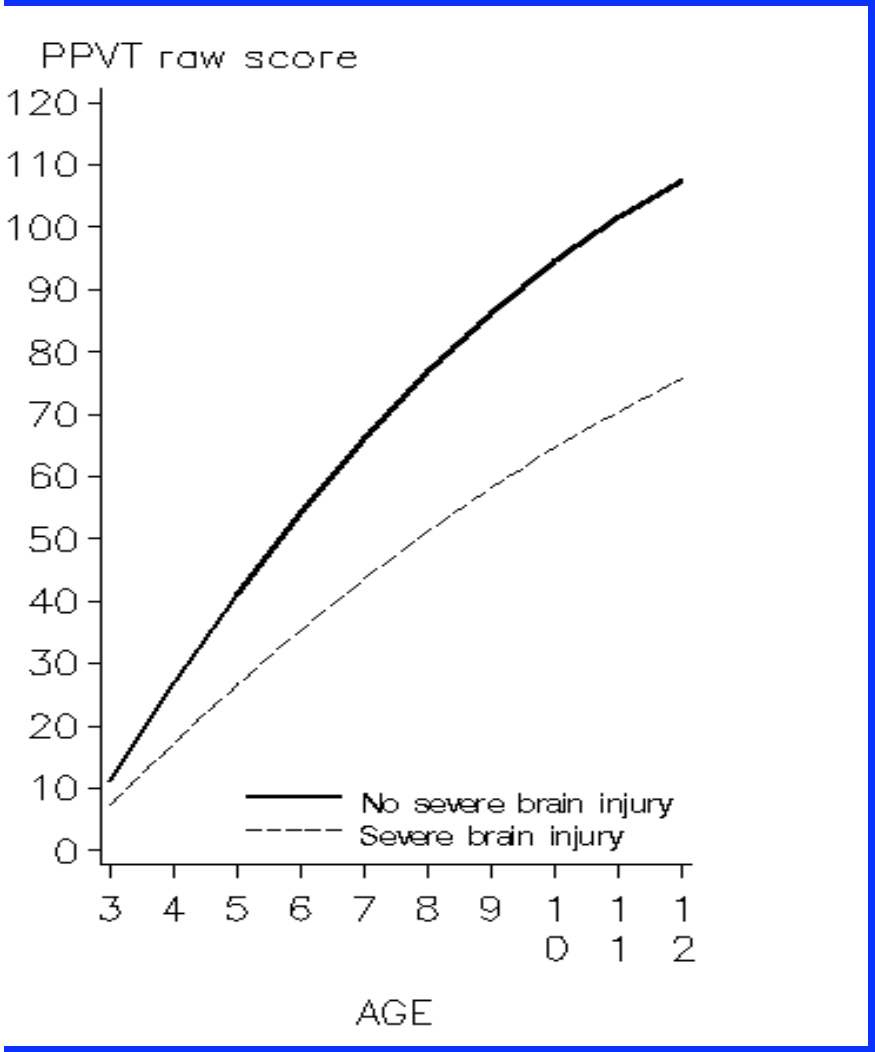
- Early language delays are associated with deficits in early school achievement (Pritchard et al., 2009; Wolke, et al., 2008)
- 44-56% of VLBW children require Special Education Resources (Vohr & Msall, 2000)
- At school age they have ↑ deficits in executive function, working memory, verbal fluency, verbal memory, and attention

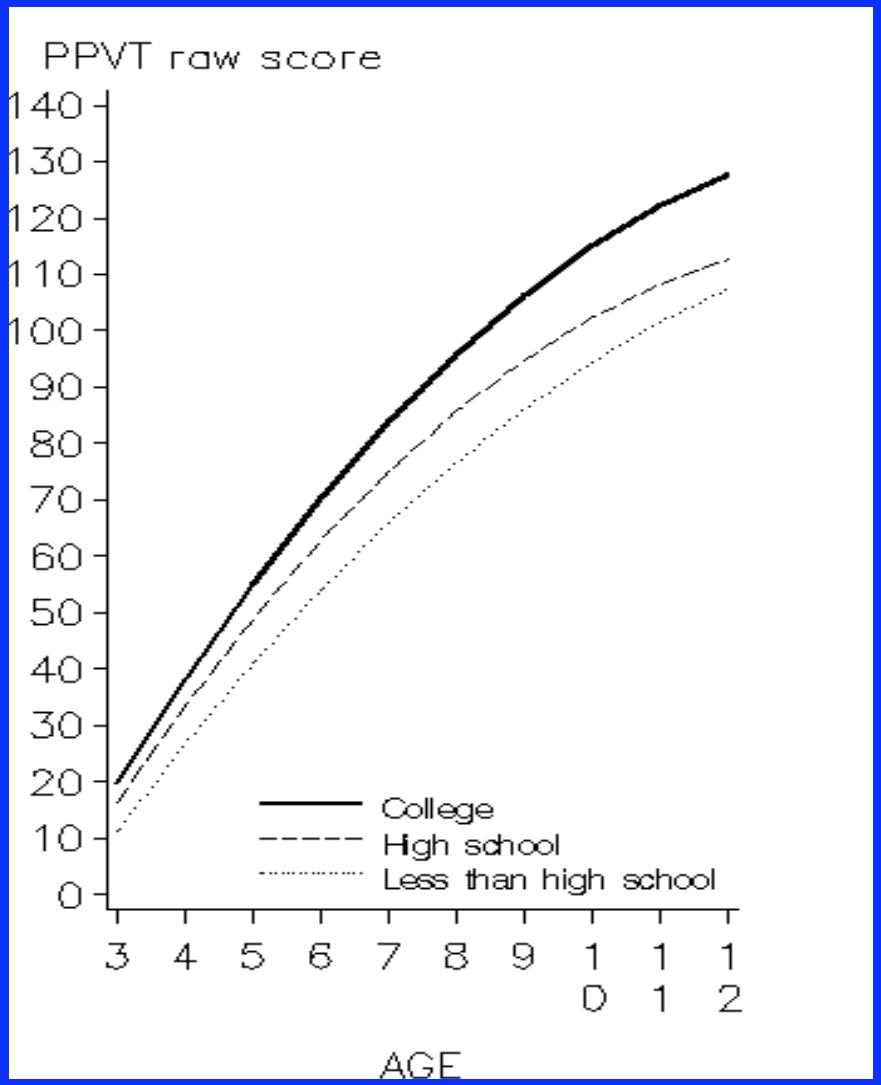
Improving PPVT Scores from 3 to 12 years
Evidence for recovery with increasing age ?



Raw Scores on PPVT from 3-12 y Indomethacin cohort

Luu et al SPR 2008





Study 1:
The Very Low Birth Weight Infant

- Low birth weight infants < 1250 grams cared for in the NICU at WIH are participating in a longitudinal study of the effects of language and sound exposure at 32 and 36 weeks of gestation in the NICU on infant vocalizations and language development
- Language development will be assessed to 18 months corrected age
- There have not been prior studies of immature preterm infants prior to their due date

Study 2:
Late Preterm Infants

- Late preterm infants born at 34-36 weeks gestation are the largest and fastest growing subgroup of preterm infants in the United States
- The substantial increase in the rate of late preterm births is the primary factor for a rising incidence of prematurity in the U.S.
- Although late preterm infants account for more than 70% of all premature births, the majority of research has focused on extremely low birth weight and very preterm infants

Study 2:
Late Preterm Infants

- There is limited data on neurodevelopmental outcome of late preterm infants including language development

- This study will examine the effects of language and sound exposure for the late preterm and term infant at birth and 44 weeks and subsequent language development

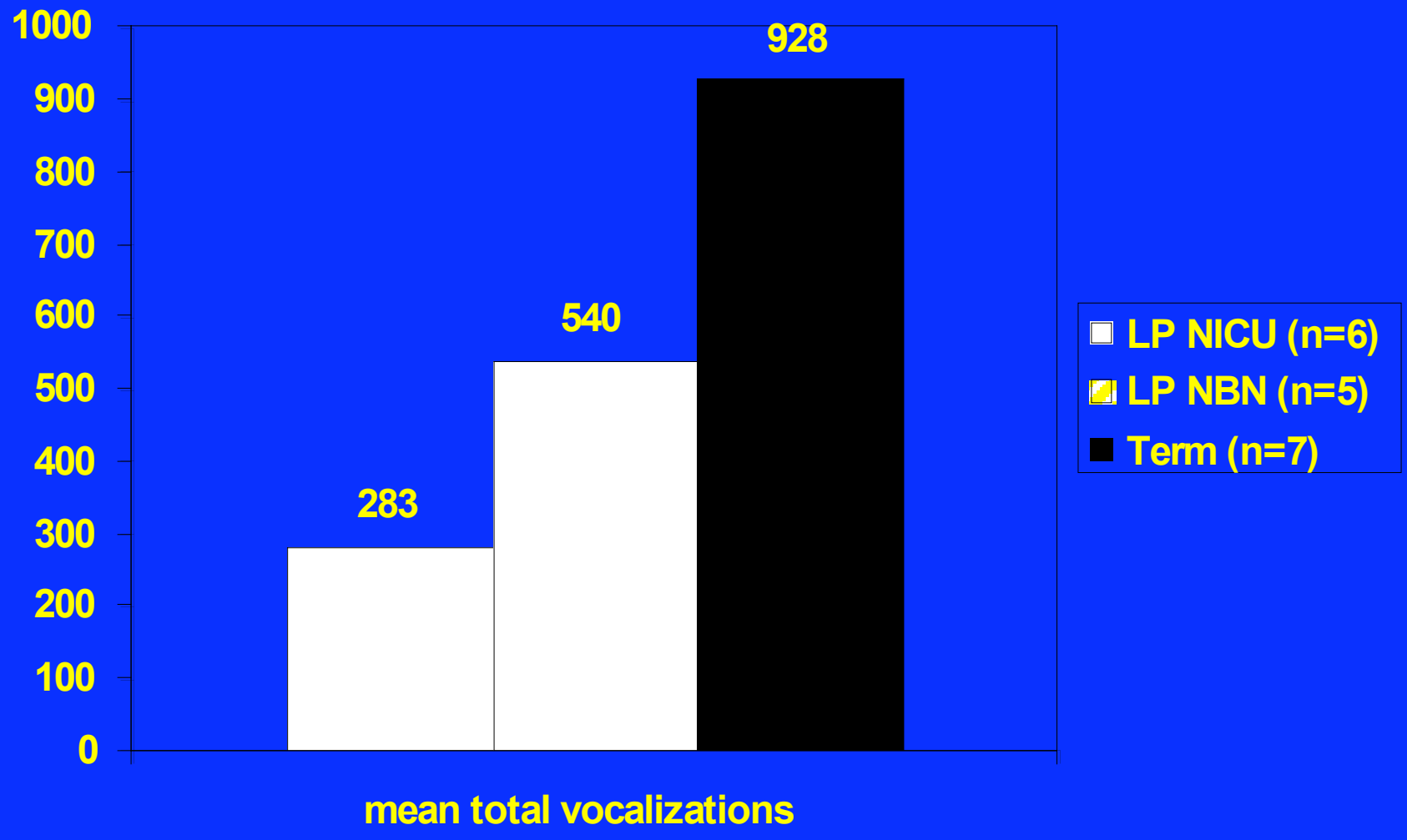
Late Preterm Methods

- Study Groups:
  - Late Preterm NICU;
  - Late Preterm Well Baby;
  - Term Infants
- Recordings are performed in the NICU or newborn nursery prior to discharge, at 44 weeks post conceptual age (PCA), 7 months corrected age, and 18 months corrected age for the 3 groups

Late Preterm Methods

- The results from these recording samples will then be compared to language scores on the Bayley Scales of Infant Development III, which will be performed at 7 months and 18 months corrected age
- It is hypothesized that late preterm infants, a group at risk for neurodevelopmental impairment, will have lower rates of infant vocalization and lower language scores at 7 and 18 months corrected age compared to term controls
- It is hypothesized that there will be a positive relationship between the rate of infant vocalization, adult word counts, and conversation turns and language scores at 7 and 18 months

Child vocalizations during newborn recording



Johnson et al

Study 3: Longitudinal Assessment of Children with Hearing Loss

- Infants with congenital hearing loss (HL) identified late are at increased risk of:
  - language,
  - cognitive,
  - behavior, and
  - academic delays

Study 3: Longitudinal Assessment of Children with Hearing Loss

- This is a prospective study of the language outcomes of infants identified in the RI newborn hearing screening program who were born between 10/15/02 and 1/31/05
- The cohort consists of infants screened in either the NICU or well baby nursery and diagnosed with congenital HL and matched hearing controls who passed the newborn screen
- The children have been followed prospectively to 6 years of age and we are obtaining 16 hour LENA recordings in conjunction with comprehensive 6 year cognitive and language assessments on the children with HL and controls

Hypotheses for Ages 5 and 6

- Children with bilateral moderate, severe, or profound HL will have lower language and adaptive scores than children with mild or unilateral HL and children with typical hearing

- Children with moderate, severe, or profound HL will receive more IEP services than children with mild or unilateral HL or hearing children

Hypotheses

- Children with bilateral moderate, severe, or profound HL will have↓ vocalizations, ↓ reciprocal vocalizations and ↓ MLU with LENA
- MLU on LENA will be correlated with language scores
- Among both HL and hearing controls, ↑ adult language will be associated with ↑ child conversational turns

Reynell Scores at 3-5 Years of Age

Hearing Status (N)	Mod-Pro (19)	Mild/Uni (10)	Hearing (74)	p
Age at Test (Months)	62.5±10	62.3±12	60.4±9.7	.6609
<u>Verbal Comprehension</u>				
Standard Score (M±SD)	72±17*+	81±22*	95±15	.0001
Standard Score < 70	13(68%)	4(40%)	5(7%)	.0001
Test Age Equivalent	38±15*	46±17*	53±10	.0001
<u>Expressive Language</u>				
Standard Score (M±SD)	81±17*	86±16*	97±16	.0002
Standard Score < 70	8(42%)	3(20%)	6(8%)	.001

*[1] Test score for older age used * vs Hearing + vs Moderate-Profound*

Average Test Score=100 1SD=85 2SD=70

Services at 3-5 Years of Age

Services	Mod-Pro (19)	Mild/Uni (10)	Hearing (74)
Early Intervention	19(100%)	8(80%)	24(32%)
Family Guidance	17(89)	6(60)	2(3)
Physical Therapy	13(68)	4(40)	15(20)
Occupational Therapy	8(42)	5(50)	15(20)
Speech/Language	18(95)*	6(60)	22(30)
VNA Services	8(42)	1(10)	5(7)
Any Services	19(100)	8(80)	27(36)

**ASL*

6 Year Assessment of HL Cohort

- K-ABC non-verbal subtest
- Woodcock Johnson Reading Mastery Test
- Reynell Developmental Language Scales
- Child Behavior Checklist
- LENA 16 hour recordings
- Vineland Adaptive Behavior Scales
- Parent reports

Summary

We are in the early phases of our studies preliminary data on VLBW Cohort will be presented by Melinda Caskey, MD