

Sound beginnings: Variables affecting speech directed to infants and toddlers with auditory impairment in English- and Spanish-speaking families



Helen Morrison, PhD., LSLS Cert.-AVT¹, Donna Kramer, M.Ed.², Dolores Lasswell, M.Ed.², Lisa Lopez, M.A., LSLS Cert.-AVT², Lindsay Rodriguez, M.Ed.², Adrienne Russell, M.Ed., LSLS Cert.-AVEd., Julie Sill, M.DEHS² ¹Texas Christian University; ²Sunshine Cottage School for Deaf Children

Introduction

This study investigates the use of LENA measures in describing the participants and outcomes of a parent-infant program for children with hearing loss, Sunshine Cottage School for Deaf Children, Sunshine Cottage supports families and children from San Antonio and South Texas. Infants enrolled in the Sunshine Cottage Parent-Infant program present with hearing losses or auditory dysynchrony/neuropathy that range from mild through profound. A substantial number of families in the program speak Spanish as their primary language or speak both Spanish and English in the home.

The LENA system offers several advantages for use with infants and toddlers with hearing loss. Not only do LENA measures describe the frequency of vocal input to infants and their own vocal behavior. Aspects of the acoustic environment that are crucial to access to spoken language can be discovered as well

Four questions were posed:

- 1. Does degree of hearing loss impact LENA measures?
- 2. Does the language in the home impact LENA measures?
- 3. What is the acoustic environment in the lives of infants and toddlers with
- hearing loss? 4. How to LENA measures obtained from infants and toddlers with hearing loss compare to those obtained from typically developing infants'

Method

PARTICIPANTS



| | | | Hearing Technology Home Language | | | | uage | |
|-----------------|----|-----------------------------|----------------------------------|------|------------------------|---------|----------------------|---------|
| Hearing Loss | n | Mean Chron. Age (mos) | Hearing Aid(s) | BAHA | Cochlear Implant(s) | English | English + Spanish | Spanish |
| Mild | 7 | 17.9 | 7 | | | 5 | 2 | |
| Moderate | 10 | 20.1 | 7 | 3 | | 6 | 4 | |
| Mod- Severe | 8 | 21.2 | 7 | 1 | | 5 | 2 | 1 |
| Severe | 10 | 20.2 | 5 | 1 | 3 | 4 | 5 | |
| Profound | 14 | 23.6 | 2 | 1 | 11 | 10 | 3 | 1 |
| Group | 48 | 21.0 | 28 | 6 | 14 | 30 | 16 | 2 |

DATA COLLECTION

DLPs were provided to families who were instructed how to put the recorder on their infant and how to turn on the device. Recordings that were at least 10 hours in duration were used for data analysis. Parents completed the LENA Developmental Snapshot via interview with their Parent Advisor at the time of DLP recordings

DATA ANALYSIS

The following variables were extracted via LENA analysis and analyzed:

| Category | Measure | Measurement | Abbreviation | |
|-----------------------|--|--|---------------|--|
| | Meaningful Speech | | PCTMeaningful | |
| Assurable Condensated | Distant Speech | % of total duration | PCTDistant | |
| Acoustic Environment | Electronic Sources | | PCTElectr | |
| | Silence | | PCTSlience | |
| | Adult Words | Counts projected for a 12-hour | AWCProj | |
| Vocal Counts | Conversational Turns | | CTCProj | |
| | Child Vocalizations | duration recording | CVCProj | |
| | Adult Word Percentiles | Referenced to | AWCPctile | |
| Veeel Descentiles | Conversational Turn Percentiles | typically | CTCPctile | |
| vocal Percentiles | Child Vocalization Percentiles | of equal age | CVCPctile | |
| | Automatic Vocalization Analysis Estimated Developmental Age | Age equivalencies | AVADevtlAge | |
| Developmental Status | LENA Snapshot Developmental Age | referenced to typically developing infants | SnpshtDevAge | |

Results

EFFECTS OF DEGREE OF HEARING LOSS AND HOME LANGUAGE

A two-way MANOVA was performed to test the separate and combined effects of degree of hearing loss & home language on the acoustic environment, vocal counts, and developmental measures. Chronological age was included as a covariate. An alpha level of .05 was used as the criterion for statistical significance.

Only 2 out of 48 families reported that they used Spanish only in the home. The Spanish-only families were combined with families who reported that they spoke only English in the home to create 2 home language groups: monolinguals and bilinguals

There was no statistically significant effect of degree of hearing loss or home language on measures of the acoustic environment or vocal counts.

Due to the absence of significant difference between groups by degree of hearing loss or home language, the full participant sample was combined for subsequent analysis.

ACOUSTIC ENVIRONMENT

The following histograms display the frequencies of duration of each acoustic environment as



(1) a clustering in the distribution of electronic background in shorter durations and (2) outliers appearing at longer durations of electronic source, noise and silent episodes

COMPARISON TO TYPICALLY DEVELOPING INFANTS: VOCAL COUNT

The histograms to the right display frequencies of occurrence for percentile rankings of adult words, conversational turns, and child

The mean percentile rankings of Adult Word Counts, Conversational Turns, and Child Vocalizations were slightly above the 50th percentile for typically developing infants.

Just over one-third of the sample produced Adult Words (35.42%) and Conversational Turns (37.50) at a rate that was at or above the 80th percentile for families of typically developing children.

The distribution of Child Vocalizations was bi-modal, with 62.5% of the distribution clustering at the highest and lowest 20th percentiles. 37.5% of the infants produced vocalizations at rate that placed them at or above the 80th percentile. 25.0% of the infants produced vocalizations that placed them in the 20th percentile





DEVELOPMENTAL MEASURES

The figures to the left display frequencies of occurrence of chronological ages, LENA Developmental Snapshot ages, and Automatic Vocalization Analysis Estimated Developmental ages (AVA), plotted in months. The mean Snapshot and AVA age equivalencies lag behind the mean chronological age. The mea AVA age lags behind the mean Snapshot developmental age by 4.35 months.

The scatterplot below displays the relationship between Snapshot and AVA age equivalencies across infant chronological age. AVA age remains higher than the Snapshot Developmental across ages. The scapes of the trend lines are almost distincial. 0.70 for the Developmental Snapshot and 0.76 for AVA. This suggests that although each measure predicts different developmental levels, rate of change over time is equivalent.



CONCLUSIONS: Variations in degree of hearing loss did not create differences in vocal interactions as measured by LENA. Nor did the condition of bilingual input in the ambient land

Individual variations were noted in the extent to which families managed the acoustic environment, with a few families living with more extensive periods of background electronic sources, noise or even silence than others in the ample

When LEMA measures were compared to values obtained from hybridally evenloping children and their families, 2 findings were obtained. - Parents and coegnetwork tender to supply high naides of prot of the and is a negated. - Infrants, however, were neared or supply in valuation tends in a near and which that was present that he supply and by the set of their tends are substantial proportion of families whose rate of input fell within the upper 20th percentile. This trand was also reflected in the rate of conversational turns that paenes megaded. - Infrants, however, enconstrated variability in valuation tends. Some vocalized at rates high tert than or equivalent to their hearing peens, commensurate with other reports of equal volubility among infrants with hearing loss and their hybridally developing peers. - Still other infrants vocalized at all and hower rate, possibly indicating a risk for slow development of spoken language.

ntal measures indicated that infants with hearing loss lagged behind hearing peers in vocal behavior. Discrepancy was observed in the extent of delay as measured by the AVA Estimated Age and LENA Snapshot

FUTURE DIRECTIONS: The individual variations observed will be analyzed ruther in order to identify factors that greated thigh variants and the variants of the variants and the variants of the variants and the variants of the variants variety of vocal types that are coded by the LENA algorithm as being typical when they are not.