An Analysis of the Natural Language Environments of Children with Hearing Loss: The Impact of Home Language & Maternal Education Level

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Purpose

To investigate of the impact of home language & maternal education on adult-infant interaction in the natural language environments of monolingual English-speaking & bilingual Spanish/English-speaking families who have children with hearing loss (CWHL).

Introduction

The number of adult words a child hears from 0 - 3 years is related to increased vocabulary growth, IQ test scores, & academic success (Hart & Risley, 1995), in addition, predicts language ability & conversational interactions later in life (Gilkerson & Richards, 2000a, 2008b).

Home Language

The fastest growing minority group in the US is Spanish speakers (Ramirez & de la Cruz, 2003). According to the US Census Bureau (2006), 14.8% of the population is Hispanic & that number is projected to be 24.4% of the population by 2050. With a growing number of culturally diverse families in the US, linguistic diversity & bilingualism are common features that arise within these households.

Maternal Education

Socioeconomic status (SES) has been shown to be the strongest influence on the amount of talking that goes on in families (Hart & Risley, 1995). Higher levels of maternal education and higher SES promote increased achievement & development for children (Auerbach, Lerner, Barasche, & Palti, 1992).

Children with Hearing Loss (CWHL)

Children with hearing loss are now identified & receive hearing technology at ages that permit auditory brain development & spoken language close to typically developing children. In addition, a growing number of Spanish speaking families have CWHL (GRI, 2008). Important developments to consider are the decrease in age of CWHL receiving intervention & these changes in demographics of families.

Research Questions

(1)What is the effect of home language on adult words & adult-infant interactions?
(2)What is the effect of maternal education on adult words & adult-infant interactions?
(3)What is the combined effect of home language & maternal education on adult words & adult-infant interactions?

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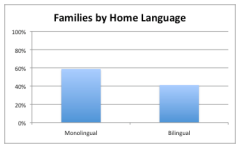
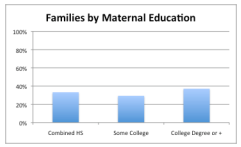
Methodology

I. Participants

Participants included 51 infants with hearing loss & their families from San Antonio, Texas who are enrolled in the Sunshine Cottage School for Deaf Children, Birth to Three Parent-Infant Program.

A. Families

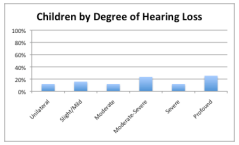




B. Child Characteristics

The following child characteristics can impact parent-child interaction & were included in the participant descriptions.

Degree of Hearing Loss



Chronological Age (CA) - The children ranged in age from 5 - 40 months, with a mean age of 19.65 months.

Hearing Age (HA) - Hearing age is the duration of technology use. The children's hearing age ranged from 1 - 31 months, with a mean hearing age of 10.14 months.

Developmental Age (DA) - The LENA Developmental Snapshot (LDS) was used to measure developmental age (Gilkerson & Richards, 2008c). Children's developmental age ranged from 2 - 38 months, with a mean developmental age of 13.67 months.

Other Health Impairments (OHIs) 25.5% of the 51 CWHL had other health impairments that can affect development beyond the impact of hearing loss.

II. Data Collection & Extraction

Data was collected with Language ENvironmental Analysis (LENA) Digital Processors (DLP). The LENA DLP is a small recording device worn on the child that can record up to 16 hours.

Speech recognition software analyzed the recordings to yield counts of utterances:

- *Adult Word Counts (AWC)* measured the number of adult words spoken in the child's environment (Gilkerson & Richards 2008a).
- *Conversational Turn Counts (CTC)* measured the number adult-child alternations per day that occurred within a 5-second interval (Gilkerson & Richards 2008a).
- *Percentile rankings of AWC & CTC* compared the data with norms that included families with children of equivalent ages.

III. Variables Summary

Independent variables: Home language & maternal education level.
Dependent variables: Adult word count & conversational turn count percentile measures.

Results

1: What is the effect of home language on adult words & adult-infant interactions?

Child Characteristics:
Hearing loss categories were fairly evenly distributed across family language groups.

MANOVA conducted to test for differences between home language groups by CA, HA, & DA obtained no significant differences suggesting that groups were homogenous with regard to age measures.

Dependent Variables: AWC & CTC percentiles
MANOVA was conducted to test for differences between home language groups on AWC & CTC percentile measures obtained no significant differences.

2: What is the effect of maternal education on adult words & adult-infant interactions?

Child Characteristics:
Hearing loss categories were fairly evenly distributed across maternal education groups.

MANOVA testing for group differences by age measures obtained significant differences between groups by HA & DA ($p = 0.05$). Post hoc testing obtained the following significant differences between maternal education groups:

Dependent Variable	Independent Variable	Comparison	Mean Difference	Significance
Hearing Age	College or Higher	Combined HS	6.51	*0.03
	Combined HS	Some College	-7.02	*0.03
Developmental Age	College or Higher	Combined HS	7.99	**0.01
				* $p = 0.05$
				** $p = 0.01$

Dependent Variables: AWC & CTC percentiles
MANOVA testing for group differences by AWC & CTC obtained a *slightly* significant difference for CTC ($p = 0.10$). Post hoc testing obtained the following significant differences between maternal education groups:

Dependent Variable	Independent Variable	Comparison	Mean Difference	Significance
CTC	College Degree or Higher	Combined HS	22.87	*.050
				* $p = 0.05$

3: What is the combined effect of home language and maternal education on adult words & adult-infant interactions?

MANOVA testing for the combined effect of home language & maternal education on AWC & CTC percentile measures obtained no significant differences on either measure at neither the 0.01 nor 0.05 probability levels.

Discussion & Conclusions

I. Summary

- Results indicated no significant differences among child characteristics, adult words, & adult-infant interaction measures between home languages.
- There were no significant differences for maternal education along AWC measures. There was a slightly significant impact of maternal education on CTC percentile measures when comparing College Degree or Higher with Combined HS groups. Significant differences were found among lower maternal education groups for lower HAs & DAs.
- Results showed no significant differences for the combined effect of home language & maternal education on AWC and CTC percentile measures.

II. Limitations

- The level of bilingual proficiency of families & percentages of languages used in the samples were not specified, which could influence AWC & CTC measures.
- AWC & CTC measures may be language dependent. Validity & reliability research studies were done with LENA data to obtain a normative sample with typically developing children with participants from English-speaking households only.
- LENA devices recorded not only the mother's words & mother-infant interactions in the environment, but all adult words in close range & any adult-child alternations throughout the day. Maternal education level may have no direct correlation with AWC & CTC measures.
- Yoshinaga-Itano & Gilkerson (2010) found that maternal education level began impacting language outcomes for CWHL at 84 months of age. Participants in this study were in a 0 - 3 parent-infant program & only ranged from 5 - 40 months of age.
- This study relied on software for analysis of AWC & CTC percentile measures & did not validate findings through handwritten transcription.
- When groups were categorized into 2 languages, & 3 education levels, group numbers became smaller, thus, the study had a limited sample size.

III. Clinical Implications

- This study supports interventionists working with CWHL from monolingual & bilingual families to encourage the use of home languages, advocate for early identification & amplification, & implement parent training & coaching strategies to facilitate listening & spoken language development.
- In addition, there is an overwhelming need for skilled interventionists & more research with this specific population of culturally & linguistically diverse CWHL.
- Future research will need to replicate & expand the small number of recent findings.