Impact of Language Underperformance on Communication and Social Functioning in Young Children who are Deaf or Hard of Hearing

Jareen Meinzen-Derr, Sandra Grether, Rosie McAuley, Laura Smith, Susan Wiley

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Background

• Hearing loss influences all aspects of child’s language acquisition
  – High risk for language delays

• Early intervention provides opportunities to attain appropriate language and vocabulary development
Persistent language delays continue

- Unfortunately, many continue to fall short of age- and cognitively appropriate levels

- Even minor lags in early language – at risk
  - Average and low average language not good enough
  - Long term consequences

- Gaps widen with age – irrespective of hearing loss levels

Tomblin, 2015; Nittrouer 2014, 2016; Meinzen-Derr, 2014
Luckner 2005; Traxler, 2000
Importance of social functioning

• Ability of a person to interact easily and successfully with others
  – Important for independent functioning

• Plays significant role in emotional, behavioral development, and academic skills

Kaczmarek, 2002; Deater-Deckard, 2001; McElwain, 2005
Functional impact of language delays

• Language is a primary human function
  – Gateway to social functioning

• Language abilities can facilitate (or hinder) social interactions & functioning

• DHH at risk for poorer social-emotional, academic outcomes
  – Language deficits magnify risk

Study Aim

• Investigate relationship between language underperformance and functional skills (in children <48 months of age who are deaf or hard of hearing (DHH))

• *Focused on social and communication functioning*

Meinzen-Derr 2014; Wiley 2012;
Theoretical framework for research

- Comprehension
  - Neurocognitive domains
  - Executive functioning
- Language skills
  - Language consistent with nonverbal cognitive abilities
- Functional abilities
  - Communication
  - Social functioning

Language Interventions
- TALI Program vs. Standard Care

Academics
- Literacy

Maximizing Independence

New studies

Current studies

Potential long term outcomes
Theoretical framework for research

Kiessling 2003; Sweetow 2004; Thelen 1994 & 2005
Study Design

• Language and Independent Functional Expectations (LIFE)
  • Longitudinal study
  • 0-6 years at first visit
  • Annual visits for up to 3 years

• Current analysis focused on cross-sectional data (first visit)
Study Participants

• Inclusion
  – 0-6 years
  – Permanent bilateral hearing loss (any degree)
  – Nonverbal IQ (NVIQ) >40

• Exclusion
  – Unilateral hearing loss
  – Significant communication disorders (i.e., ASD)

• 147 enrolled to date: 77 <48 months
Assessment Tools

• Language Assessment:
  – Preschool Language Scales -5
    • Standard scores, age equivalents

• Cognitive Assessment (nonverbal):
  – Leiter International Performance Scale-R
    • Brief-IQ
  – Mullen Scales of Early Learning
    • Visual Reception Scale
Assessment Tools

- Behavioral Assessments – parent report
  - Behavioral Rating Inventory of Executive Function
    - Working memory
  - Child Behavior Checklist
    - Internalizing and externalizing behaviors

- Functional Assessment
  - Vineland Adaptive Behavior Scales
  - Pediatric Evaluation of Disability Inventory
Outcome Measure
Vineland Adaptive Behavior Scales

• Reflects the individual’s personal and social skills as he/she interacts with environment
  – 383 items
  – Communication, Daily living skills, socialization, motor skills
  – Standard scores (mean 100+15)

• Can measure adaptive behavior in different subgroups
Outcome Measure
Pediatric Evaluation of Disability Inventory

• Comprehensive standardized measure of essential daily functional activities
  – 197 discrete functional skill items
  – Self-care, mobility, social function
  – Standard (mean 50±10) and Scaled Scores

• Useful in treatment planning and identifying specific areas where assistance is needed

• Aligned with the International Classification of Functioning, Disability, and Health in children and youth
Language Performance

Quantified as language abilities relative to cognitive abilities

Receptive Language standard score
Nonverbal IQ standard score

LANGUAGE = 85
IQ = 100

>35% have ratio <85

Research in Developmental Disabilities 32 (2011) 757–767

(J Dev Behav Pediatr 35:197–206, 2014)
<table>
<thead>
<tr>
<th>Characteristic of participants</th>
<th>N=77</th>
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<tbody>
<tr>
<td>Mean Age at study (mos)</td>
<td>33 (11.5)</td>
</tr>
<tr>
<td>Mean Age at HL identification (mos)</td>
<td>7.9 (10.6)</td>
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<tr>
<td></td>
<td>Median 2</td>
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<tr>
<td>Male</td>
<td>54.6%</td>
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<tr>
<td>Caucasian</td>
<td>86%</td>
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<tr>
<td>Born premature</td>
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<tr>
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<td>59.7%</td>
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<tr>
<td>Received a cochlear implant</td>
<td>27%</td>
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<tr>
<td>Maternal education</td>
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<td>16%</td>
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<tr>
<td>Some college</td>
<td>18.7%</td>
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<tr>
<td>College graduate</td>
<td>29.3%</td>
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<tr>
<td>Post college</td>
<td>36%</td>
</tr>
<tr>
<td>Public health insurance only</td>
<td>32.4%</td>
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<tr>
<td>Income at or below poverty level</td>
<td>19.5%</td>
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</table>
Cognitive and Language Levels

Standard Scores

Nonverbal IQ: 110 ± 10
Receptive SS: 90 ± 10
Expressive SS: 90 ± 10

p<0.0001
Compared to standard norms

- Communication
- Social
- Either Comm or Social

1 SD below
- Communication: 40%
- Social: 35%
- Either Comm or Social: 45%

2 SD below
- Communication: 20%
- Social: 15%
- Either Comm or Social: 25%
Among those with NVIQ >100

Communication  Social  Either Comm or Social

1 SD below

2 SD below
Language scores decrease with age

$r = -0.17; p = 0.14$
Social functioning decreases with age

As children get older, the effects on social functioning increase

$r = -0.31; p = 0.008$
NVIQ stable across age

$r = 0.4; p = 0.74$
Language and functioning

45%

Better Language

Better function

Communication; $r = 0.73$

Social Function; $r = 0.63$

Receptive Language Standard Score

Standard Scores

30 40 50 60 70 80 90 100 110 120 130 140 150 160

50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Commensurate language and functioning

Commensurate Language

Better function

36%

Communication; \(r=0.35, p=0.002\)

Social Function; \(r=0.32, p=0.006\)
Impact of low language on social functioning

Controlling for age study, HL severity, age HL identification, SES

p=0.002
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<td>Age at study (mos)</td>
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<td>32.3</td>
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<td>77%</td>
<td>91.1%</td>
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<td>Mild to moderate HL</td>
<td>44.4%</td>
<td>67.4%</td>
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<tr>
<td>NVIQ</td>
<td>106.8</td>
<td>91.9</td>
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<td>NVIQ &lt;80</td>
<td>0</td>
<td>26.5%</td>
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<tr>
<td>Receptive Language scores</td>
<td>75.4</td>
<td>92.8</td>
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<td>Expressive Language scores</td>
<td>80.3</td>
<td>93.7</td>
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Summary

• Language underperformance negatively impacts social and communication skills in children who are DHH
  – language levels not commensurate with their cognitive abilities

• Occurs at very young ages, across all levels of ability and degrees of hearing loss
Summary

• Social functioning appears to worsen with age
  – Perhaps due to persistent or widening gaps in language

• Children with language underperformance appear to have on average higher NVIQ, but lower SES markers

• Even if language levels are in average range, if not meeting cognitive potential, impacts other outcomes
Implications and future directions

• Longer term implications for behavior (see Bonfield poster) and academic outcomes

• Social functioning should be incorporated as regular assessments as early as possible
  – Functional assessments take a whole child approach and can provide specific areas to target for intervention purposes
Implications and future directions

• Consider aggressive adjustments to current EI strategies when kids perform below cognitive potential
  – Early recognition of slower trajectories is critical
  – Requires understanding of cognitive abilities

• Current interventions slow to introduce innovative models
  – Gap in knowledge about evidence-based approaches for DHH

• Novel approaches to learning language should be considered in future research
Thank you

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Susan Wiley, MD
Meredith Will, PhD
UCEDD LEND
Participating Families

Questions?
EXTRAS
Communication strategies

- Oral: 90%
- Sign: 50%
- Behavior: 40%
- 1 strategy: 30%
- 2 strat.: 20%
- 3 strat.: 10%
Mastery of skills - example

21. Tries to show you the problem or communicate what is needed to help the problem.
22. If upset because of a problem, child must be helped immediately or behavior deteriorates.
23. If upset because of a problem, child can seek help and wait if it is delayed a short time.
24. In ordinary situations, child can describe the problem and his/her feelings with some detail (usually does not act out).
25. Faced with an ordinary problem, child can join adult in working out a solution.
Mastery of skills - example

G. Peer Interactions: (Child of similar age)

31. Notices presence of other children, may vocalize and gesture toward peers
32. Interacts with other children in simple and brief episodes
33. Tries to work out simple plans for a play activity with another child
34. Plans and carries out cooperative activity with other children; play is sustained and complex
35. Plays activities or games that have rules
VABS Communication Domain

- Smiles when you smile at him or her
- Makes sounds of pleasure
- Makes sounds or gestures to keep activity going or to stop it
- Names objects
- Asks who what why questions
- Tells about experiences in simple sentences
- Recognizes name in printed form
- Identifies printed letters
Social Function Domain

- Comprehension Word Meanings
- Comprehension of Sentence Complexity
- Functional Use of Communication
- Complexity of Expressive Communication
- Problem-resolution
- Social Interactive Play (adults)
- Peer Interaction (child of similar age)
- Play with Objects
- Self-Information
- Time Orientation
- Household Chores
- Self-Protection
- Community Function
Impact of low language communication function

Controlling for SES, HL severity, age HL identification