Hearing Loss and Beyond

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01/18/2019
Disclosures

- AG Bell Board of Directors
- MED-EL Pediatric Advisory Board
- Research agreement - Advanced Bionics
- Research funded by:
  - NIDCD R01 DC04797
  - NIDCD R03 DC014760
  - NIDCD R21 DC016265
- Speaker Honorarium AAA & ASHA
- Consultant for Cochlear
Learning Objectives

• Develop an understanding of learning challenges that co-occur with hearing loss
• Define executive function & how EF skills are critical for child learning
• Learn to promote the development of executive function skills
• Identify foundational strengths and weaknesses for reading and math skills in children with learning disabilities
• Understand how reading and math challenges manifest as a secondary disability for students who are deaf/hard of hearing
• Describe formative assessments in the areas of reading and math
• Apply knowledge of EF, LD, and learning challenges to the development of an Individualized Educational Plan
DHH Population

• It is estimated that 1/3 to 1/2 of DHH children have an additional diagnosis (Knoors & Marschark, 2014)
  – Genetic conditions
  – Developmental delays
  – Social or behavioral disorders
  – Learning difficulties
# Common Comorbidities in Children with Hearing Loss

<table>
<thead>
<tr>
<th>Name</th>
<th>Prevalence in All Children</th>
<th>Prevalence of Hearing Loss in Children with Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autism Spectrum Disorder</td>
<td>One per 68</td>
<td>1-6%; as high as 35% in severe to profound HL</td>
</tr>
<tr>
<td>Developmental Delay</td>
<td>One per 6</td>
<td>10.2%</td>
</tr>
<tr>
<td>CHARGE Syndrome</td>
<td>One per 9-10,000</td>
<td>24-28% have severe to profound hearing loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75% have some degree of hearing loss</td>
</tr>
<tr>
<td>Cerebral Palsy</td>
<td>One per 323</td>
<td>12-25%</td>
</tr>
<tr>
<td>Usher Syndrome</td>
<td>10 per 100,000</td>
<td>100%</td>
</tr>
<tr>
<td>Waardenburg Syndrome</td>
<td>One per 42,000</td>
<td>35-78% with WS I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55-91% with WS II</td>
</tr>
<tr>
<td>ADHD</td>
<td>50-150 per 1,000</td>
<td>5.4-11.8%</td>
</tr>
<tr>
<td>Learning Disorder</td>
<td>50-150 per 1,000</td>
<td>3-60%</td>
</tr>
</tbody>
</table>
Reading Outcomes

• Average deaf learner graduates from high school with a reading comprehension level at about a 3rd or 4th grade level

• Mean vocabulary is below average when compared with hearing peers (De Diego-Lazaro, D., Restrepo, M.A., & Yoshingaga-Itano, C. (2018)
  – Children who received intervention by 6 months had significantly higher vocabulary than children who started intervention later
Reading Outcomes & Cochlear Implants

- Children with cochlear implants are often reported as having better literacy outcomes than deaf children without implants (Knoors & Marschark, 2019)
- Long-term CI users have better reading comprehension and word recognition,
  - About half of the CI sample falling in the average range or higher (Geers & Hayes, 2011)
- Academically, adolescents who used CIs for ≥10 years have shown performance on written expression and phonological processing tasks that is well below that of their peers
Math Outcomes

• 50% of DHH students scored “basic” or “below basic” on math subtest of Stanford Achievement Test (Traxler, 2000)

• Of 23 studies on DHH student’s math performance, most studies found a 1 to 4 year delay compared to hearing peers (Gottardis, Nunes & Lunt, 2011)

• “DHH students have been found to have difficulty with number comparisons, calculation, rote counting, number facts, numeral literacy, mathematical concepts, measurement, story problems, multiplication and fractions” (Knoors & Marshark, 2019).
Higher Education

- 2010 US Census reported that 16% of DHH people ages 25-59 obtained a bachelors degree or higher compared to 30% of the entire US population.
Career Attainment of DHH College Graduates

- Of 195 employed respondents, 70 different occupations were reported

Table 5
Respondents's Occupations, by Hearing Status (by Percentage)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Deaf</th>
<th>Hard of hearing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional, managerial, technical</td>
<td>62.4</td>
<td>38.5</td>
<td>55.5</td>
</tr>
<tr>
<td>Clerical</td>
<td>23.8</td>
<td>25.0</td>
<td>24.2</td>
</tr>
<tr>
<td>Crafts, labor, machine operation</td>
<td>13.8</td>
<td>36.5</td>
<td>20.3</td>
</tr>
<tr>
<td>N</td>
<td>130</td>
<td>52</td>
<td>182</td>
</tr>
</tbody>
</table>

Note: Boldfacing highlights particularly significant findings.

IQ in DHH Students

• In over 50 years of research comparing IQ of typical hearing and DHH children, it was found that DHH children’s IQ is approximately the same as typical hearing children (Vernon, M., 2005).

• When looking at children with CIs, the same results were found (Cejas, Mitchell, Hoffman, Quittner, & CDaCI Investigative Team, 2018).
When a child with hearing loss is not making “appropriate” progress

1. Has the child had a change in his/her hearing loss?
   - Yes: Return to managing audiologist for evaluation, adjustment of amplification
   - Unsure: Return to managing audiologist for repeat hearing test and evaluation of effectiveness of amplification
   - No: No change in hearing; no changes in amplification needed

2. Is the intervention appropriate to the child’s strengths, needs, and community resources?
   - No: Change in management occurred
   - Yes: Consider discussion with family and providers about change in intervention strategies

3. Has the family been able to access interventions and appointments effectively?
   - No: Assess barriers to care, address family needs, implement coaching strategies by early intervention providers, therapists
   - Yes: Provide input to IFSP or IEP team; Are there ways that the intervention program can be altered and monitored to influence child’s progress? Request regular updates.

4. Does the child have risk factors or evidence of other developmental or behavioral issues which could impact language progress?
   - No: Re-evaluate progress after change in interventions
   - Yes: Refer to developmental pediatrician, broader intervention services such as physical therapy, occupational therapy, behavioral psychologist

Do they have appropriate access?

Are they receiving sufficient intervention?

Are they following through with recommendations?

Do they have other learning challenges?
- Behavioral/social
- Executive function
- Learning disability
Behavior Regulation

• Externalizing & internalizing behavior problems are consistent risk factors for future behavior, school and social difficulties

• Prevalence of Internalizing behavior problems:
  – Children with hearing loss: 24.6% to 38%
  – Hearing Children: 2 to 17%

• Prevalence of Externalizing behavior problems:
  – Children with hearing loss: 11.6% to 44%
  – Hearing Children: 3 to 18%

• Strong evidence that behavior problems, language and cognitive abilities are related

Barker, et al., 2009; Mitchell & Quittner, 1996; Van Eldik, et al., 2004
Attention Difficulties in Children With Hearing Loss

• Visual Attention
  – Despite the visual system developing normally, children with hearing loss still experience problems with their visual attention
  – Younger children with CI’s tend to “catch up” to their hearing peers

• Joint Engagement
  – By 36 months and older, normal hearing children spent about 93% of their time in symbol-infused joint engagement
  – Deaf children only spent about 34% of time in this state

Behavior and Social Skills

• Social skills and behavior problems are related (Montroy, Bowles, Skibbe, Foster, 2014)
  – Impact self-regulation and literacy

• Self-regulation is the foundation in which children learn to interact with others learning
Social Competence

- Social competence has been defined as a construct with several sub-domains
  - Social adjustment
  - Social skills
  - Social performance
- **Social skills** are the tools that enable people to communicate, **learn**, ask questions, ask for help, get their needs met in appropriate ways, get along with others, make friends, and develop healthy relationships.
- **Social skills** enable people to interact appropriately with those they meet in their journey through life.
Social Skills & Learning

- **Social skills** can be the hardest subject to pass in school.
- **Social skills** play a very important role in a child's emotional health and well-being.
- Children with language and communication difficulties are at-risk for delays in social functioning.
Social Skills in Children with Hearing Loss

• Substantial evidence suggests that school-age children with hearing loss have lower social competence than hearing peers

• Children who are teased, isolated or maltreated are at a higher risk of depression
  – DHH children who are unable to make themselves understood are also at a higher risk of depression (Fellinger et al., 2009)
Social Skills and Academic Achievement

• Implementation of social and emotional learning programs increased academic achievement (Durlak, Weissberg, Dymnicki, Taylor & Schellinger, 2011).

• Social skills predicted academic achievement in children 1st through 8th grade (Gustavsen, 2017)
Social Skills and Executive Functioning

• There is a significant relationship between executive functioning and social maturity for high school and college students (Marschark, M., et al, 2017)
  – No statistical difference between CI users and nonusers
Executive Function in DHH Preschoolers

- Poorer performance compared with peers with NH and with national norms (Beer, Kronenberger, Castellanos, Colson, Henning & Pisoni, 2014)
  - inhibition-concentration
  - working memory

- No group differences in visual memory or organization-integration
Executive Function Research

• Hintermair, 2013
  – Administered Behavior Rating Inventory of Executive Function (BRIEF) to teachers of DHH children
  – **Inhibition**: 22% of DHH children had elevated scores
  – **Working Memory**: 31% of DHH children had elevated scores
  – **Cognitive Flexibility**: 29% of DHH children had elevated scores
  – **Emotion Regulation**: 26% of DHH children had elevated scores
Executive Function Research

• Botting et al., 2017
  – Administered nonverbal executive function tasks to 108 DHH children ages 5-12
  – DHH children scored significantly worse in visual-spatial working memory, inhibition and flexibility compared to hearing children

• Approximately 1/3 to 1/2 of the CI sample scored in a below average range on most of these measures (Kronenberger et al., 2013)
  – CI children performed significantly worse on verbal working memory and inhibition, but not visual-spatial working memory (Kronenberger, Colson, Henning and Pisoni, 2014)
Executive Functioning and Language

- Language & executive function are related (Botting et al., 2017; Kronenberger, Colson et al., 2014; Sikora, Roelofs, Hermans, & Knoors, 2016; Vygotsky, 1978; Marschark, et al., 2017)

- Chronological age and duration of CI use had no consistent relationship with executive functioning (Kronenberger et al., 2013)
  – Even after 7 years of CI use -- duration of experience with the CI was not related to executive functioning outcomes
Preview: Interventions

• Post schedules and directions, and make sure the student sees them
• Make written directions very simple and concrete
• Create an assignment notebook for teacher and parents to check
• Check in frequently to make sure the student understands the work
• Use organizers and mind-mapping software
Learning Disorders

• Etiologies of deafness associated with LD (Edwards, L., 2010 in The Oxford Handbook of Deaf Studies, Language and Education Volume 2)
  – Meningitis, maternal rubella infection, cytomegalovirus infection, and prematurity
  – Not all LDs are associated with infection or genetic predisposition
• “Accurately identifying those children affected by a learning disability remains one of the most pressing and pertinent challenges facing both researchers and practitioners” (Edwards, L., 2010 pg. 436)
Learning Challenges

• Phonological skills
• Basic reading skills
• Reading comprehension
• Information processing
• Memory
• Attention
• Problem solving
• Sequencing
Learning Disorders and Social Skills

• Research has consistently demonstrated that many children with LD also have related social skill deficits

• 75% of students with LD also show some difficulties in social skills that interfere with their ability to learn (Kavale and Forness, 1995)
How can we identify learning challenges?

• How DHH teachers identify learning difficulties?
  Soukup & Feinstein (2007)
  – 65% - visual perception problems
  – 60% - behavior problems
  – 46% - achievement or other testing methods

• Need to be reviewing their psychoeducational evaluations
  – Is there a gap between their IQ and achievement performance?
    ▪ If yes, then we should be further assessing
What Can We Do?

Identification

Evaluation

Intervention

Better Outcomes
Recap

- Language
- Executive Function
- Learning
- Social Skills & Behavior
Executive Function

Language

Social Skills & Behavior

Learning
- Academic Achievement
Summary

- DHH students are underperforming when compared to their peers despite normal IQ
- Learning challenges need to be addressed when working with DHH students
- It is important to look at the whole child when developing a plan to help them
  - Learning, executive function and language
Why it Matters

When we identify other issues, determine effective team partners in order to expand intervention strategies, and implement them effectively, we see the rewards of our efforts. When we see children who learn differently make progress and develop new skills, even if they are not at the same rate or level as other children of similar ages, it is very rewarding. Our goals and timelines to goals may differ, but it can be that much more exciting when we share with family’s journeys towards each step forward!

Susan Wiley is a developmental pediatrician with a focused clinical and research interest in children who are deaf or hard of hearing with coexisting disabilities. She has evaluated more than 700 children who are deaf or hard of hearing. Her research interests have focused on understanding the language and functional progress of children who are deaf or hard of hearing with additional disabilities.
Save The Date

July 10 – 13
2019

The world famous Diplomat Beach Resort will be the host site for CI2019 which features Ft Lauderdale and Miami Beach. See you in South Florida in 2019.