

Validating a Developmental Screening Tool in Children who are Deaf/hoh



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Goal of this Project

- ★ To validate a developmental screening tool for use in children with all levels of hearing loss in order to provide interventions for all of a child's developmental and behavioral needs

Potential Impact

- ★ 17 per 1000 children and adolescents have some form of hearing loss
- ★ High rate of additional disabilities among children who are deaf/hoh (30-40%)
 - ★ In part, related to over-lapping risk factors for HL and developmental concerns
- ★ A tool is needed to screen for an additional disability among children who are deaf/hoh at earlier ages so that specific and effective interventions can be implemented

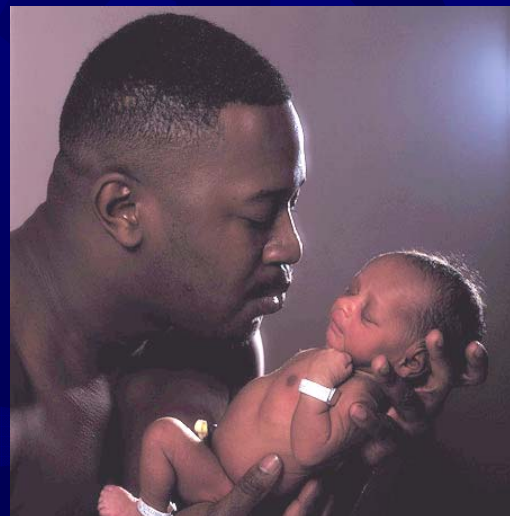


Age of Identification

- ✦ An additional disability can delay the identification of hearing loss
- ✦ Hearing can delay the identification of an additional disability
 - ✦ Autism is diagnosed ~ 1 year later in children with HL

Developmental Screening

A **brief** assessment designed to **identify** children who **need more intensive** diagnosis or evaluation in order to **improve** child health and well being.





Screening

- ✦ Should sort out those who probably have problems from those who probably do not

Standards for Screening Tests

- ★ SPECIFICITY = % of children without problems correctly detected (by passing, above cutoffs/scores)
- ★ SENSITIVITY = % of children *with* problems correctly detected
- ★ 70% to 80% is the standard



Why does it matter?

- ★ Screening for developmental concerns allows for a pro-active approach to overall child development
- ★ Identifying additional concerns early can allow for more effective intervention strategies
- ★ The American Academy of Pediatrics, Bright Futures, Centers for Disease Control, Healthy People 2010 all endorse developmental screening in the general population



AAP Developmental Surveillance and Screening Policy Statement

- ★ 2006 update on developmental screening in general pediatric practices
- ★ Surveillance at every visit
- ★ Objective screening at 9, 18, and 24-28 months and at any visit with parental or provider concern
- ★ Main changes from prior policy:
 - ★ Objective screening at specific visits rather than all visits
 - ★ Endorsement of a number of specific screening tools

Why Objective Screening?

- ★ Physician clinical judgment detects fewer than 30% of children with developmental disabilities

- ★ Palfrey et al. J Peds. 1994;111:651-655

- ★ Rydz et al Pediatrics 2006 118e 1178e-1179e



Developmental Screening Tools

- ★ The Ages and Stages Questionnaire © (ASQ)
- ★ The Parent's Evaluation of Developmental Status (PEDS)
- ★ The Denver Developmental Screening Tool II (DDST-II)

No screening tool has been validated in children with hearing loss

Aims of Project

- ★ The global aim of this project is to validate a developmental screening tools among children who are deaf/hoh and to determine the best method for screening these children
- ★ Screening tool
 - ★ Ages and Stages Questionnaire© (ASQ)



Methodology

★ Enrollment:

- ★ Children under 36 months of age with mild to profound bilateral sensorineural hearing loss
- ★ Children were identified through the Southwest Regional Infant Hearing Program and Cincinnati Children's Hospital Medical Center ENT Division

★ Exclusion Criteria

- ★ Auditory neuropathy, conductive hearing loss
- ★ Previously identified with an additional disability
- ★ English as a second language in the home

Methodology

- ★ Parents completed the Ages and Stages Questionnaire © upon entry into study
- ★ Within 2-4 weeks of completing the screening tool, their child received a formal developmental assessment with the Revised Gesell Developmental Schedules
- ★ If an area of delay was confirmed by the developmental assessment, Part C was contacted implement broader services on their Individualized Family Service Plan

Ages and Stages Questionnaire

- ★ 30-35 items on each age-specific form
- ★ Parent rates their child's skills on specific questions (not yet, sometimes, yes)
- ★ Questions regarding developmental domains of (many with picture support):
 - ★ Gross Motor Skills
 - ★ Fine Motor Skills
 - ★ Self-help Skills
 - ★ Communication Skills
 - ★ Problem Solving Skills



Ages and Stages Communication 8 mos

- ★ If you call your baby when you are out of sight, does he look in the direction of your voice?
- ★ When a loud noise occurs, does your baby turn to look to see where the sound came from?
- ★ If you copy the sounds your baby makes, does your baby repeat the same sounds?
- ★ Does your baby make sounds like da, ga, ka, and ba?
- ★ Does your baby respond to the tone of your voice and stop an activity at least briefly when you say no to her?
- ★ Does your baby make two similar sounds like ba-ba, da-da, or ga-ga? (He may say these sounds without referring to any particular object)



Ages and Stages Gross Motor 8 mos

- ★ When you put her on the floor, does your baby lean on her hands while sitting? (If she already sits up straight without leaning on her hands, check yes for this item)
- ★ Does your baby roll from his back to his tummy, getting both arms out from under him?
- ★ Does your baby get into a crawling position by getting up on her hands and knees?
- ★ If you hold both hands just to balance him, does your baby support his own weight while standing?
- ★ When sitting on the floor, does your baby sit up straight for several minutes without using her hands for support?
- ★ When you stand him next to furniture or a crib rail, does your baby hold on without leaning his chest against the furniture for support?



Revised Gesell Developmental Schedules

- ✦ A developmental evaluation tool for children birth to 36 months
- ✦ Good correlation with Bayley Scale of Infant Development
- ✦ Evaluates the domains of:
 - ✦ Gross Motor
 - ✦ Fine Motor
 - ✦ Personal-Social
 - ✦ Communication
 - ✦ Problem Solving (all non-verbal tasks)

Patient Characteristics

Characteristic	N=21	
Male	48% (n=10)	
Race	Caucasian African American	86% (n=18) 14% (n=3)
Median Age at time of Study (range)	18 mos (8-36)	
Median Age of Identification (range)	3 mos (1-30)	
Median Age of Amplification (range)	6 mos (1-32)	
Median decibel loss in better ear (range)	70 dB (25-130)	
Degree of hearing loss	Severe- Profound Moderate-Severe Mild	42% 32% 26%

Patient Characteristics

Characteristic	N=21
Communication Mode	
Oral	29% (6)
Oral/Signing	9.5% (2)
Signing	24% (5)
Signing/Behavior	9.5% (2)
Behavior	29% (6)
Amplification	
Hearing Aids	86% (18)
Cochlear Implants	14% (3)

Patient Characteristics

Characteristic	
Parental Education Level	N=19
Some high school	11% (2)
High school graduate	11% (2)
Some college	15% (3)
College Graduate	32% (6)
Some graduate education	5% (1)
Advanced degree	26% (5)
Family Income Level	N=18
\$6000-30,000	28% (5)
\$31-60,000	16% (3)
\$61-90,000	28% (5)
\$>90,000	28% (5)

In another CCHMC study, 32% of our population of parents of children with hearing loss seen in ENT had a college degree or higher, 23% make over \$80,000

Sensitivity and Specificity

	True Developmental problem	No Developmental problem
ASQ Fail	True positive	False positive
ASQ pass	False negative	True negative

Se

Sp

True positive

True negative

all developmental problems No developmental problems

Positive and Negative PV

	True Developmental problem	No Developmental problem	
ASQ Fail	True positive	False positive	PPV
ASQ pass	False negative	True negative	
	Se	Sp	
	True positive	True negative	
	All who test positive	All who test negative	

Yellow arrows point from the 'True positive' and 'True negative' cells to the 'PPV' and 'NPV' labels respectively.

Study Results

	Sensitivity	Specificity
Communication	93%	100%
Gross Motor	75%	100%
Fine Motor	0%	89%
Cognitive	25%	94%
Personal-Social	33%	89%

Goal of screening tests is to have at least 70-80% sensitivity and 70-80% specificity

Study Results

	PPV	NPV
Communication	100%	87.5%
Gross Motor	100%	94%
Fine Motor	0%	89%
Cognitive	50%	84%
Personal-Social	33%	89%

Implications

- ★ If a child fails the ASQ in gross motor or communication, chances are the child has a developmental problem
- ★ The ASQ had poor positive predictive abilities in the domains of fine motor, cognitive, and personal-social skills (too many false negatives)
- ★ If a child passes the ASQ, they are likely okay, but the tool still misses a few children
- ★ The communication domain was much better than we anticipated



Other findings

- ✦ The older children tended to have lower cognitive skills on the ASQ, but not as much on the Gesell
- ✦ In general, it is easier to detect cognitive problems in an older child vs. a younger child, however the ASQ had poorer predictive power for older children (despite minimal language burden on problem solving questions at older ages)
- ✦ Age of Identification, amplification do not correlate with developmental skills



Goals for the Future

- ✦ Addition of another site within Ohio for improved enrollment.
- ✦ Evaluate other screening tools for better sensitivity/specificity
- ✦ Determine if a screening tool can identify delays at earlier ages in children who are deaf/hoh
 - ✦ Longitudinal study of children



Thank you

- ✦ To the CCDD board for the CCDD research scholar funding support of this project
- ✦ The families who participated in the study



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