Outcomes of Children with Hearing Loss: A Study of Children with Mild to Severe Hearing Loss

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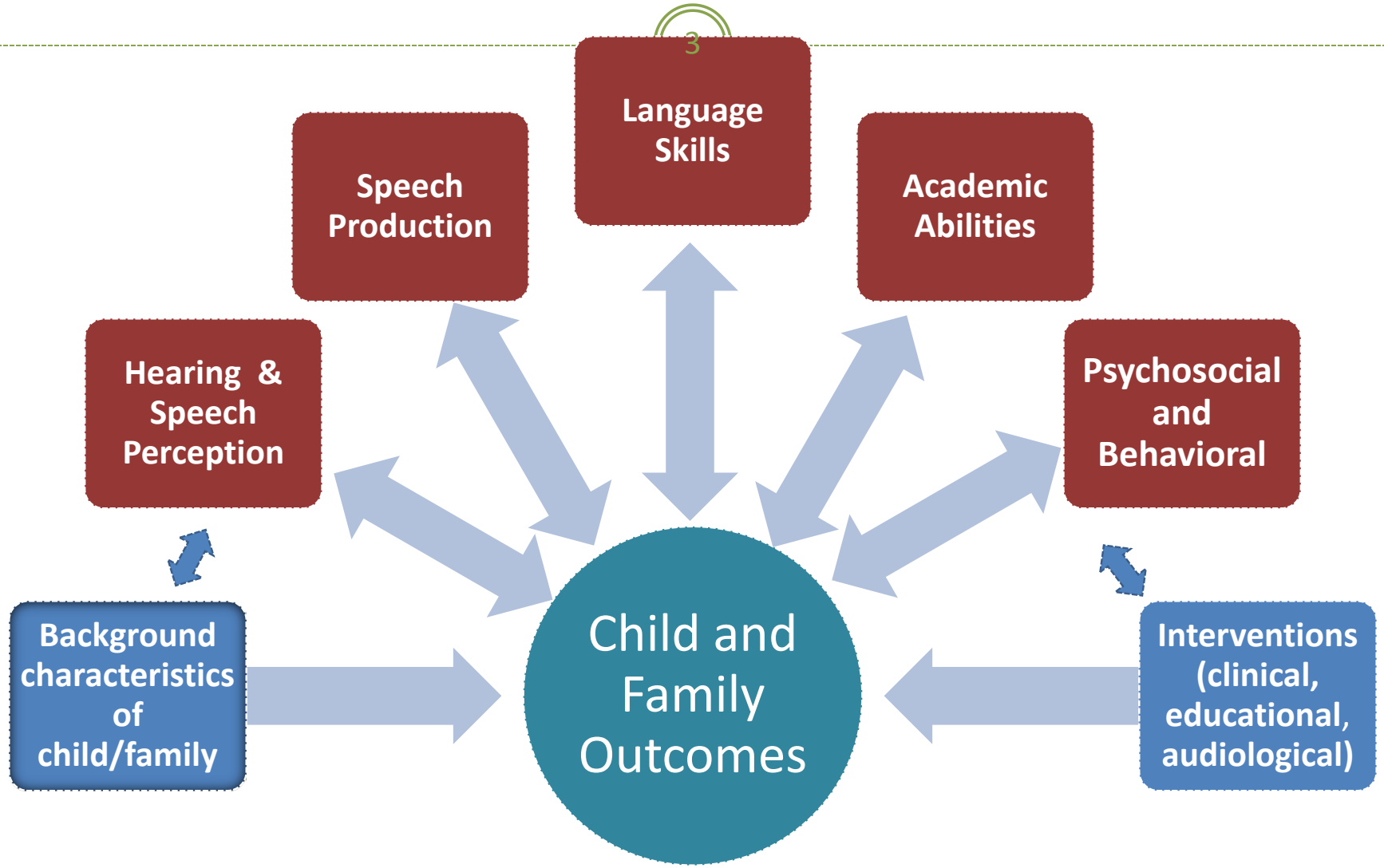
SUPPORTED BY NIDCD R01 DC009560

Background

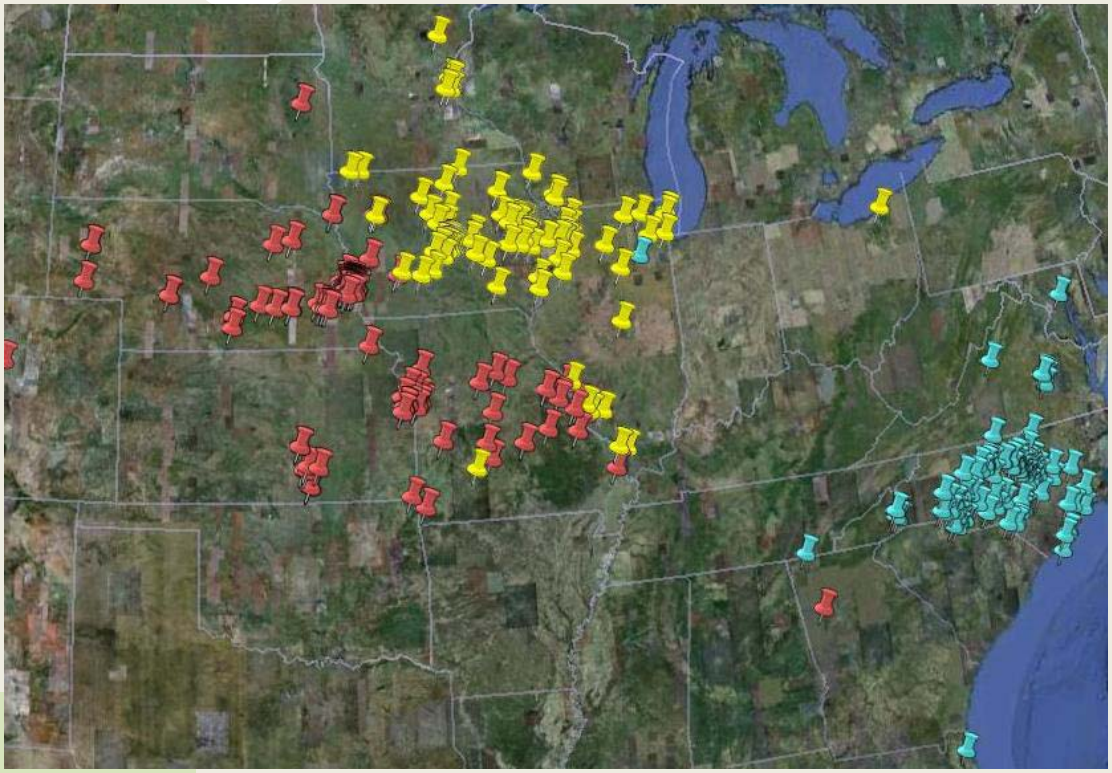
- Most outcome studies focus on children who are deaf
- Reduced body of literature concerning children with mild to severe HL
  - Sample sizes are small or mix D/HH children
  - Lack of control of amplification histories/audibility
  - Few studies attempted a population sample
  - Varied measurement strategies; earlier generation technologies
- Need to understand sources of individual difference in outcomes

Domains of study



Participants

Centers	HH	NH
Boys Town	117	40
Iowa	85	48
North Carolina	104	24
Total	306	112



- Ages 6 months – 6; 11
- English spoken in the home
- No major secondary disabilities
- Permanent Mild to Severe Hearing Loss
- PTA of 25-75 dB HL (500, 1k, 2k, 4 kHz)

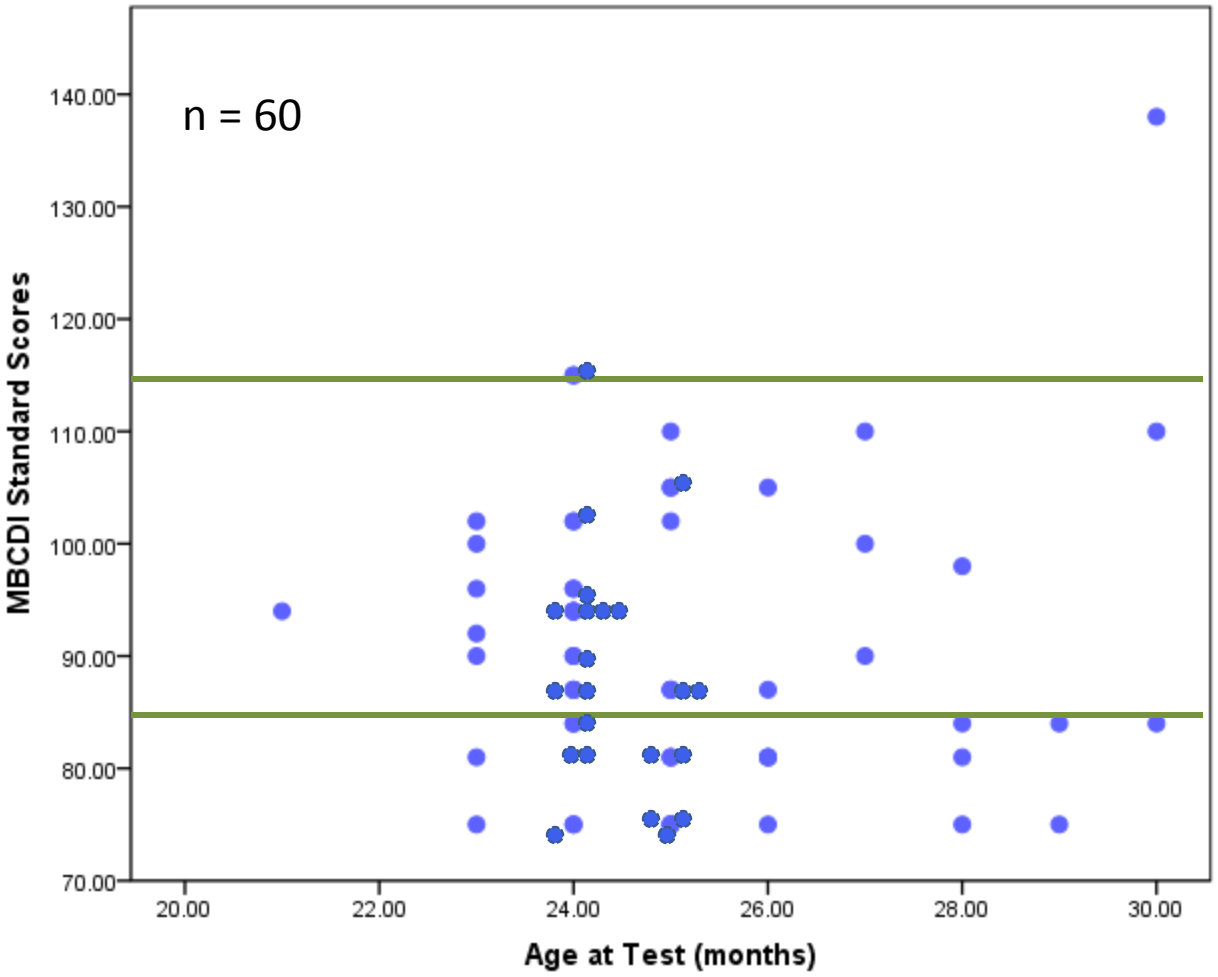
Speech and Language Outcomes: Birth to Three

- Standardized measures
  - Vocabulary
    - MBCDI
  - Receptive/Expressive Language
    - Mullen Scales
- Newer, nonstandard measures
  - Infant Vocal Interview
  - Open and Closed Set Test

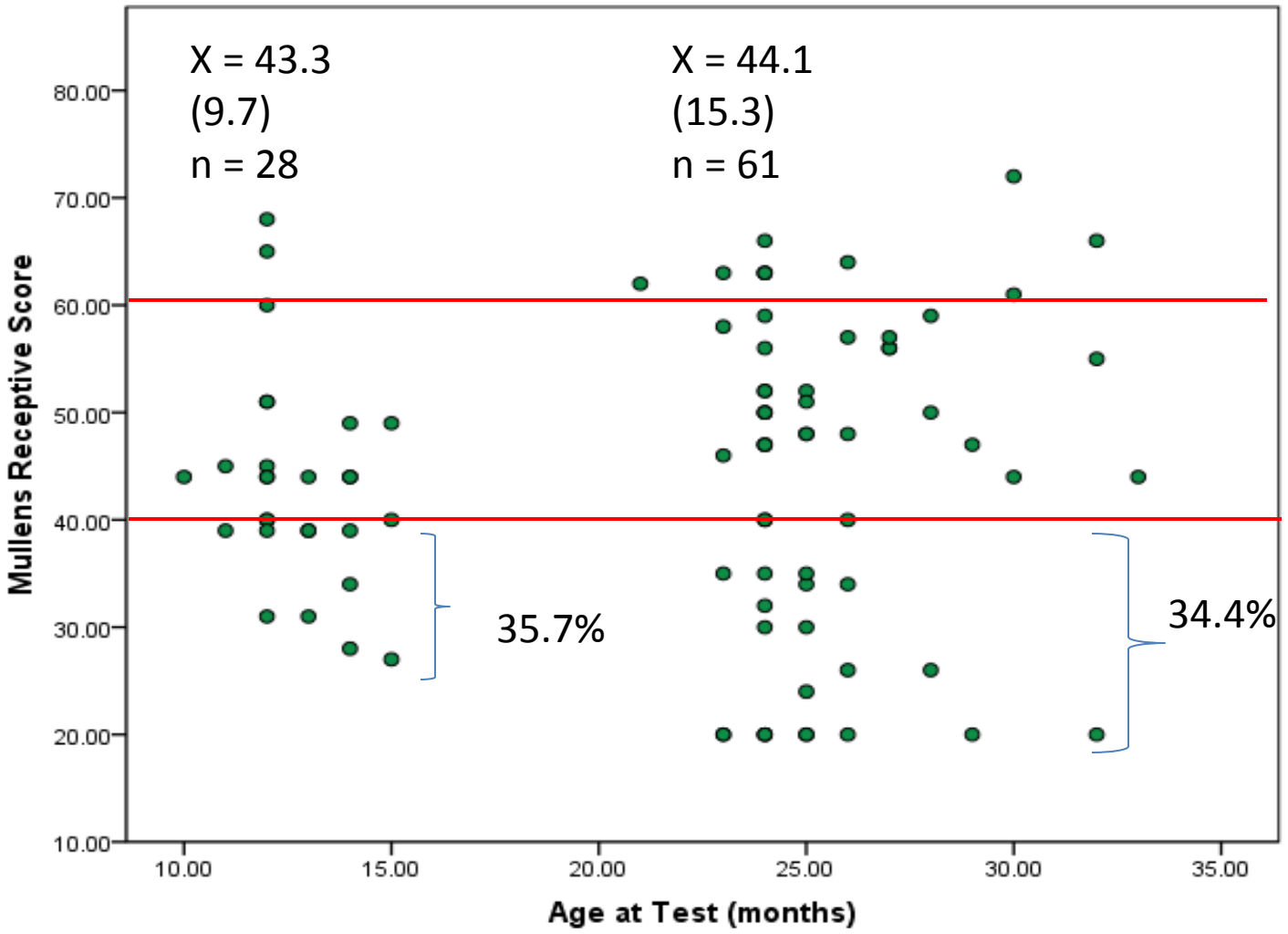
Expressive Vocabulary at Age Two - MBCDI

Mean 90.83 (12.74)

38.3% ≤ 84



1 & 2 years:
Mullen Scales--Receptive



BEPTA
r= -.425**

BESII
r=.453**

Vocal Development Landmarks Interview

PROVISION OF VOCAL EXAMPLES AND PAIRED COMPARISONS

- To avoid use of technical terms
- To ensure that parent and clinician “on same page”
- To calibrate examiners

USES STANDARD INTERVIEW FORMAT AND PP SLIDES WITH AUDIO FILES

Item 1-4 (pre-canonical)

Breathing in

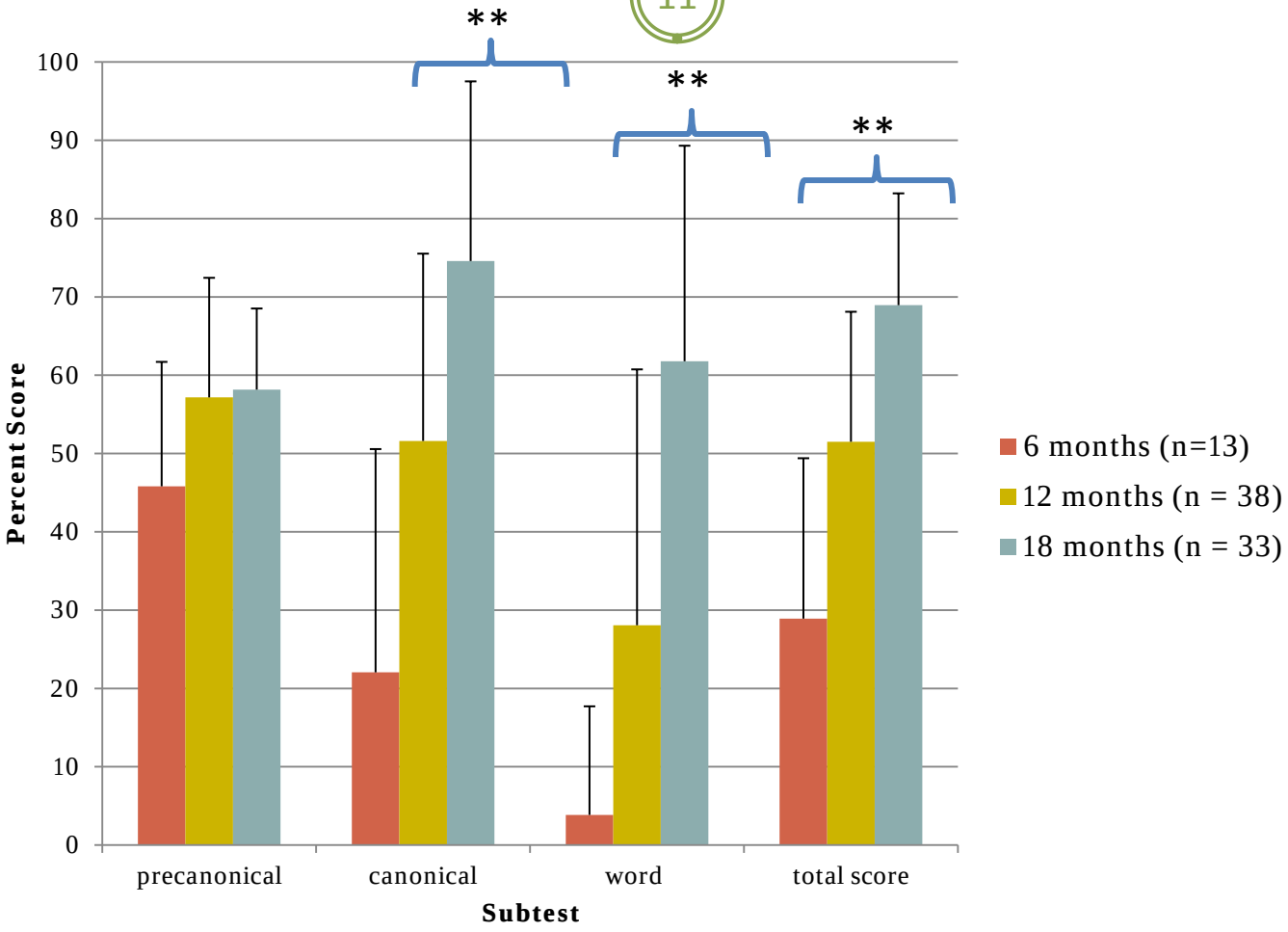
Breathing out

Item 2-3 (canonical)

ba

mbwea

Longitudinal Data: Vocal Interview



Paired samples t tests: ps < .001

Open & Closed Set Test (O & C)

KEYS

- A MEASURE OF PERCEPTION-PRODUCTION
- APPROPRIATE FOR ~18 MONTHS – 2 YEARS+
- DEVELOPED BY ERTMER, MILLER & QUESENBERRY, 2004
- 10 ITEMS, REALISTIC PICTURES
- PROMPTED PRODUCTION FOLLOWED BY PICTURE IDENTIFICATION

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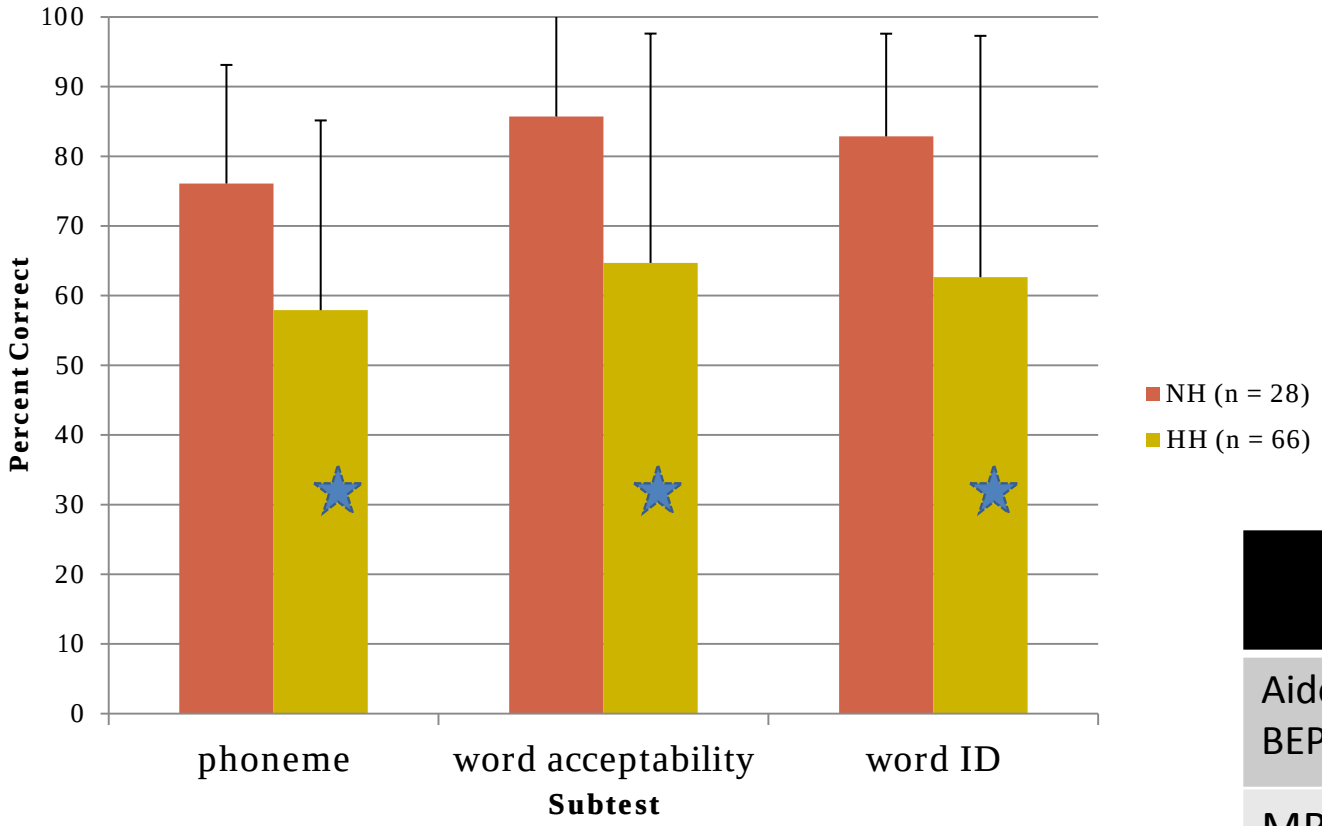
Open and Closed Set Test (Perception-Production)

Mom: And “keys”….Child: /tis/…Mom: uhhuh, where are they?
Child: /tis/ + point. Mom: very good

Two-year olds: O&C



	O&C phonology
Aided SII/ BEPTA	.349* -.326*
MBCDI-WS	.737**
Mullens Ex	.747**
Mullens Rec	.735**

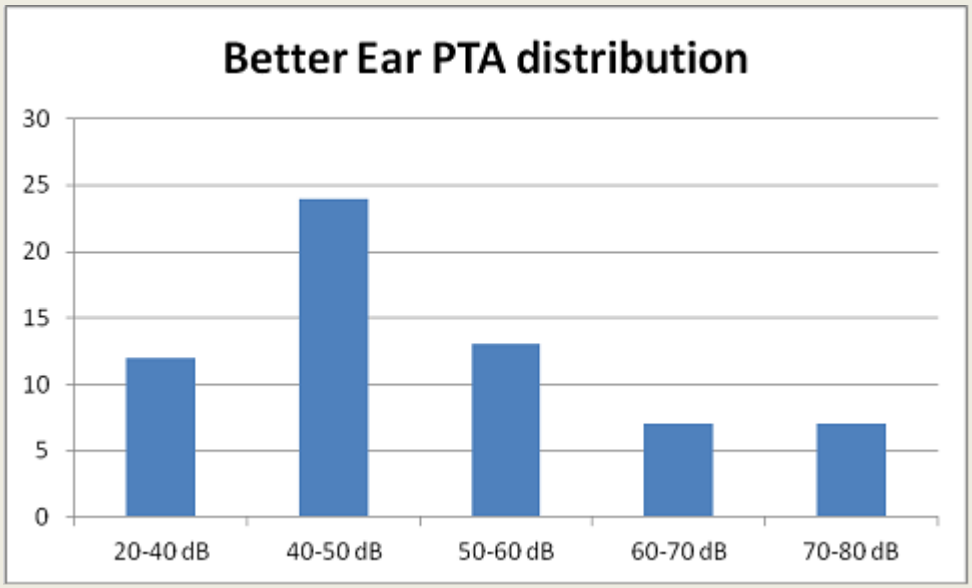
**ps< .013 Spearman's Rho

*Between groups: *ps* < .05 Mann Whitney U

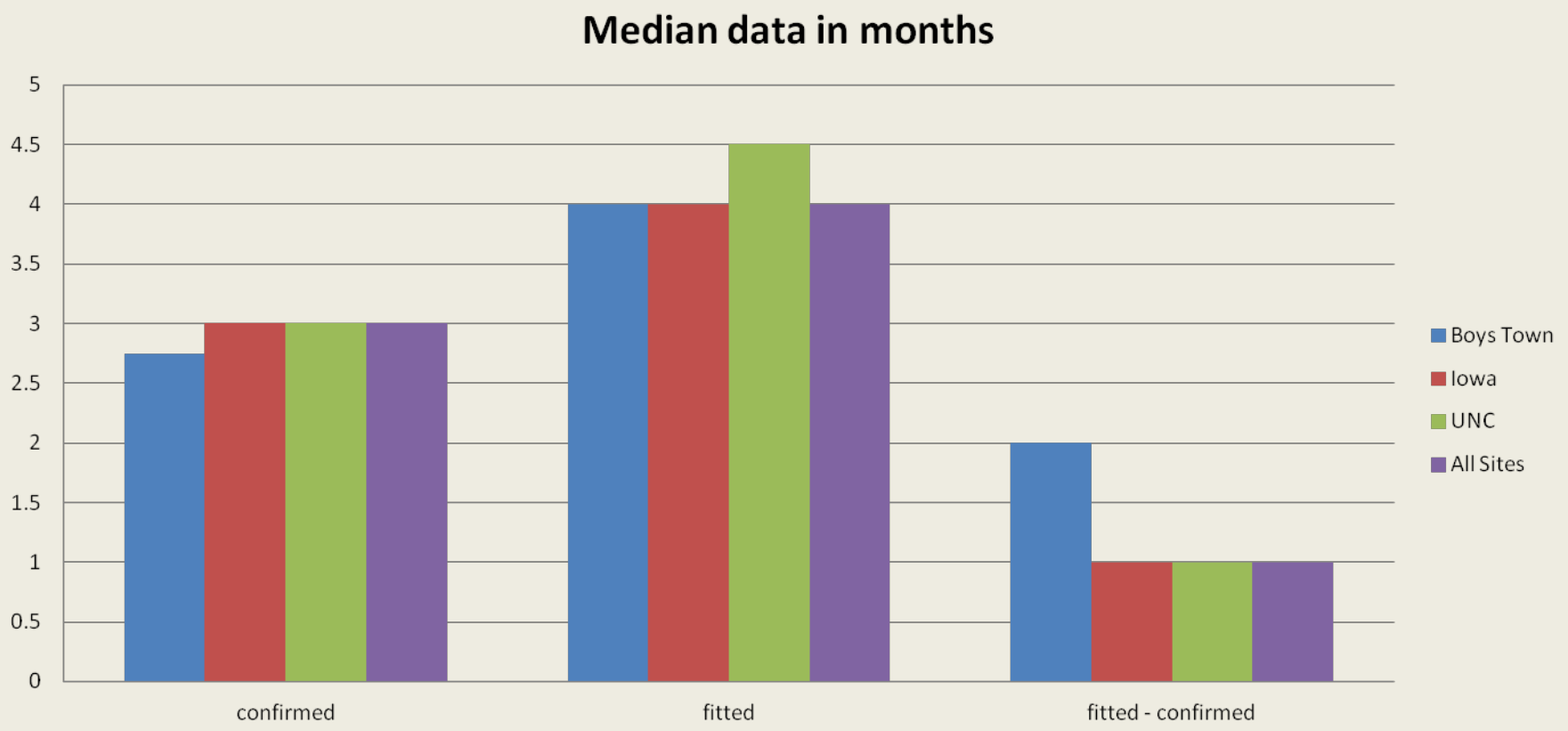
Questions

- What are general descriptive characteristics of this HOH population?
- How do subject-specific variables (site, gender, income, parents education, severity of hearing loss) affect timely diagnosis and follow-up
  - Ages of ID, HL confirmation, HA fit, entry into EI?
- What are the reasons for delays between identification and confirmation? Between confirmation and hearing aid fit?
- How are these HOH kids meeting the national 1-3-6 goals when moving through the EHDI process?

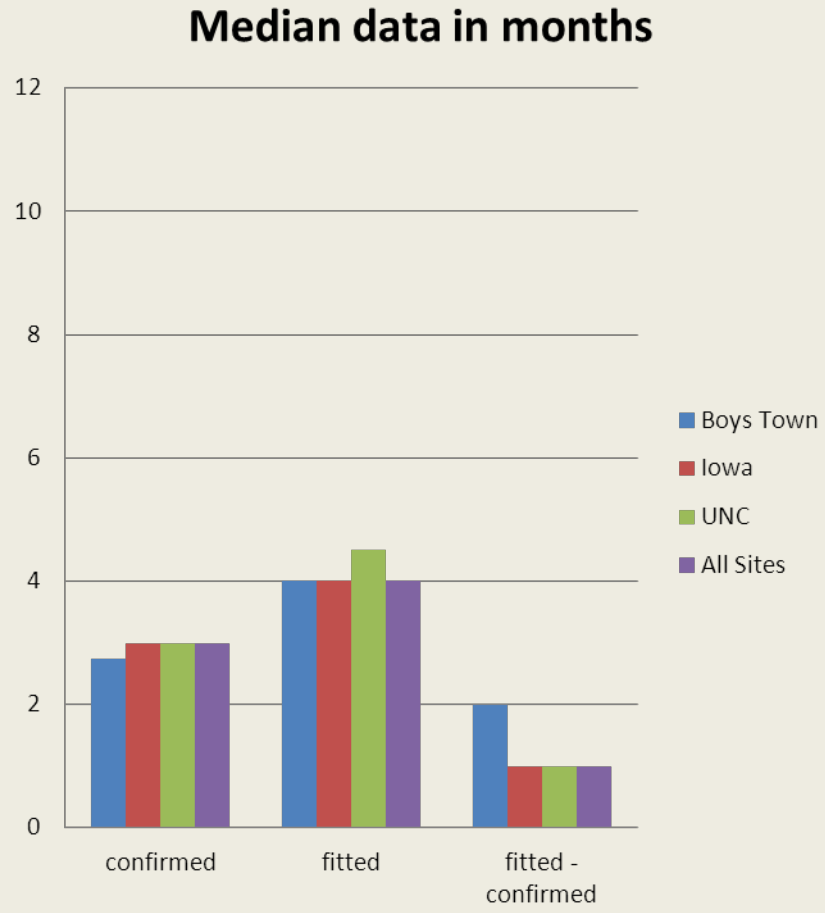
Distribution of better ear PTA

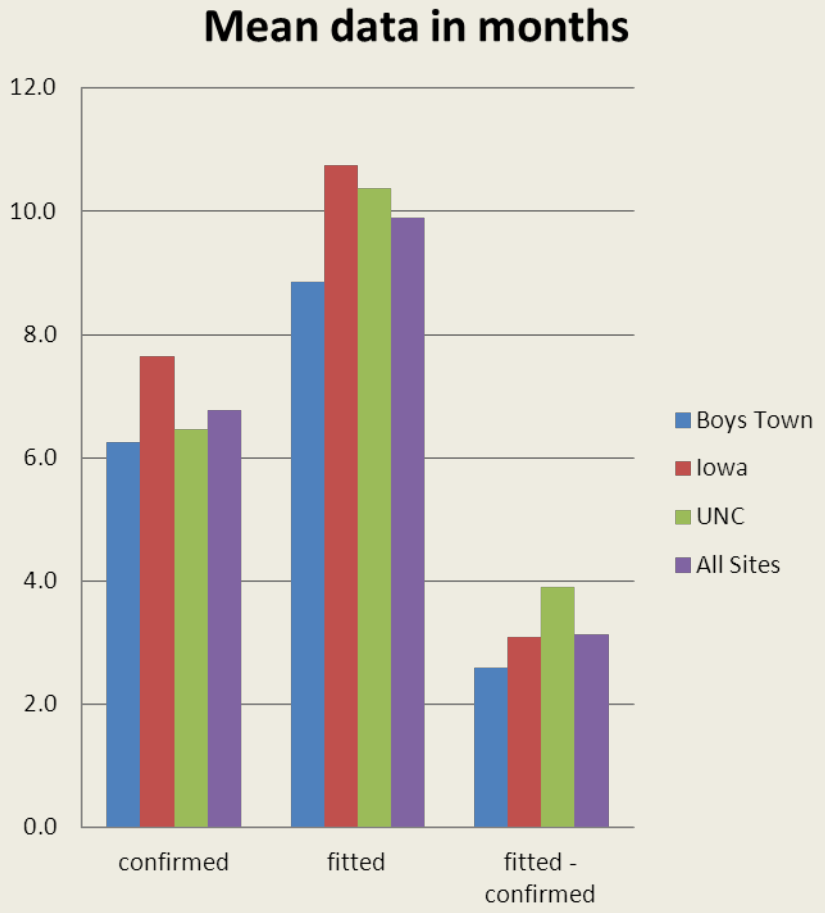


Ages of confirmation of hearing loss and age of hearing aid fitting 169 who did not pass NHS (median)

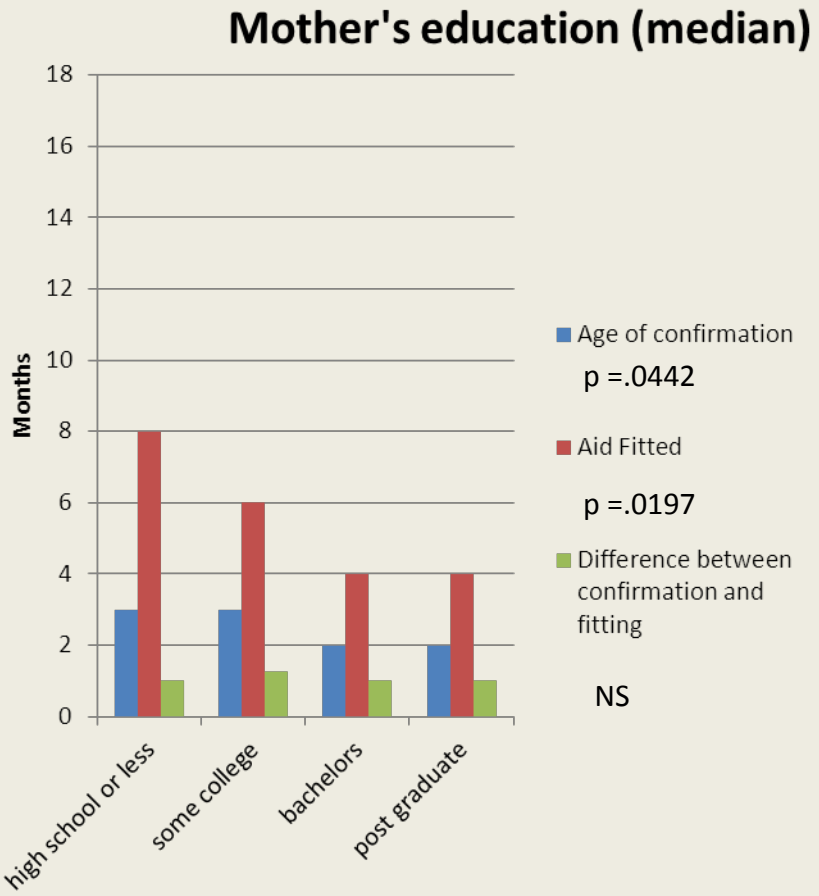


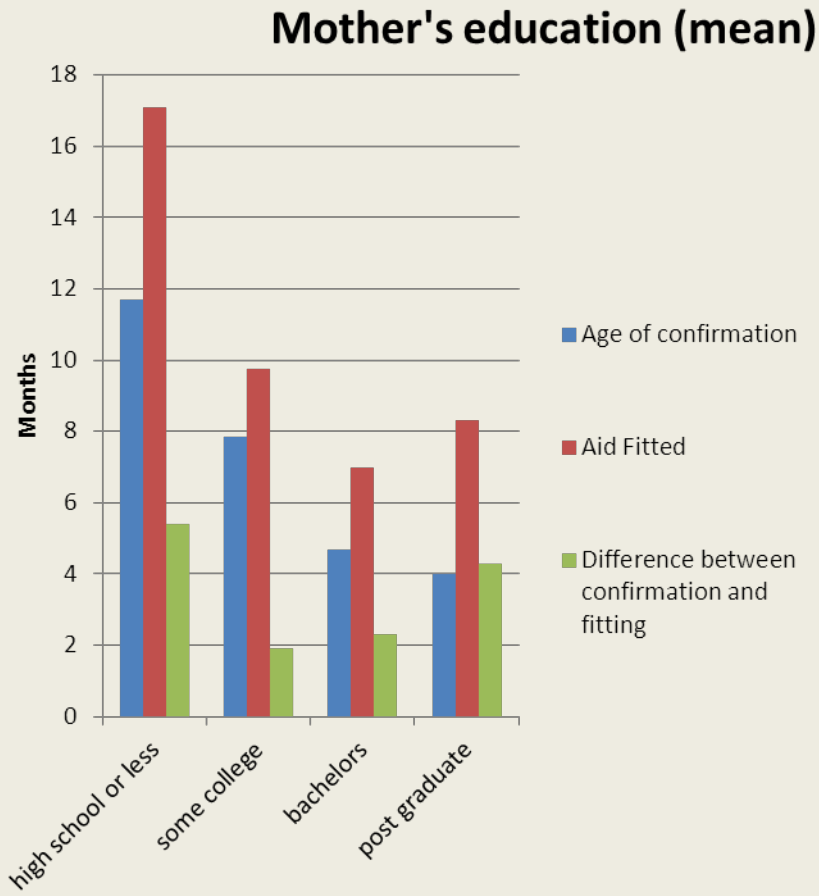
Ages of confirmation of hearing loss, hearing aid fitting and difference by site



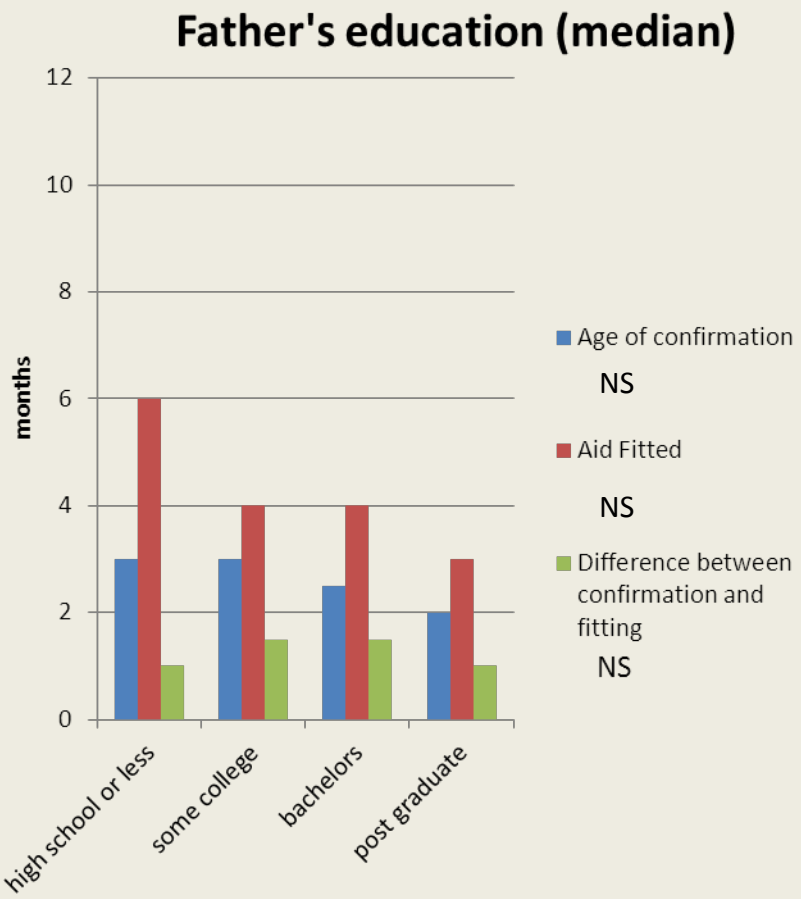


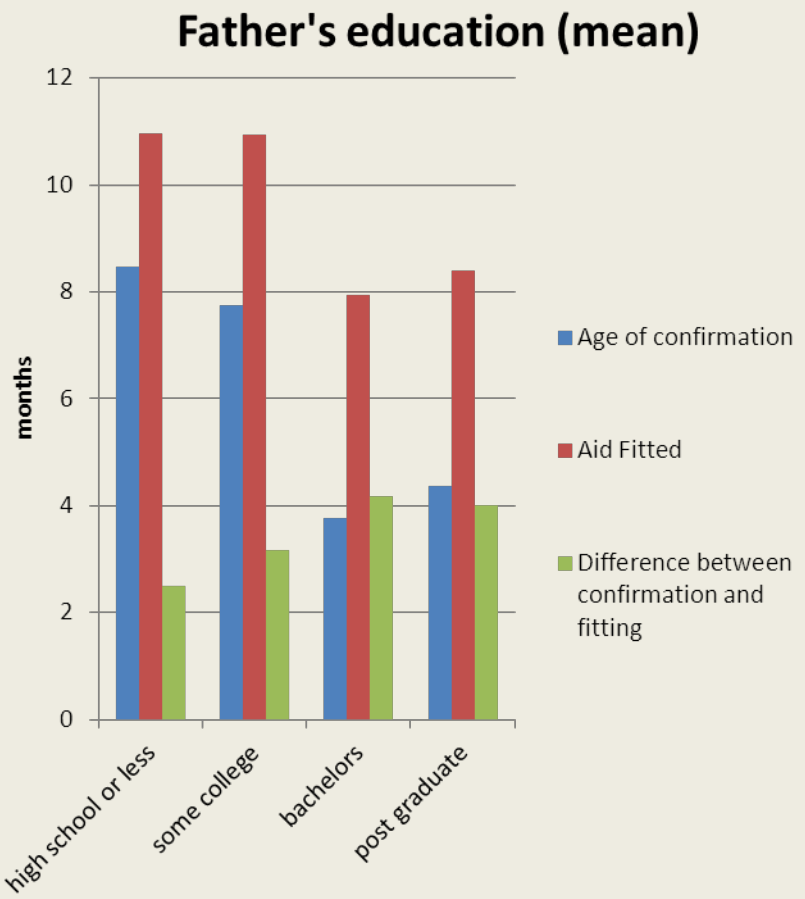
Ages of confirmation of hearing loss, hearing aid fit and difference (169 who did not pass NHS): Effect of Mother's education





Ages of confirmation of hearing loss, hearing aid fitting and difference (169 who did not pass NHS): Effect of father's education





Age of confirmation of HL for each level of mothers education: 7 month difference between highest and lowest levels of education

	Age of hearing loss confirmed	
Biological Mother's Education	Mean	SE
High School or less	11.40	17.64
Vocational school/some college	8.20	12.11
College	4.68	6.08
Graduate School	3.96	6.50

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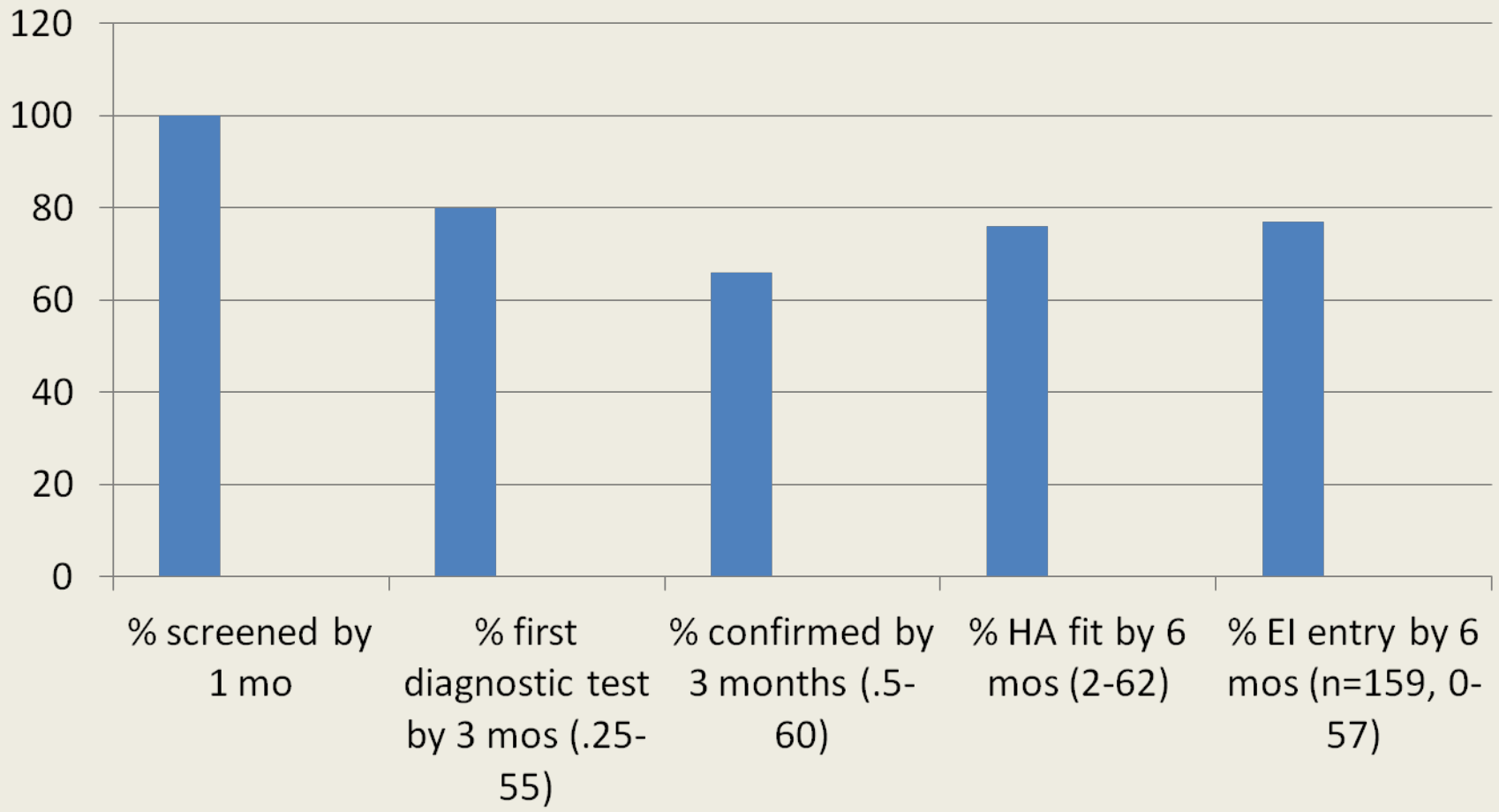
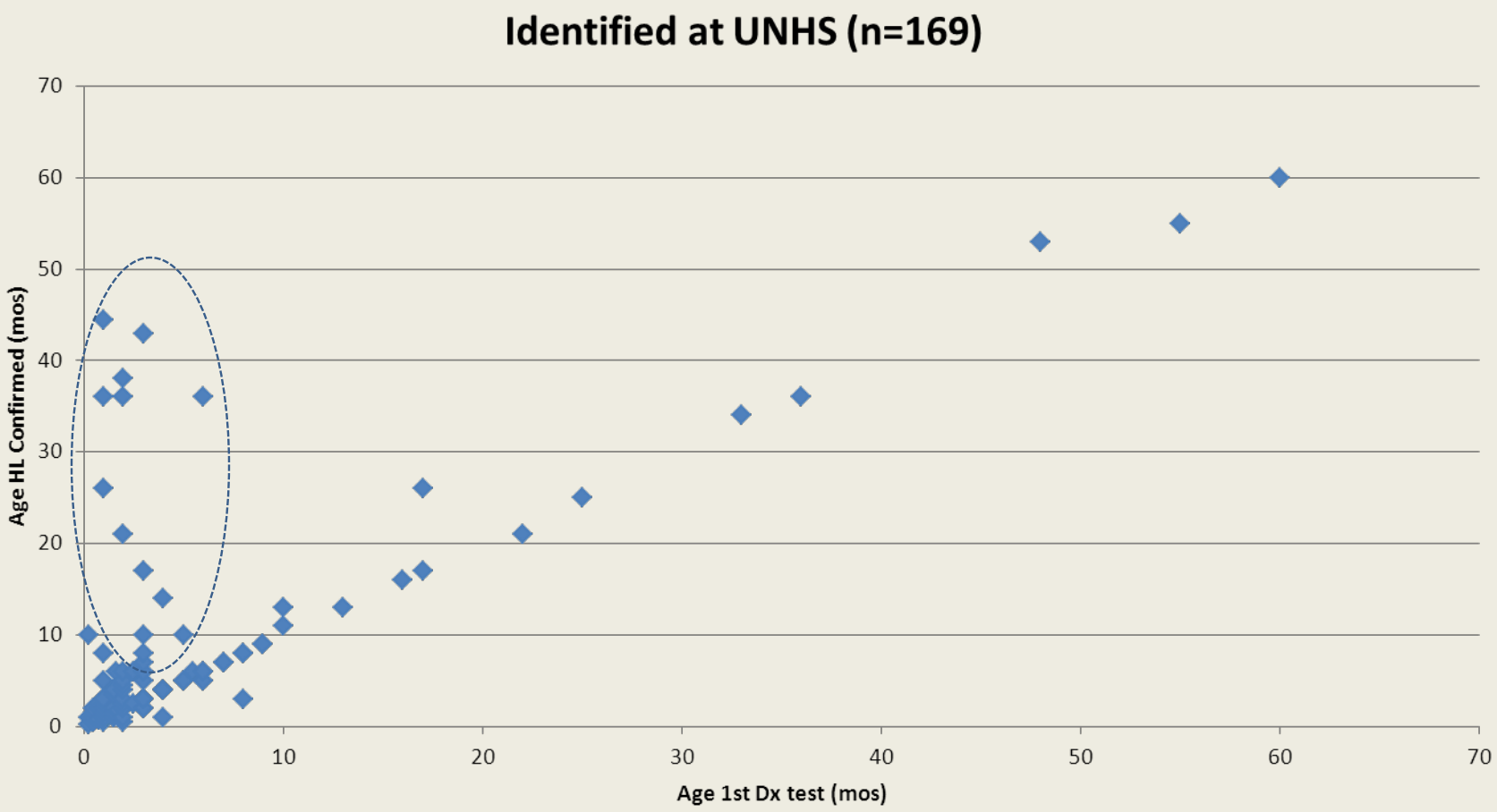
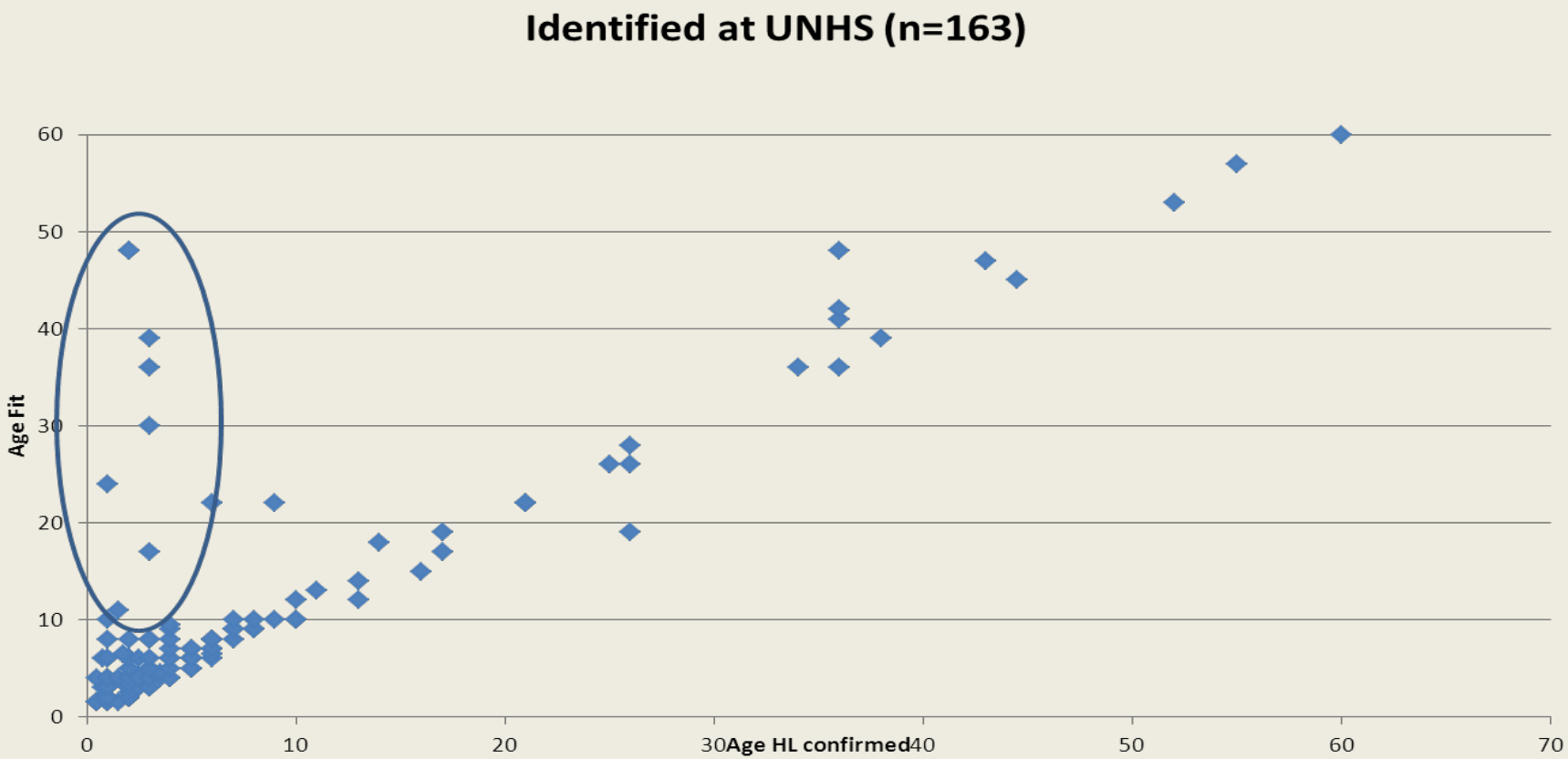
Are we meeting EHDI goals? (% subjects and ranges in months)



Age hearing loss confirmed by age of first diagnostic test

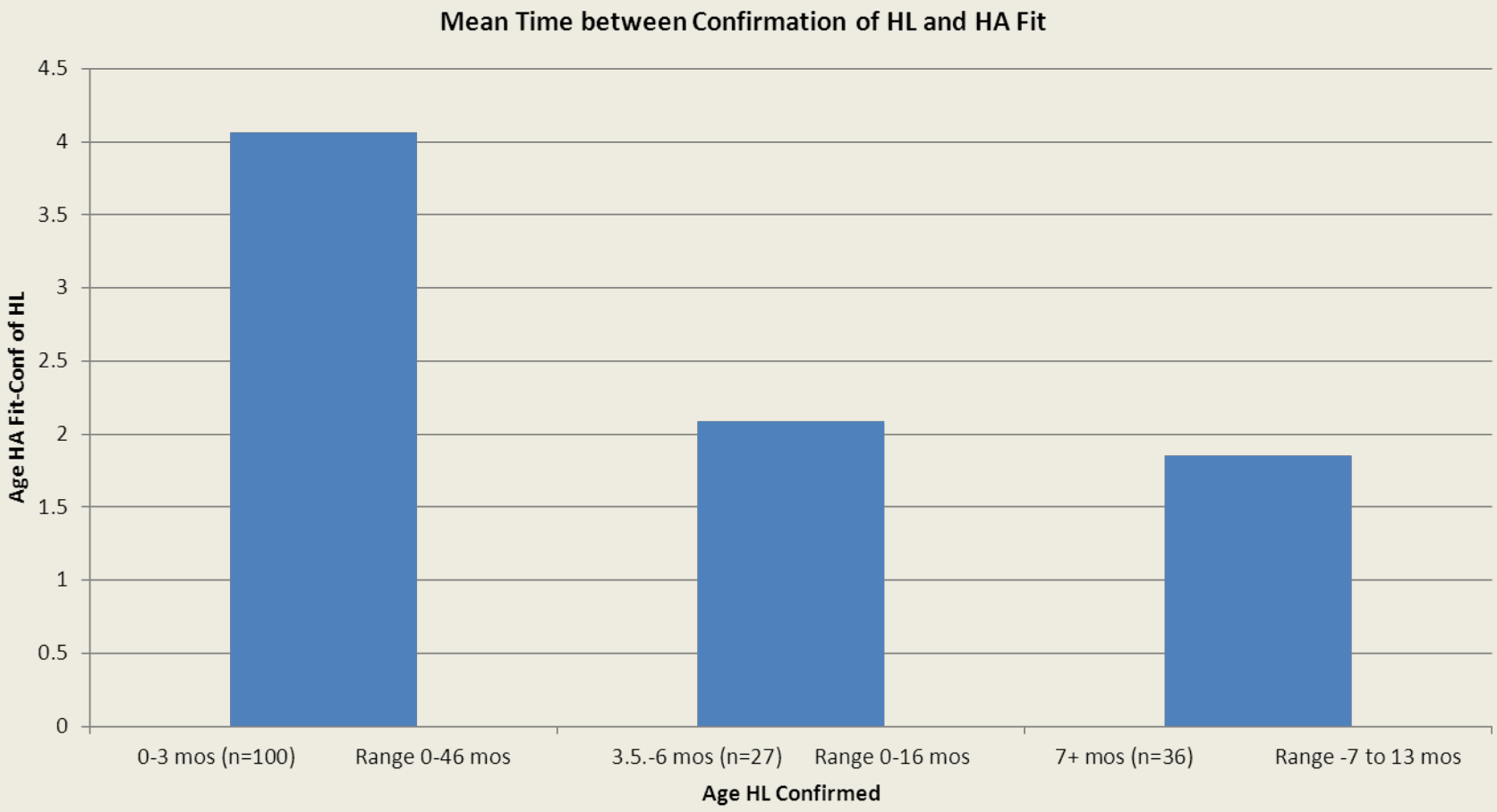


Age HA fitting by age HL confirmed



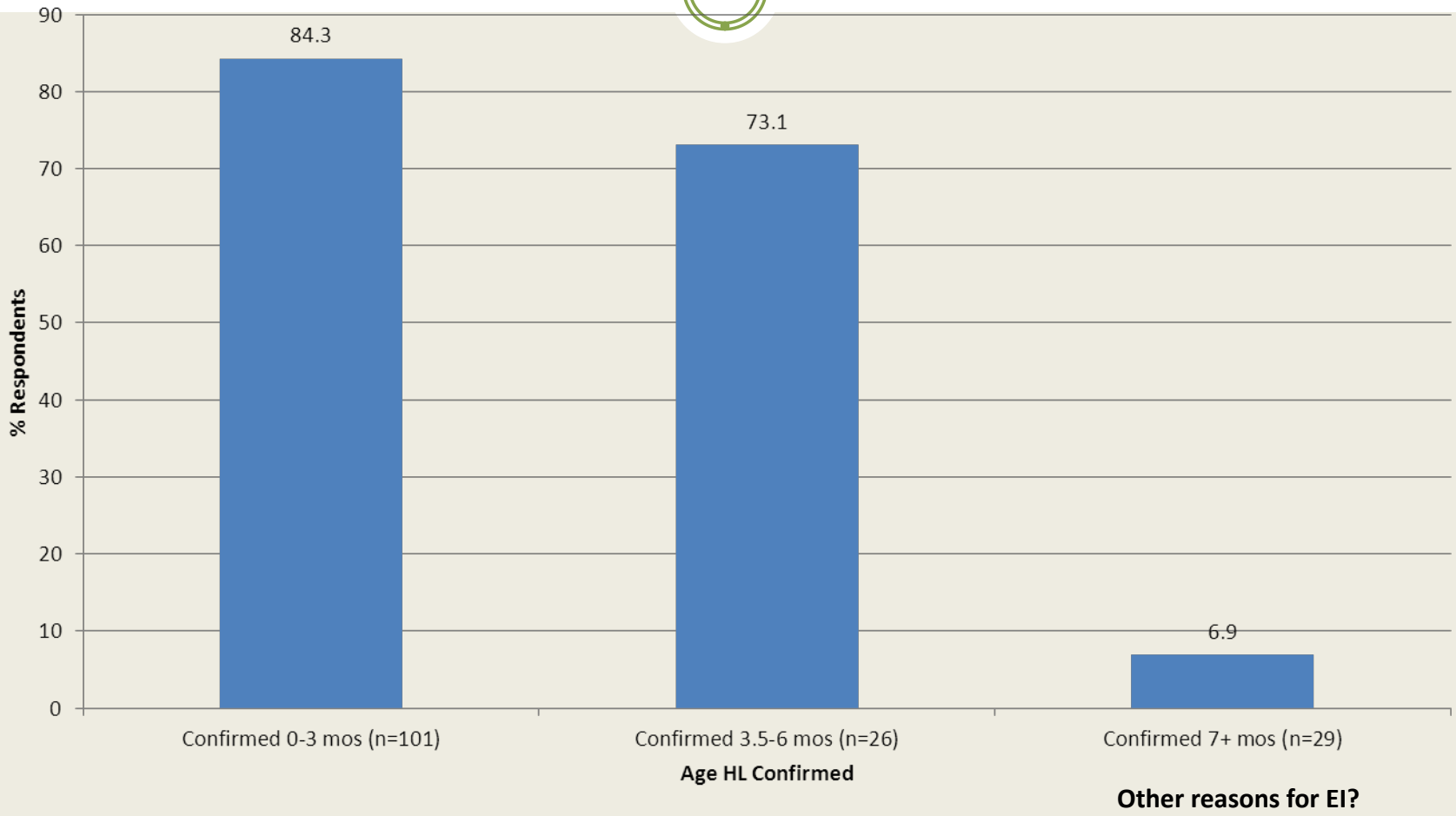
n=163 who had both Age of Fit and Age HL Confirmed.
100 were confirmed by 3 mos (61.3%)
27 were confirmed from 3.5-6 mos (16.5%)
36 were confirmed at 7+ mos. (22.1%)
Of 127 who were confirmed from 0-6 mos, 100 (78.7%) were fit by 6 mos.

Mean time between HL confirmation and HA fit by age of confirmation



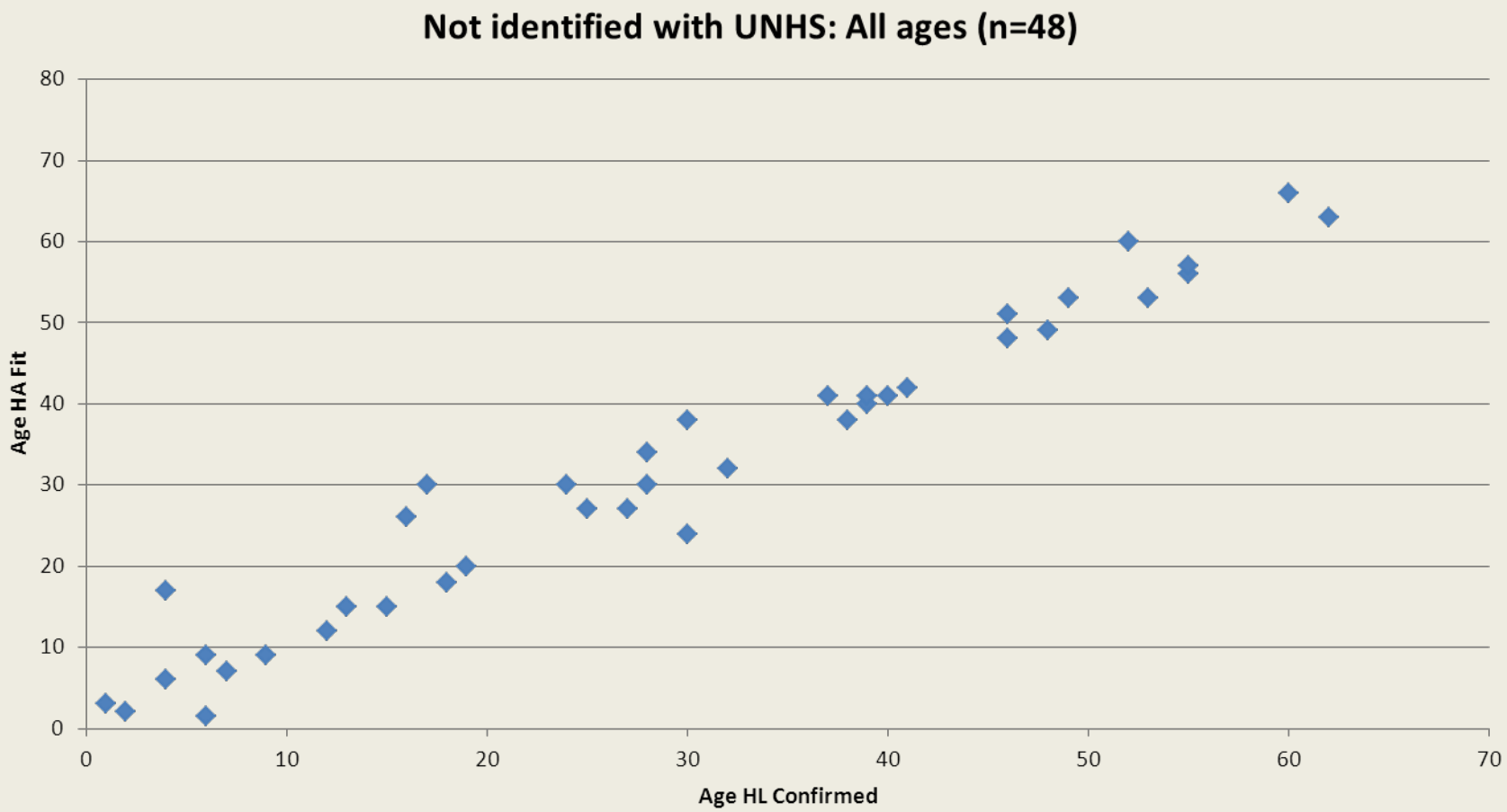
But MEDIAN time between confirmation and fit is 1 month for all age groups

% into EI before 6 months by age of confirmation



Other reasons for EI?

Subjects who did not fail NHS (includes delayed onset HL)



Characteristics of Hearing Aid Fitting

What is the quality of hearing aid fitting for children in the study?

- Audibility
  - How much of long-term speech spectrum is audible
- Fit-to target
  - How close fittings are to stated to prescriptive formula

Characteristics of Hearing Aid Fitting

What factors limit the quality of hearing aid fitting?

- Age
  - Do we have accurate thresholds on which to base the hearing aid fitting?
- Verification method
  - Real-ear verification, measured or average RECD
- Knowledge/skills of audiologist doing the hearing aid fitting
- Consistency of use
  - Parent report/data-logging

Challenges in evaluating hearing aid fitting

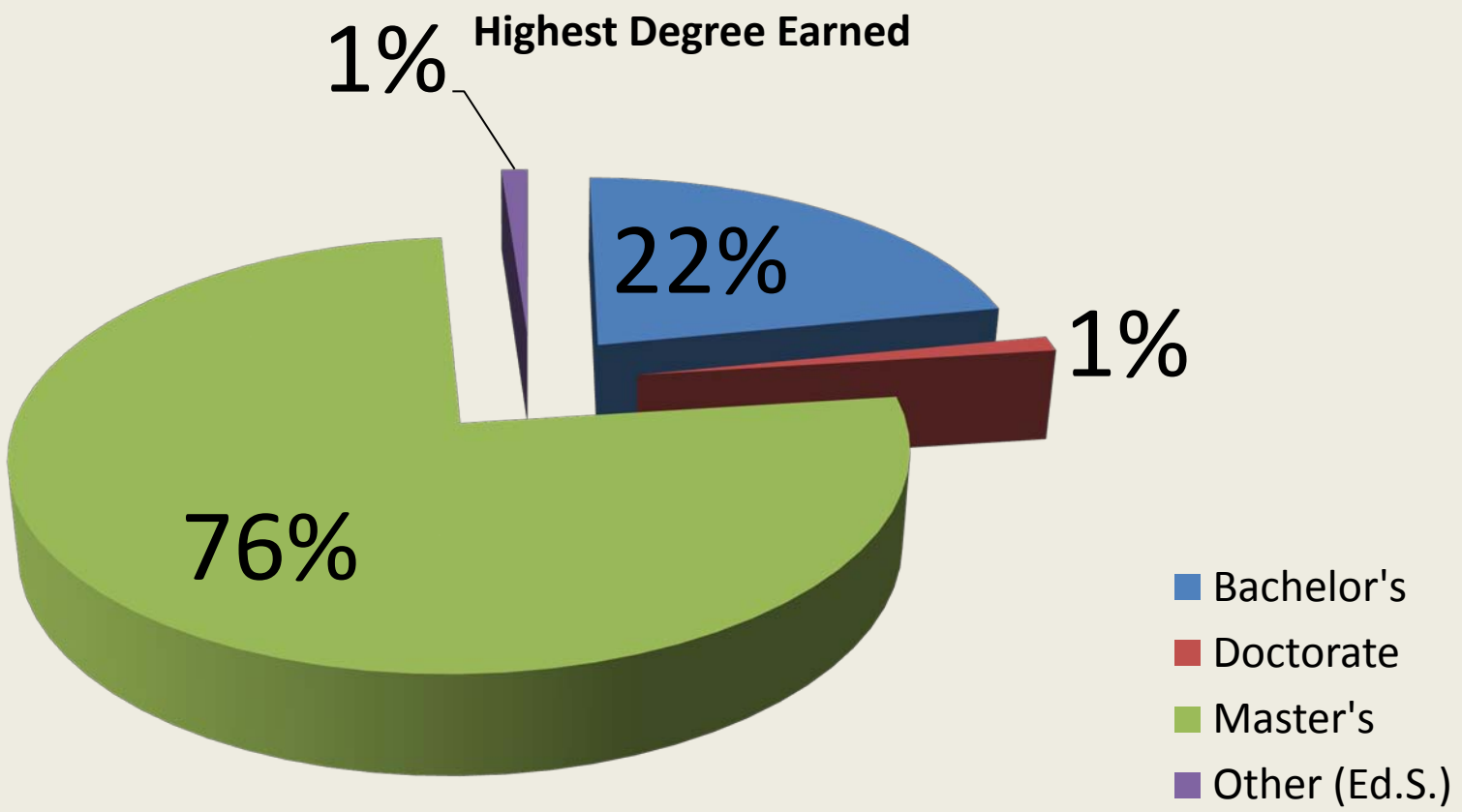
- Only evaluating hearing aid when children are in clinic
  - If hearing loss progressed following last study visit, no knowledge of when that happened
- Many study subjects now using frequency lowering devices
  - Created challenging in attempting to use SII as measure of audibility

Early Services

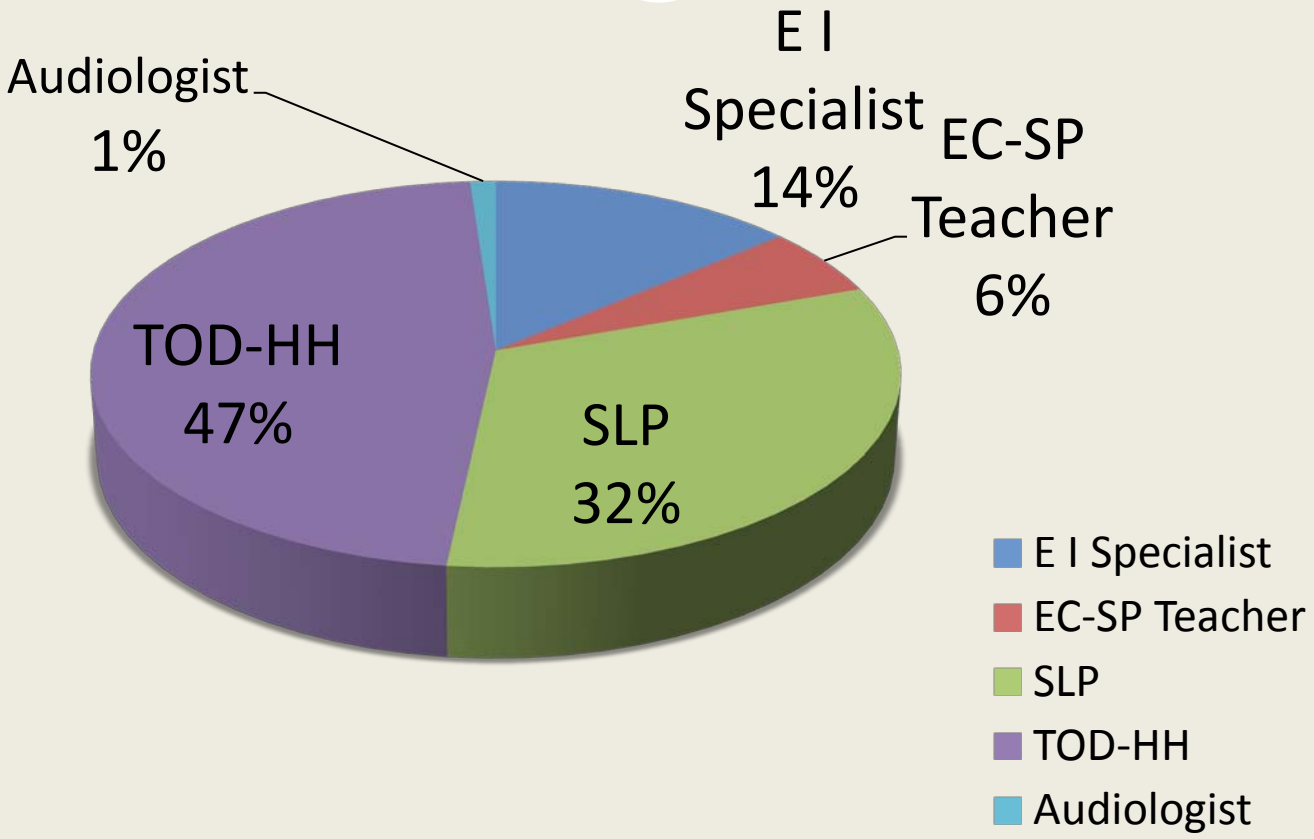
- Service Provider Surveys
  - Once each year child enrolled in study
  - Online response entry
  - Completion of survey rewarded

- Based on 86 unique professional responses
  - Iowa
  - Kansas
  - Missouri
  - Nebraska
  - North Carolina
  - Virginia

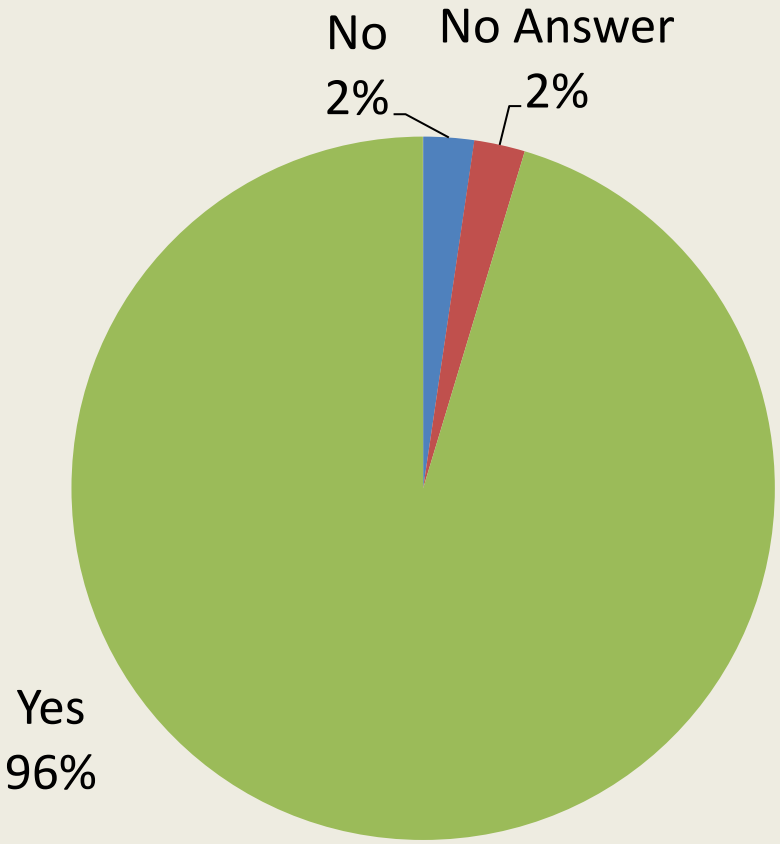
Educational Level



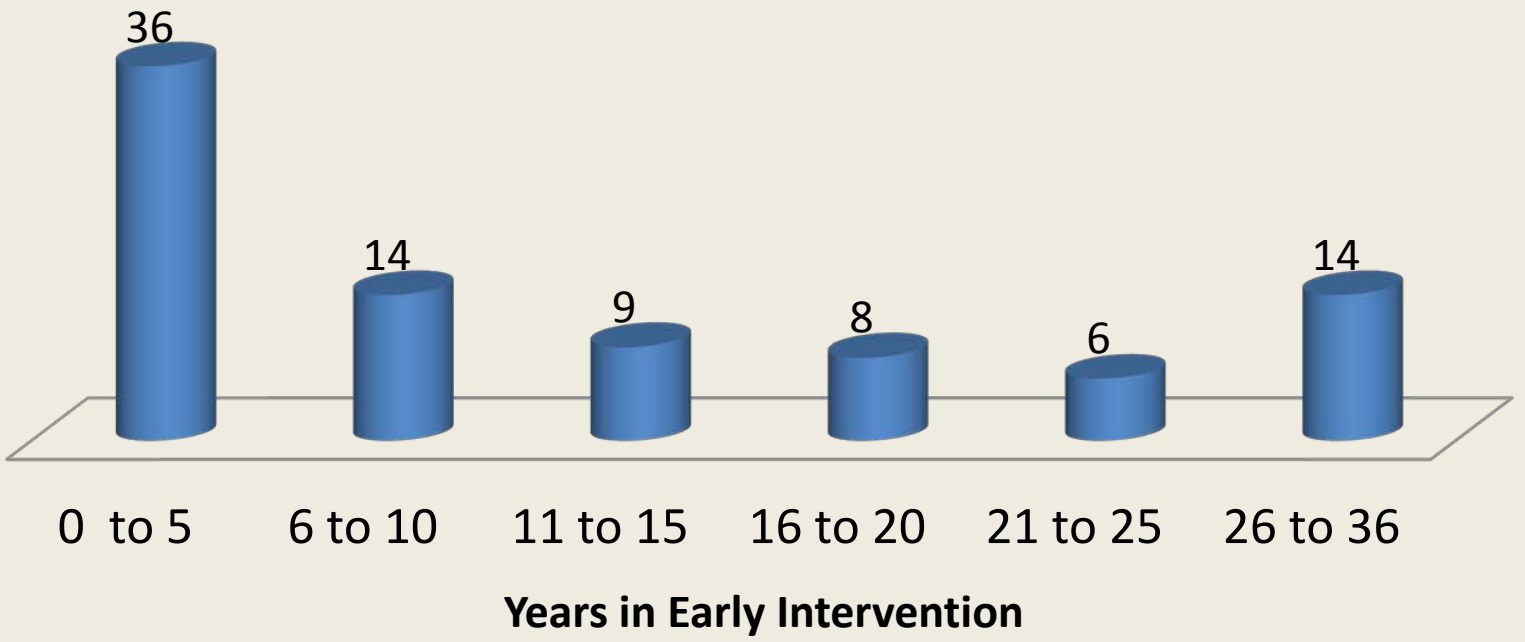
Professional Identification of Service Providers



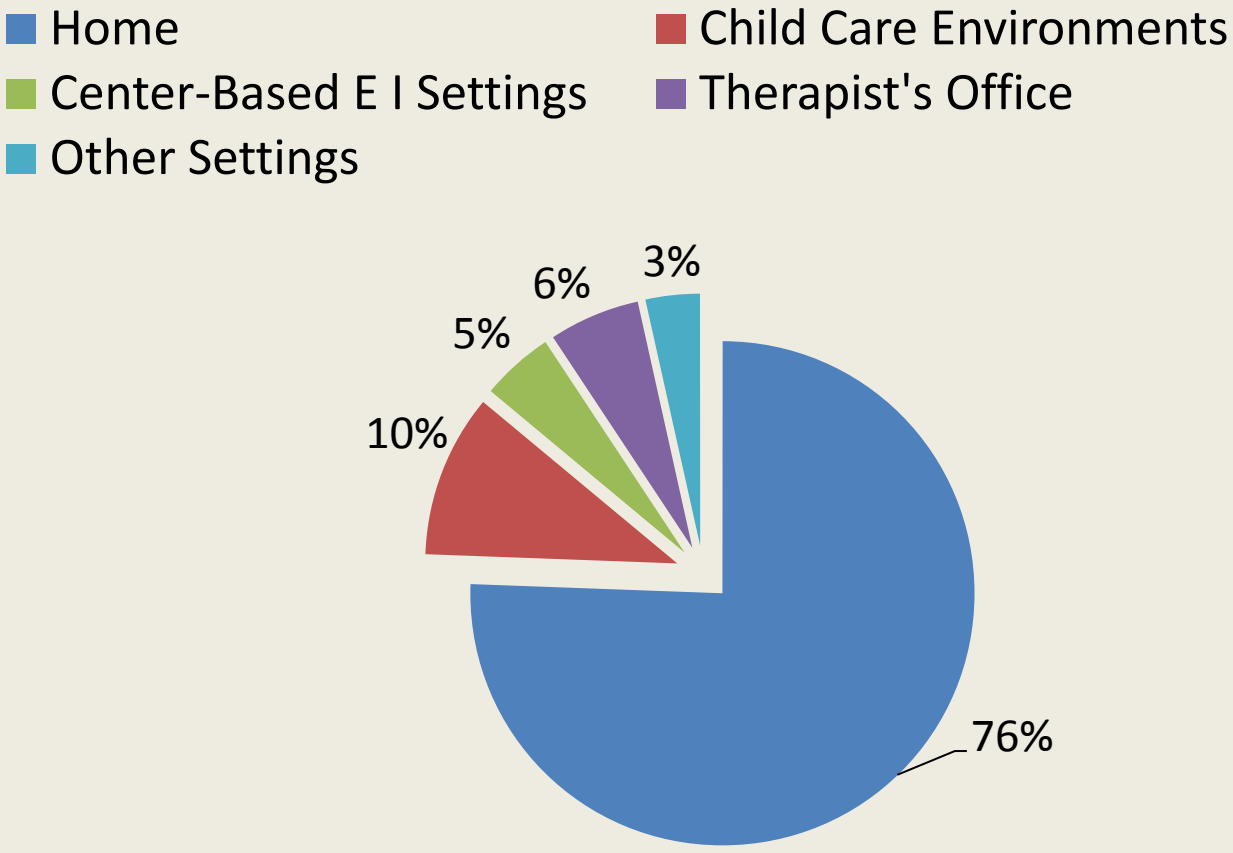
Certification in Employment Area



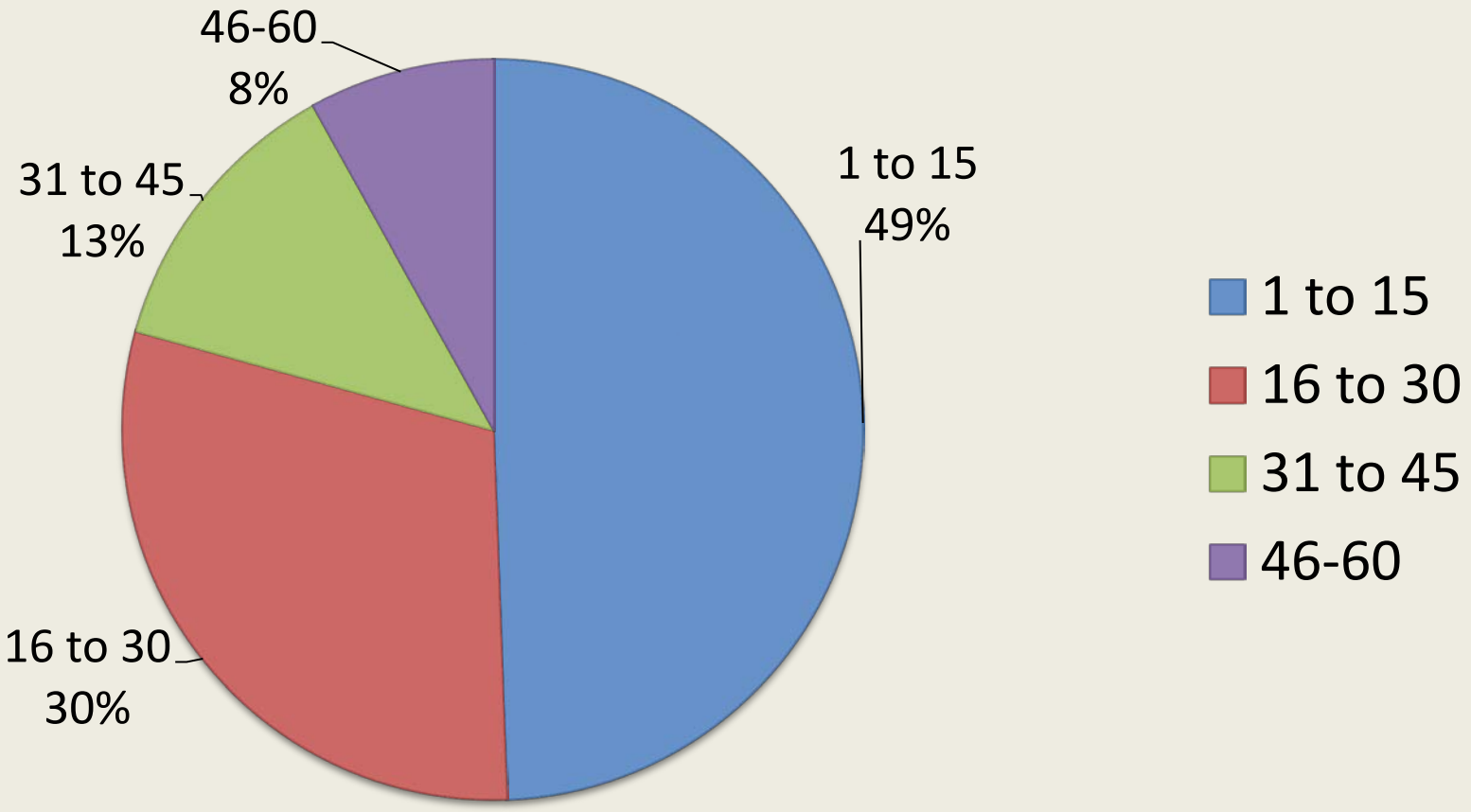
Years Providing Early Services



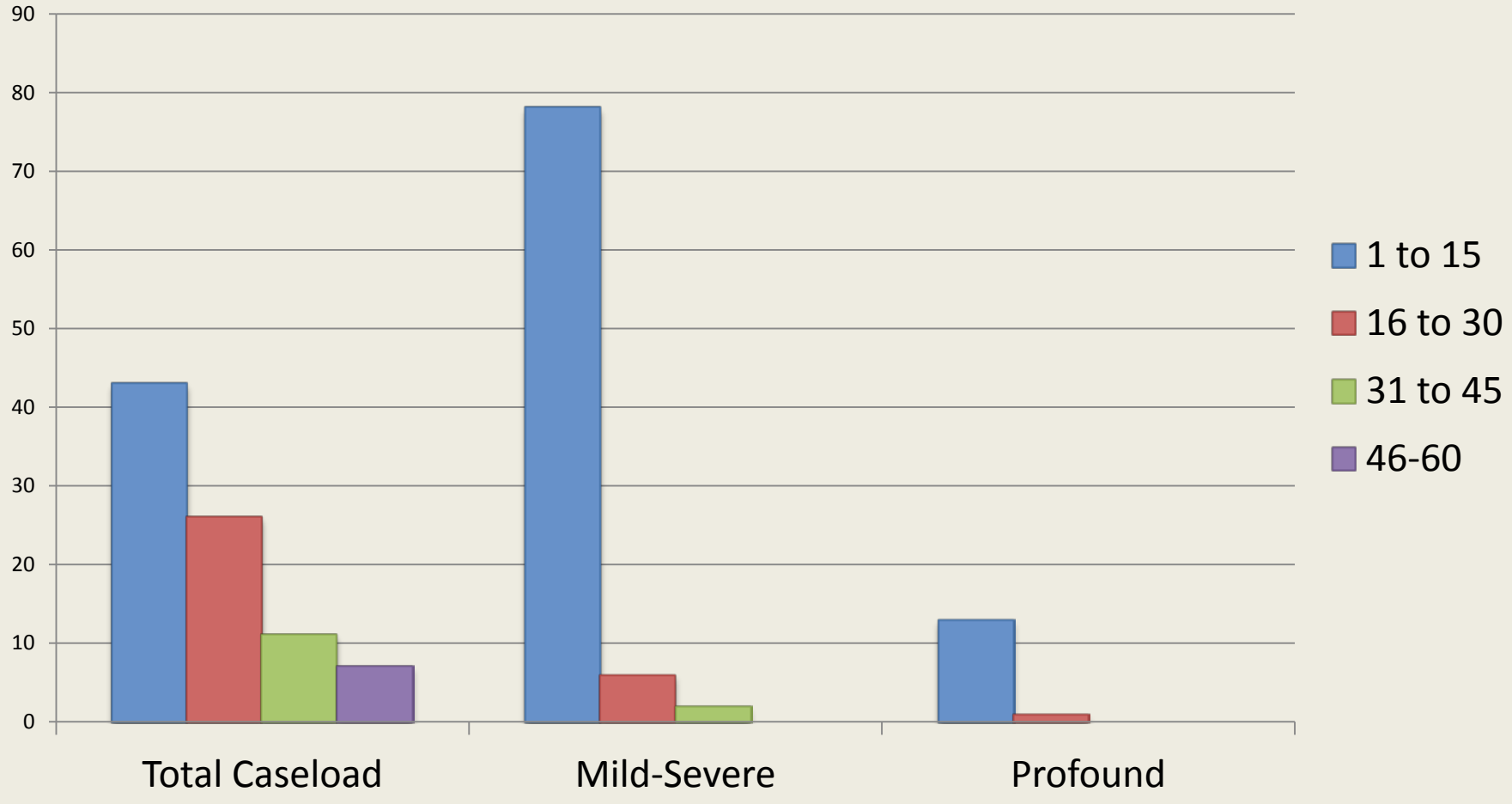
Location of Early Service Provision



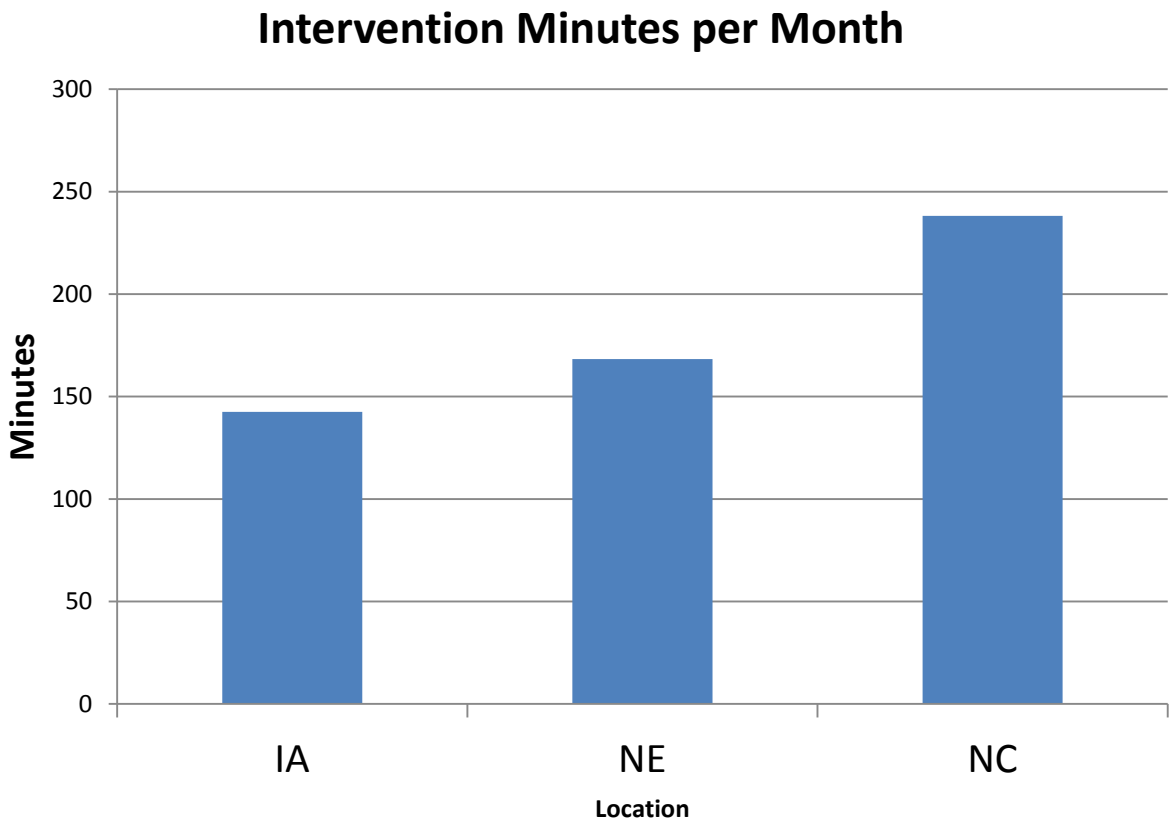
Caseloads Reported



Children with Mild to Severe Hearing Loss on Caseloads



How Much Intervention?



4 x/month most common in NC

Multiple providers more common in NE and IA

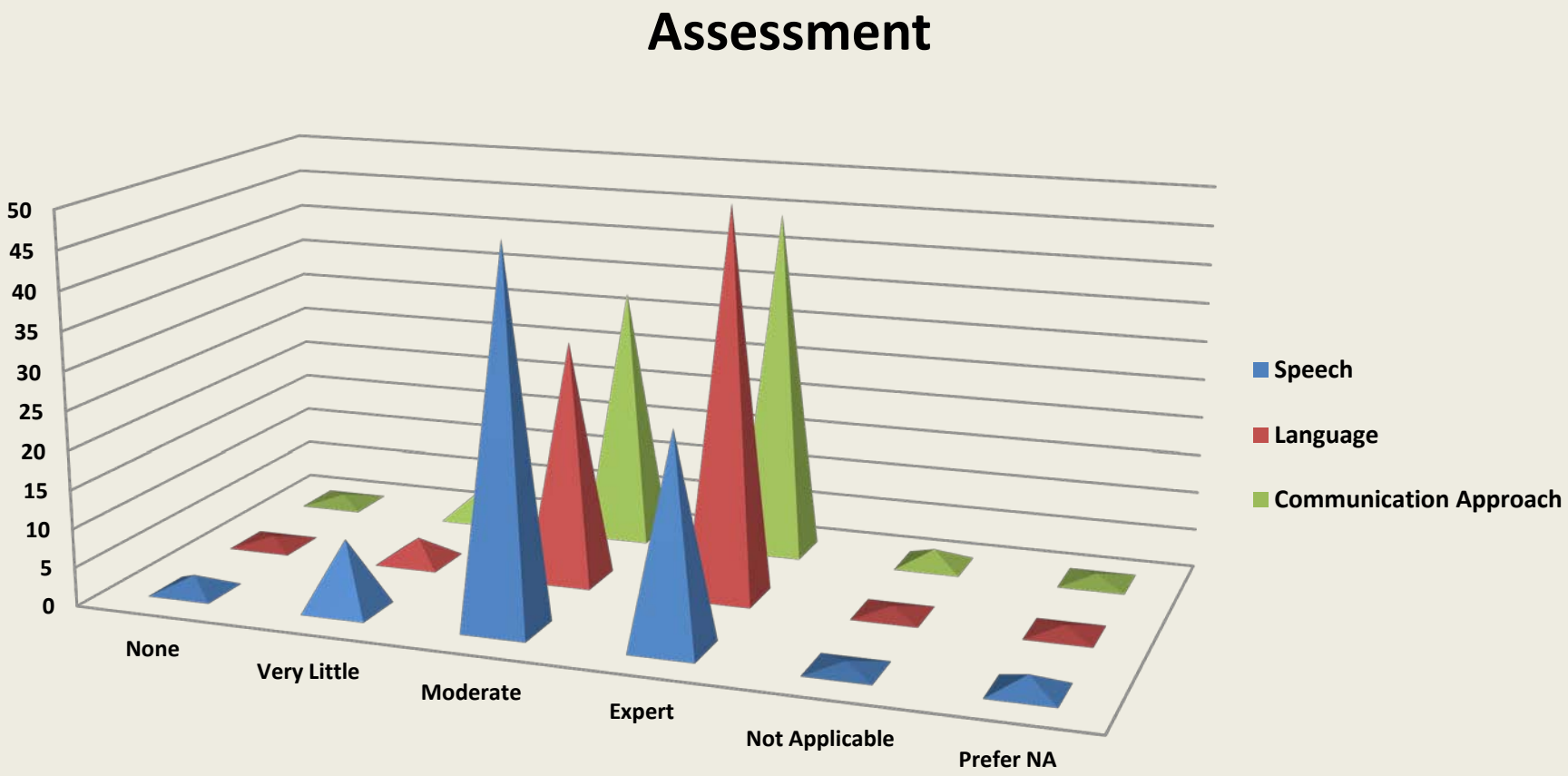
Sessions per month range from .5 to 6

Indicate your Level of Comfort Related to ……

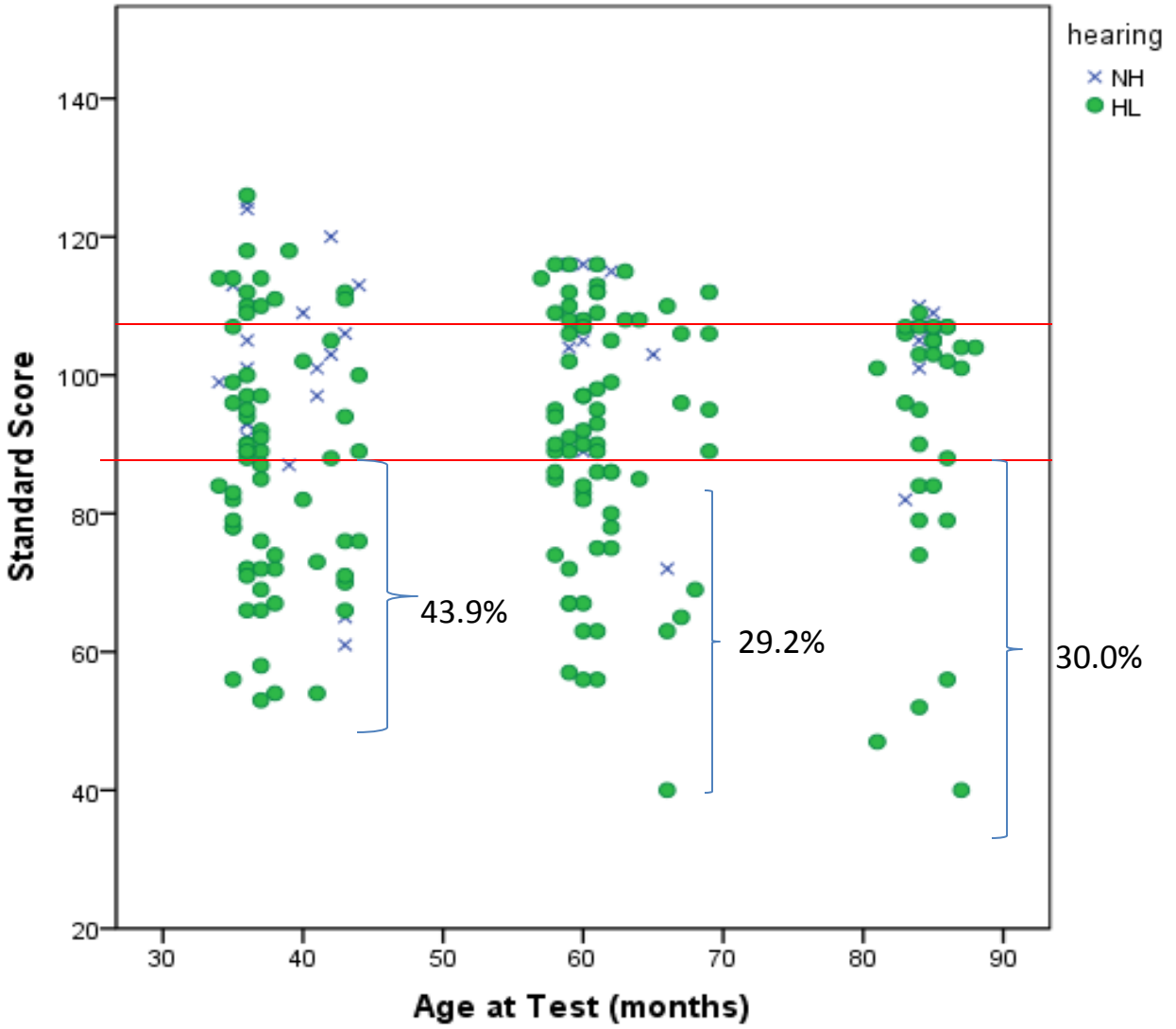
- Assessing
  - Speech development
  - Language development
  - Appropriate communciation approach
- Developmental Strategies
  - Incorporating Language into daily routines
  - Play based language development
  - Vocabulary development
  - Developing oral language
- Establishing Parent-Professional Partnerships
  - Promoting early literay
  - Carryover of language activities at home
  - Carryover of speech activities at home
- Managing Hearing Aids and FM
  - Inserting earlmolds
  - Ling 6 Sounds Test
  - Troubleshooting instruments
  - Using FM effectively

None Very Little Moderate Expert Not Applicable PNA

Professionals' Report of "Comfort Level"

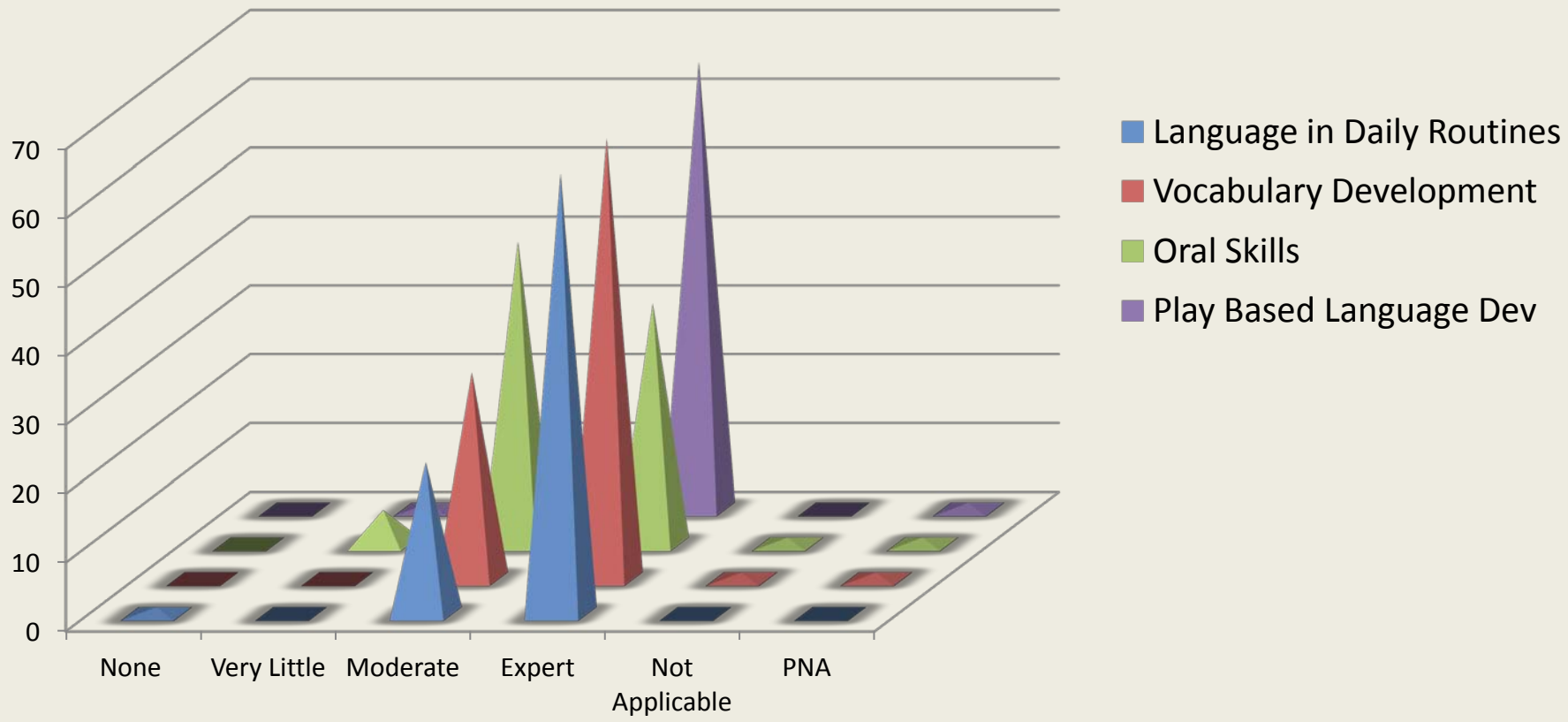


Articulation at 3, 5, & 7 years: GFTA

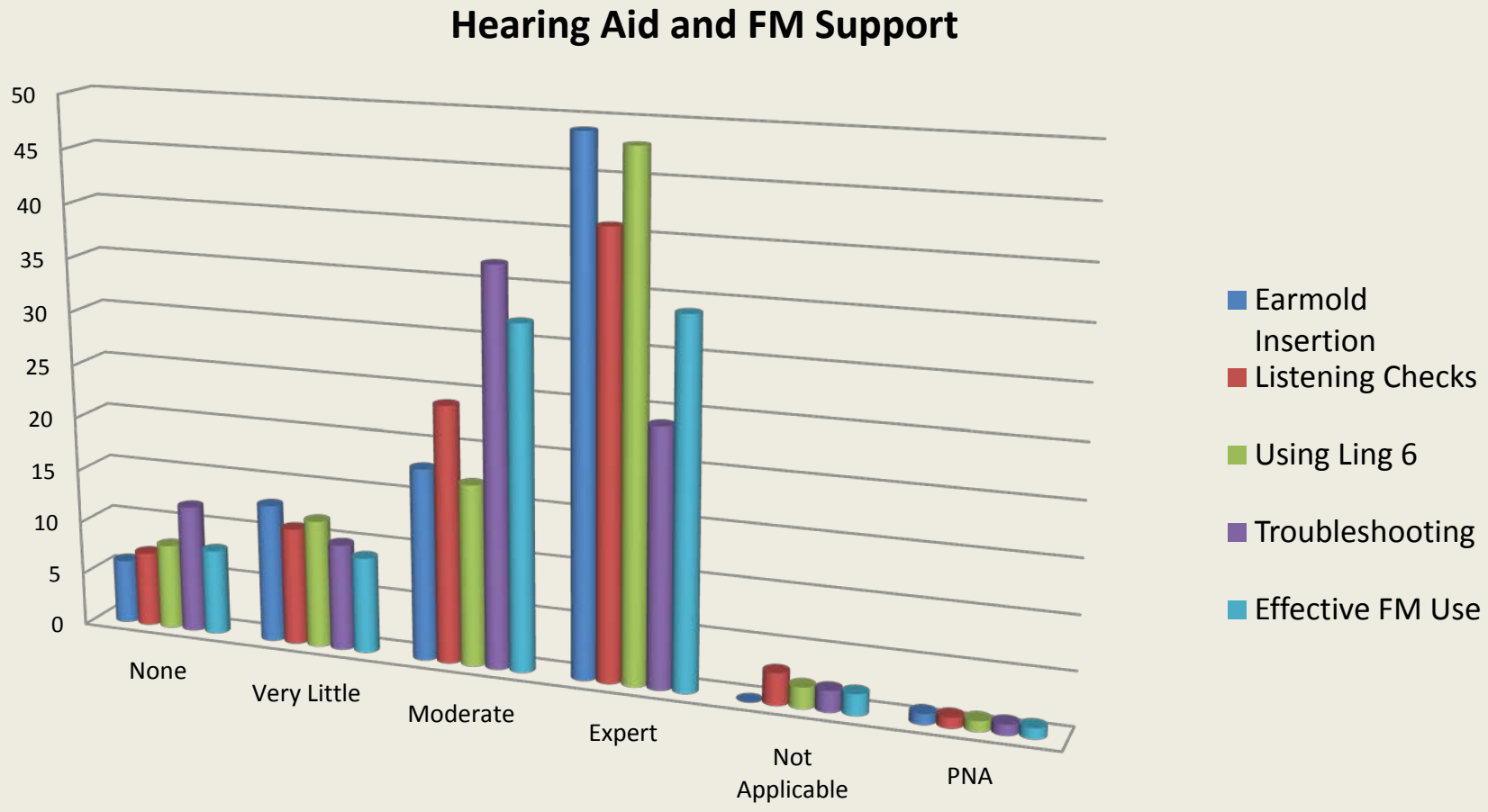


>85
SII=.79
PTA=46.0
<85
SII = .68
PTA = 52.5

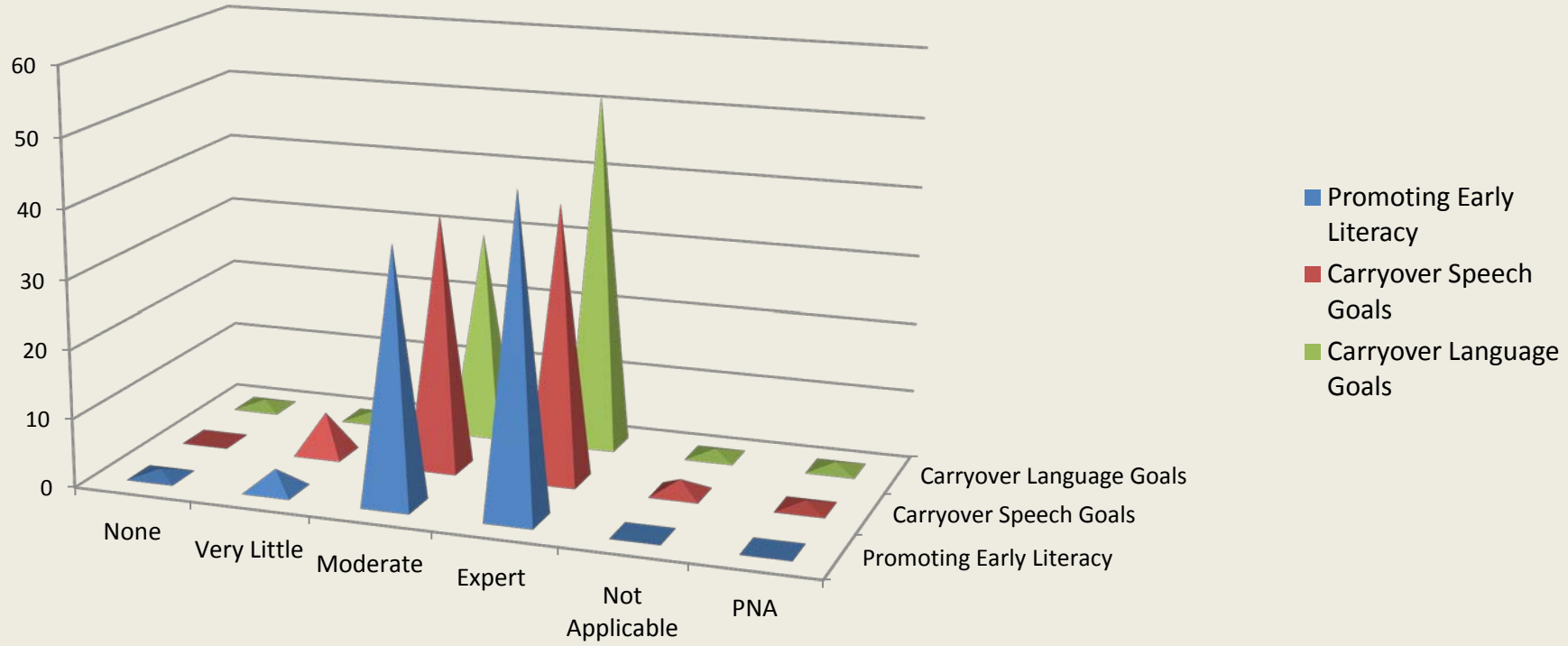
Supporting Communication Development



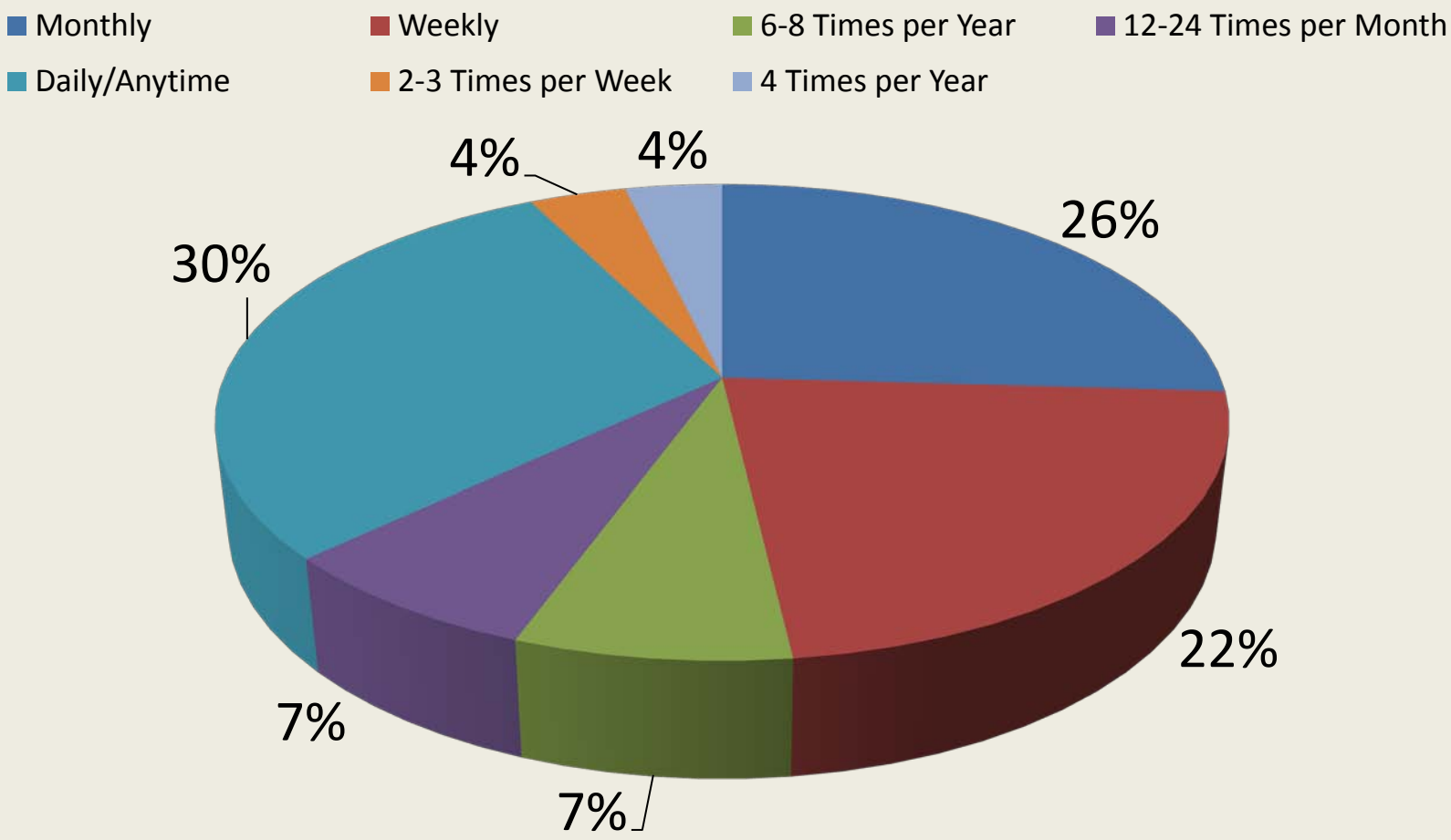
Managing Hearing Aids and FM



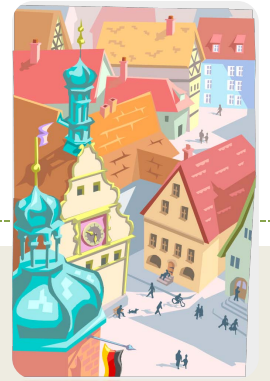
Creating Parent-Professional Partnerships



Frequency of Communication with Child's Audiologist



OCHL Team Members



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Thanks

And thanks to so many parents, schools and professionals!!

Any questions?