Technology-Assisted Language Intervention (TALI) for Young Children who are Deaf/Hard of Hearing (D/HH)

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Cincinnati Children's
changing the outcome together

Conflict of interest

- No conflicts of interest

Learning Objectives

- To recognize the impact of augmentative and alternative communication (AAC) intervention on language learning in children who are DHH

- To understand the factors impacting effect size of alternative communication in children who are DHH

- To describe strategies in early childhood to support AAC readiness in children who are DHH

Motivation for current study

- Recognition of a language gap among children who are D/HH (language outcomes for children who are D/HH continue to hover in the average to low average range)

- Belief that this gap does not have to persist (language levels should be commensurate with cognitive abilities)

- We should address this gap early in novel therapeutic ways when traditional approaches are not sufficient to allow children to meet their cognitive potential

- The theory behind this intervention study is to apply an augmentative communication approach as a teaching tool for language learning in children who are D/HH with language underperformance

Tomblin, 2015; Nittrouer 2014, 2016; Meinzen-Derr, 2014; Luckner 2005; Traxler, 2000

Study Objectives

To determine if high-tech augmentative and alternative communication (AAC) supports within the context of speech-language therapy is effective as a teaching tool to enhance language development among children who are D/HH compared to treatment as usual

We are conducting a randomized control trial to determine the efficacy of the intervention.

Randomized Control Trial

- Intervention (Technology-assisted language intervention-TALI)
  - High-tech AAC intervention (Touch-chat© on an i-pad) within a series of speech-language therapy sessions
- Control (Treatment as usual – TAU)
  - Continue with standard care
  - Given option to cross-over into the technology intervention following the 24 week period
- Language goals and interventions based on specific language gaps and family priorities

Sample Page-Set – TouchChat HD with Word Power

Technology-Assisted Language Intervention (TALI)

- AAC strategies incorporated into speech-language therapy as a teaching tool for more complex verbal language skills

- Provides static visual representations for abstract linguistic concepts, offers grammatically appropriate options

- Can easily add appropriate morphological word endings

- Consistent model for verbalizations and feedback for self-monitoring

- Children were taught to use their own voice to speak the message after creating it

- Active family participation in using aided language stimulation to model more and encourage complex language

Inclusion Criteria

- Children ages 3-10 years with bilateral permanent hearing loss
  - Current focus on 3-5 (majority of sample)

- Non-verbal IQ of $\geq$ 60

- Language "underperformance"

- *Screening visit occurred and determination made PRIOR to randomization*

Language Focused Assessments

- **Language samples**
  - Mean length of utterances- MLU (in morphemes)
  - Number of different words spoken -NDW (in 50 utterances)
  - Mean turn length - MTL
- **Standardized assessments**
  - Clinical Evaluation of Language Fundamentals -5 or CELF-P & Pragmatics Profile
  - Peabody Picture Vocabulary Test
- **Duration and frequency of use (continuous monitoring)**
  - TouchChat's software for monitoring

Other Assessments

- **Neuro-behavioral**
  - Leiter International Performance Scale-3rd edition
  - Behavior Rating Inventory of Executive Function (BRIEF-3)
- **Functional**
  - Vineland Adaptive Behavior Scales
  - Child Behavior Checklist
- **Detailed demographics questionnaire**
- **Health record review**

Study timeline
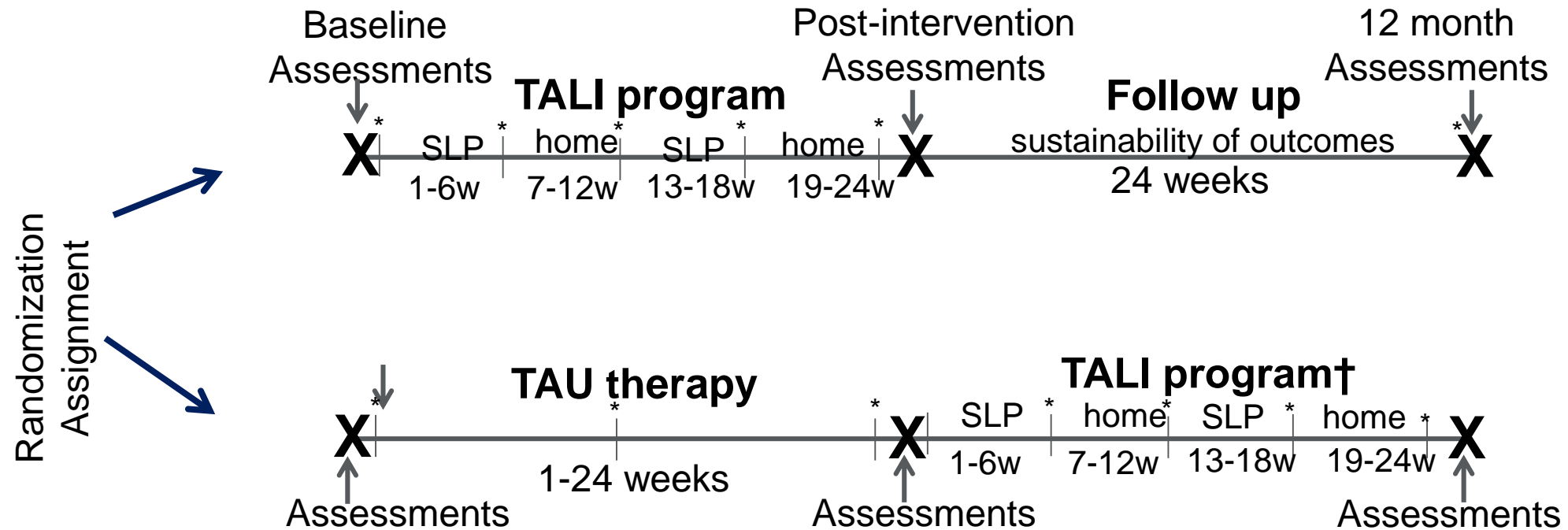
Characteristics of eligible vs. ineligible

CHARACTERISTIC	Eligible N=38	Ineligible N=13
Mean Age in years	6.4 (2.5)	9.1 (2.7)
3-5 years of age	61%	23%
Median Age identification of hearing loss	21 [iqr 2-48]	59 [iqr 18-93]
Gender – Female	50%	54%
Race - nonwhite	32%	8%
Health Insurance - Private	43%	46%
Mom college graduate	45%	54%
Household income <$20k	26%	8%
Use cochlear implants	30%	13%
Nonverbal IQ	97.8 (17)	93.8 (18)

Participant Characteristics

CHARACTERISTIC	TALI N=20	TAU N=18
Mean Age in years	6.7 (2.6)	6.4 (2.4)
3-5 years of age	60%	61%
Median age ident of hearing loss	38 [iqr 2-54]	4.7 [iqr 2-28]
Among 3-5 yr olds	4.5 [4.2-47.1]	3 [1-17]
Gender – Female	50%	50%
Race - NonWhite	30%	33%
Health Insurance – Private only	47%	39%
Mom college graduate	35%	56%
Household income <$20k	30%	22%
Use cochlear implants	25%	35%
Nonverbal IQ	97.4 (17)	98.3 (18)

TALI = technology-assisted language intervention
TAU = treatment as usual

Results:

- Children enrolled in the TALI had statistically significant improvements in:
  - Mean Length of Utterance
  - Mean Turn Length (in total group, but not statistically significant in 3-5 year olds
  - Receptive Language standard scores

Factors impacting effect size of outcomes

- Based on individual data review, no child lost skills in TALI, everyone gained skills
- Age and IQ will impact expected growth of language

- What didn't show up as important:
  - Age of Identification
  - Degree of Hearing loss
  - Maternal education level
  - Private insurance vs Public insurance status

Why we think it is so effective

- Visual component and message construction make auditory message more permanent and accessible

- Highlights low-emphasis language features that are commonly missed

- Children develop skills at an appropriate time developmentally, instead of playing catch up

- Consistent verbal model are paired with visuals

- Independent means to initiate communication and self-monitor (buy-in, control over environment, social engagement, etc...)

Limitations and next steps

- Reproduce in a larger multi-site trial (current pathway)

  – Generalizability

- Use in natural settings/other settings (e.g., schools)

- Understand who would benefit most from treatment

- Evaluate optimal treatment cycles

- Sustainability of results (currently assessing)

What to consider within EI to prepare children who may benefit from therapeutic approach

- **Nonverbally connect:** stay physically matched on child's level, show interest

- **Focus:** use actions and words consistently to facilitate new learning (visuals if possible)

- **Imitate and turn-take**: build in time for a response or imitation during interactions

- **Build:** add to what has already been said or done (action/sound/word)

What to consider, cont.

- **Model** and **honor** all types of communication

- Use **pictures/visual supports** of motivating objects, model pointing to picture or giving it to someone to communicate new messages

- Encourage and differentially **reinforce verbal attempts**

- **Read books together**, look at pictures and encourage talking about them

- Model language as a **shared learning experience** while using visuals

Thank you to participating families and Deaf/Hard-of-Hearing Research Advisory Board

Research Team Members and Collaborators:
- Laura Smith -research coordinator
- Cory Pfefferman – research coordinator
- Jeni Anderson – SLP (interventionist)
- Sandi Grether - SLP
- Ilka Riddle – Co-I/dissemination
- Lindsay Mays – psychologist
- Mekibib Altaye – biostatistician

- All SLPs who care for these children on a daily basis (their cooperation and acceptance was essential)