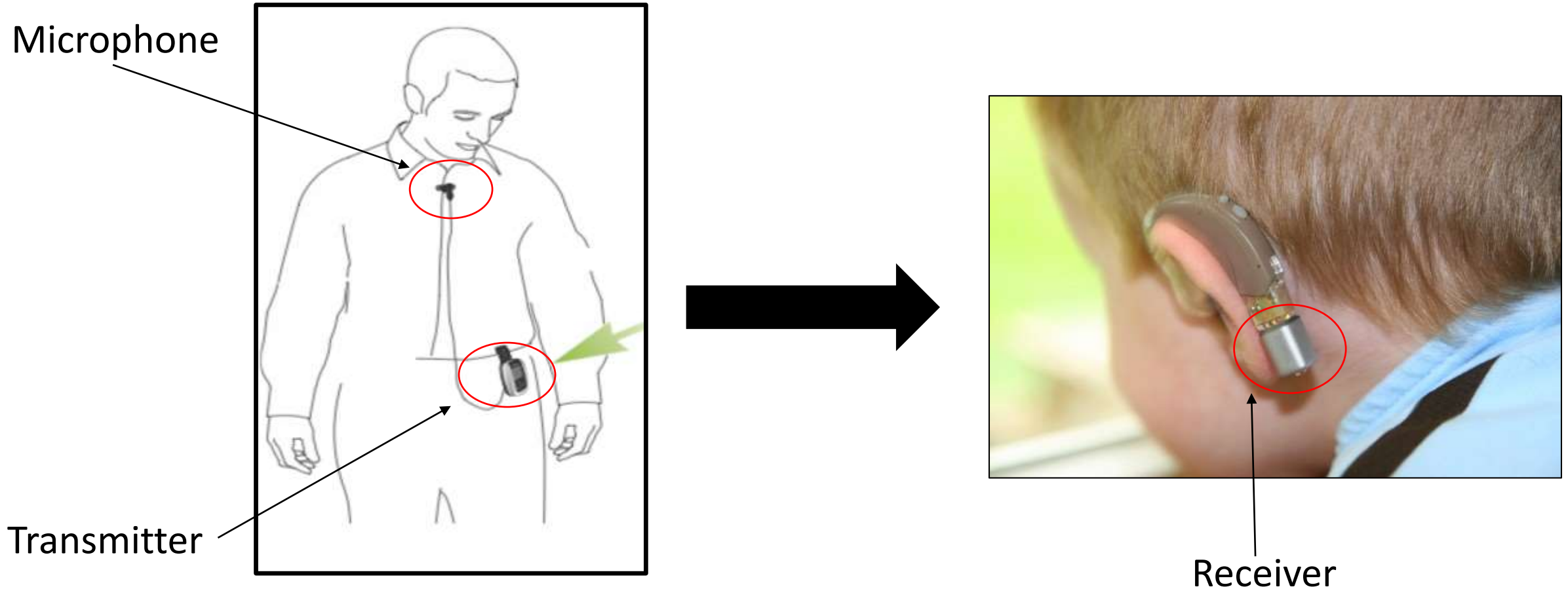


Home-Use of Roger Technology by Children with Hearing Loss

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Department of Hearing and Speech Sciences
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Remote microphone system (RM System)

- Hearing assistance technology



SHOULD CHILDREN WITH HEARING LOSS USE RM SYSTEMS CONSISTENTLY AT HOME?

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American National Standard Acoustical Performance Criteria,
Design Requirements, and Guidelines for Schools



Children spend
60% of their time
at home...

(Silvers et al., 1994)
(Hofferth & Sandberg, 2001)

How noisy are the homes of children with hearing loss?

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Children learn from language coming from a distance



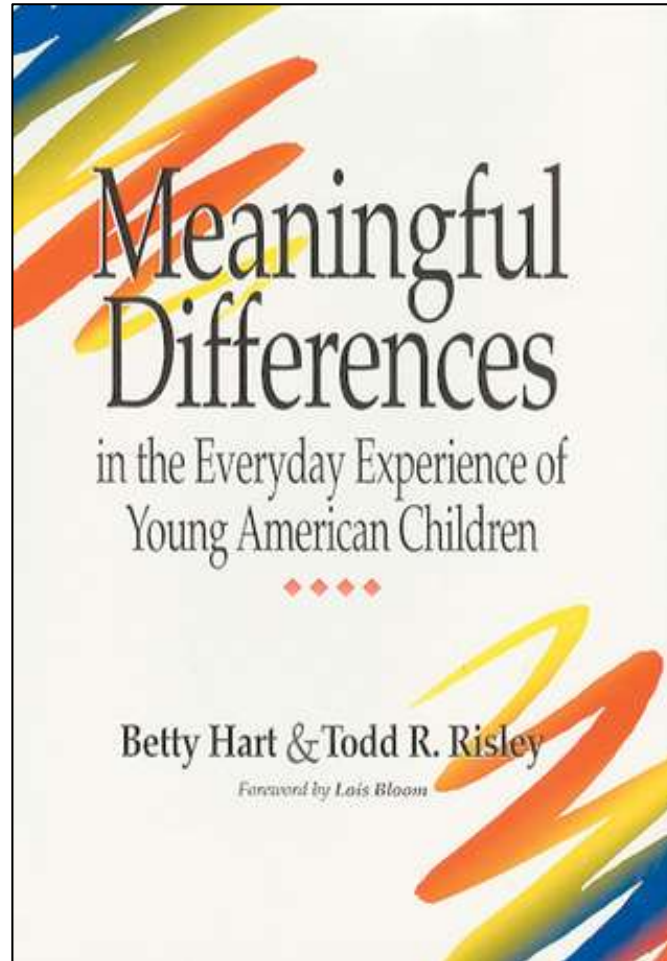
Overhearing is especially important for word learning by 2 ½ years of age



Tomasello & Barton, 1994

Akhtar, 2005

Bloom, 2000



“With few exceptions, the more parents talked to their children, the faster the children’s vocabularies were growing and the higher the children’s IQ test scores at age 3 and later. The most important aspect of children’s language experience is its amount.”

Quantity

The Contribution of Early Communication Quality to Low-Income Children's Language Success

Kathy Hirsh-Pasek¹, Lauren B. Adamson², Roger Bakeman²,
Margaret Tresch Owen³, Roberta Michnick Golinkoff⁴,
Amy Pace¹, Paula K. S. Yust¹, and Katharine Suma²

¹Temple University, ²Georgia State University, ³The University of Texas at Dallas, and ⁴University of Delaware

*“Our results confirm that both the **quantity** of language input and the **quality** of parental sensitivity affected language outcomes. Research spotlights the powerful contribution of the **quality** of the communication foundation co-constructed by the caregiver and the child”*

Therefore...



When used in the home, RM systems might **increase opportunities for children with hearing loss to access quantity and quality language**



Language Development

RM system use in homes of children with hearing Loss

Impact on
Caregiver Talk
Quantity

Impact on
Child-Directed
Speech
Quality

Impact on Child
Responsiveness
& Engagement

Caregiver
Perceptions

Data collection

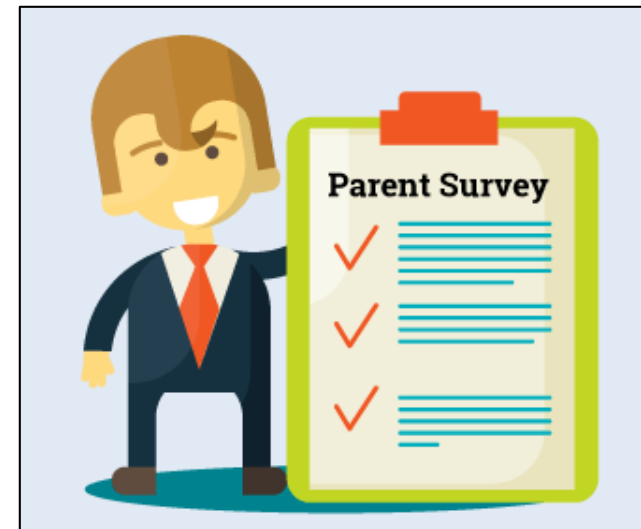
- LENA: Digital Language Processor



- RM System (Phonak ROGER)



- RM System Caregiver Survey



Data collection

NO-RM System WEEKEND



RM System WEEKEND



RM System Caregivers Survey

STUDY 1

JSLHR

Research Article

Remote Microphone System Use at Home: Impact on Caregiver Talk

Carlos R. Benítez-Barrera,^a Gina P. Angley,^a and Anne Marie Tharpe^a

Purpose: The purpose of this study was to investigate the effects of home use of a remote microphone system (RMS) on the spoken language production of caregivers with young children who have hearing loss.

Method: Language Environment Analysis recorders were used with 10 families during 2 consecutive weekends (RMS weekend and No-RMS weekend). The amount of talk from a single caregiver that could be made accessible to children with hearing loss when using an RMS was estimated using Language Environment Analysis software. The total amount of caregiver talk (close and far talk) was also compared across both weekends. In addition, caregivers' perceptions of RMS use were gathered.

Results: Children, with the use of RMSs, could potentially have access to approximately 42% more words per day. In addition, although caregivers produced an equivalent number of words on both weekends, they tended to talk more from a distance when using the RMS than when not. Finally, caregivers reported positive perceived communication benefits of RMS use.

Conclusions: Findings from this investigation suggest that children with hearing loss have increased access to caregiver talk when using an RMS in the home environment. Clinical implications and future directions for research are discussed.

STUDY 2

JSLHR

Research Article

Remote Microphone System Use at Home: Impact on Child-Directed Speech

Carlos R. Benítez-Barrera,^a Emily C. Thompson,^a Gina P. Angley,^a
Tiffany Woynaroski,^a and Anne Marie Tharpe^a

Purpose: The impact of home use of a remote microphone system (RMS) on the caregiver production of, and child access to, child-directed speech (CDS) in families with a young child with hearing loss was investigated.

Method: We drew upon extant data that were collected via Language ENvironment Analysis (LENA) recorders used with 9 families during 2 consecutive weekends (RMS weekend and no-RMS weekend). Audio recordings of primary caregivers and their children with hearing loss obtained while wearing and not wearing an RMS were manually coded to estimate the amount of CDS produced. The proportion of CDS that was likely accessible to

children with hearing loss under both conditions was determined.

Results: Caregivers produced the same amount of CDS when using and when not using the RMS. However, it was concluded that children with hearing loss, on average, could potentially access 12% more CDS if caregivers used an RMS because of their distance from their children when talking to them.

Conclusion: Given our understanding of typical child language development, findings from this investigation suggest that children with hearing loss could receive auditory, speech, and language benefits from the use of an RMS in the home environment.

**Quantity
& Caregiver perceptions**

Quality

STUDY 3

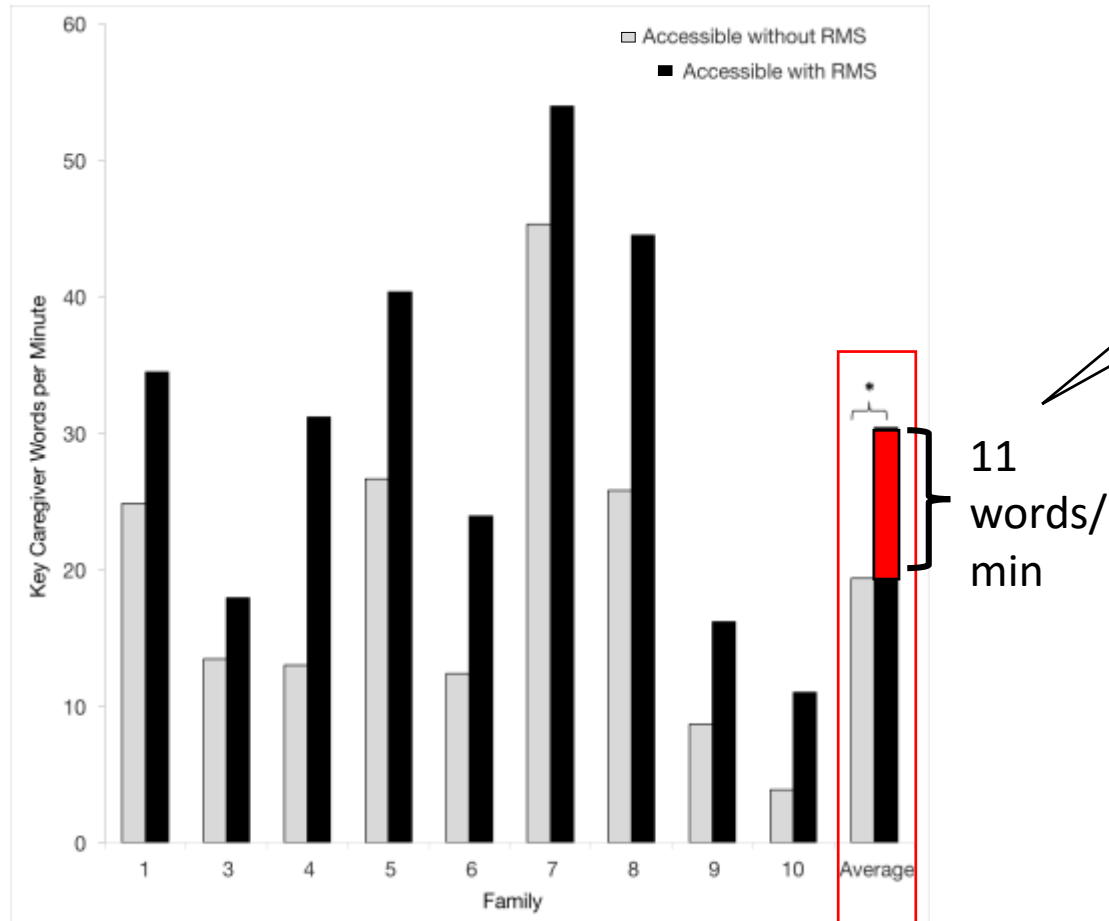
Remote Microphone System Use in the Homes of Children with Hearing Loss: Impact on Caregiver Communication and Child Vocalizations

Journal:	[REDACTED]
Manuscript ID	Draft
Manuscript Type:	Research Article
Date Submitted by the Author:	n/a
Complete List of Authors:	Thompson, Emily; Vanderbilt University, Hearing and Speech Sciences Benitez-Barrera, Carlos; Vanderbilt University, Hearing and Speech Sciences; Angley, Gina; Vanderbilt University School of Medicine, Hearing and Speech Sciences; Woynaroski, Tiffany; Vanderbilt University School of Medicine, Hearing and Speech Sciences Tharpe, Anne Marie; Vanderbilt University School of Medicine, Department of Hearing & Speech Sciences
Keywords:	Children, Hearing loss, Technology, Communication

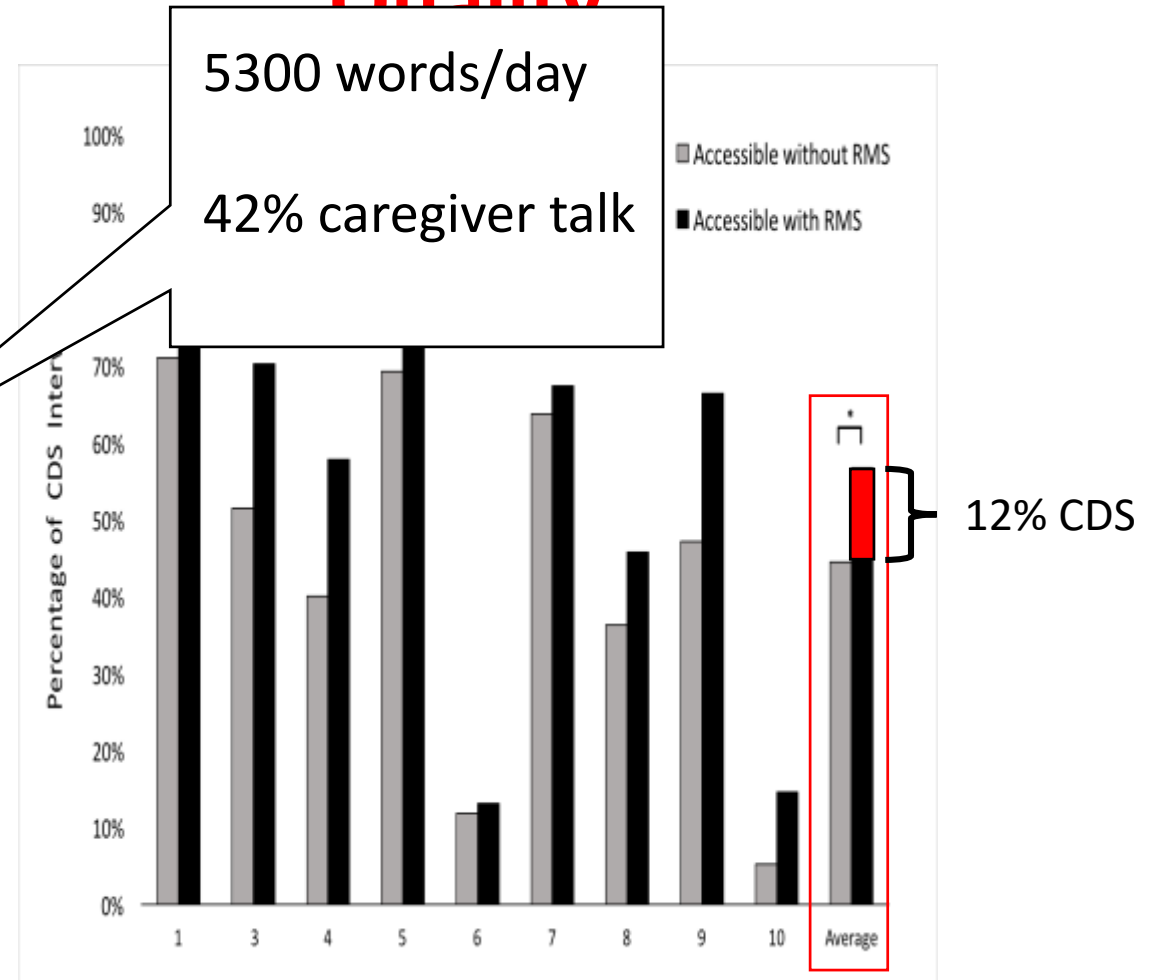
Child responsiveness & engagement

RQ1. Does an RM system provide a child with more access to caregiver talk as well as CDS in the home than when not using an RM system?

Quantity

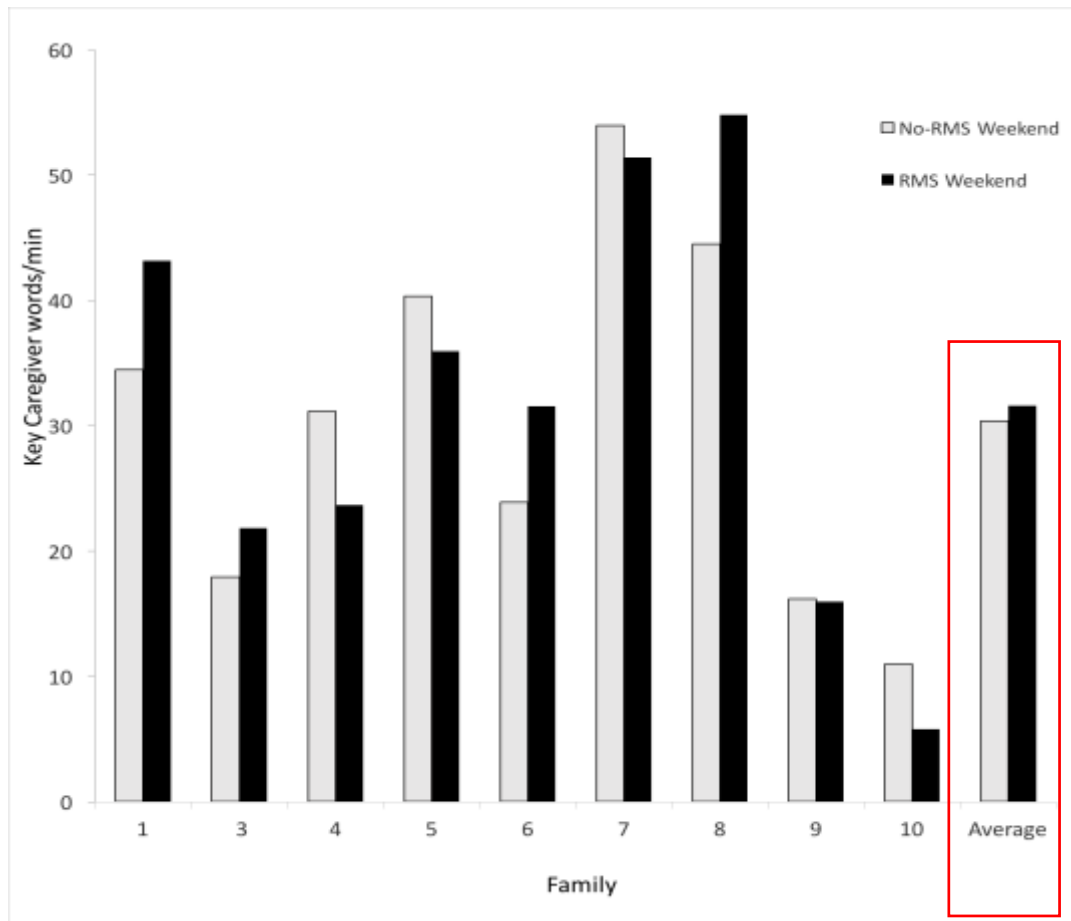


Quality

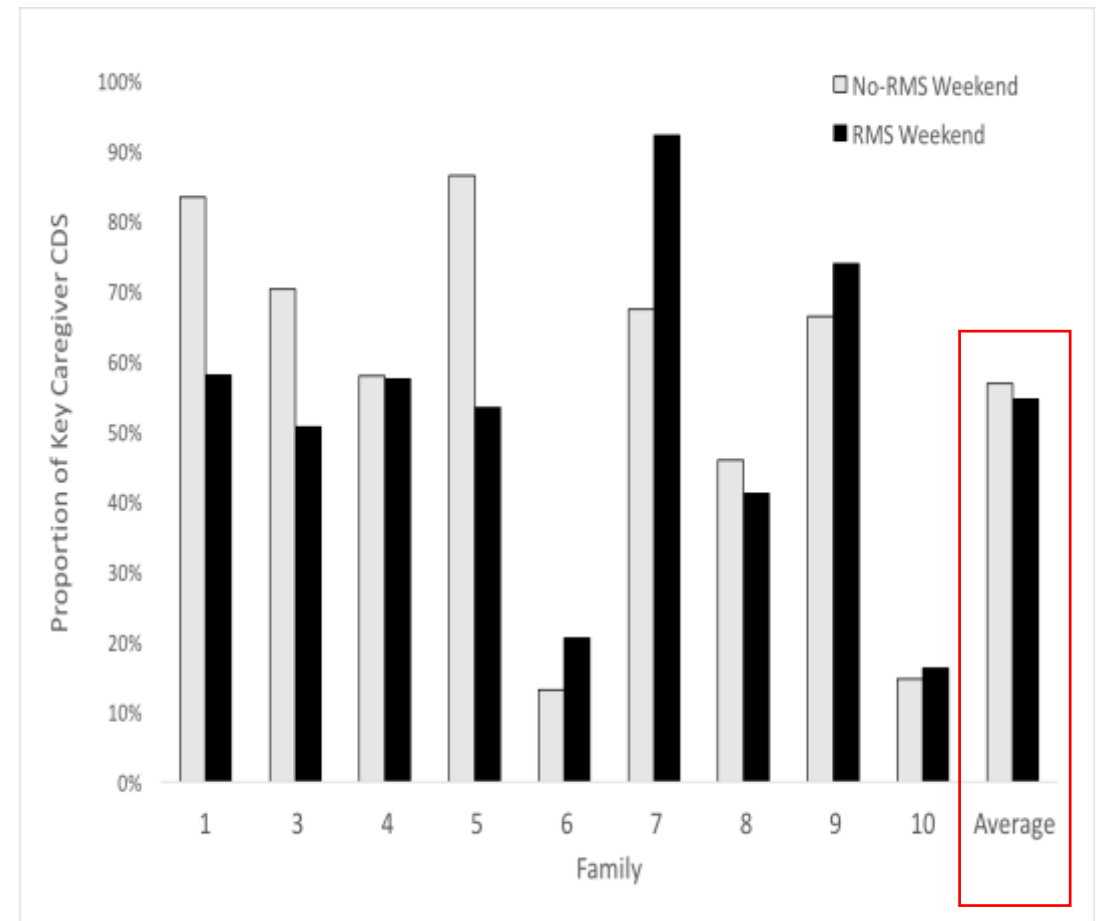


RQ2. Is there a difference between the number of words as well as the amount of CDS caregivers produce when using and when not using an RM system?

Quantity

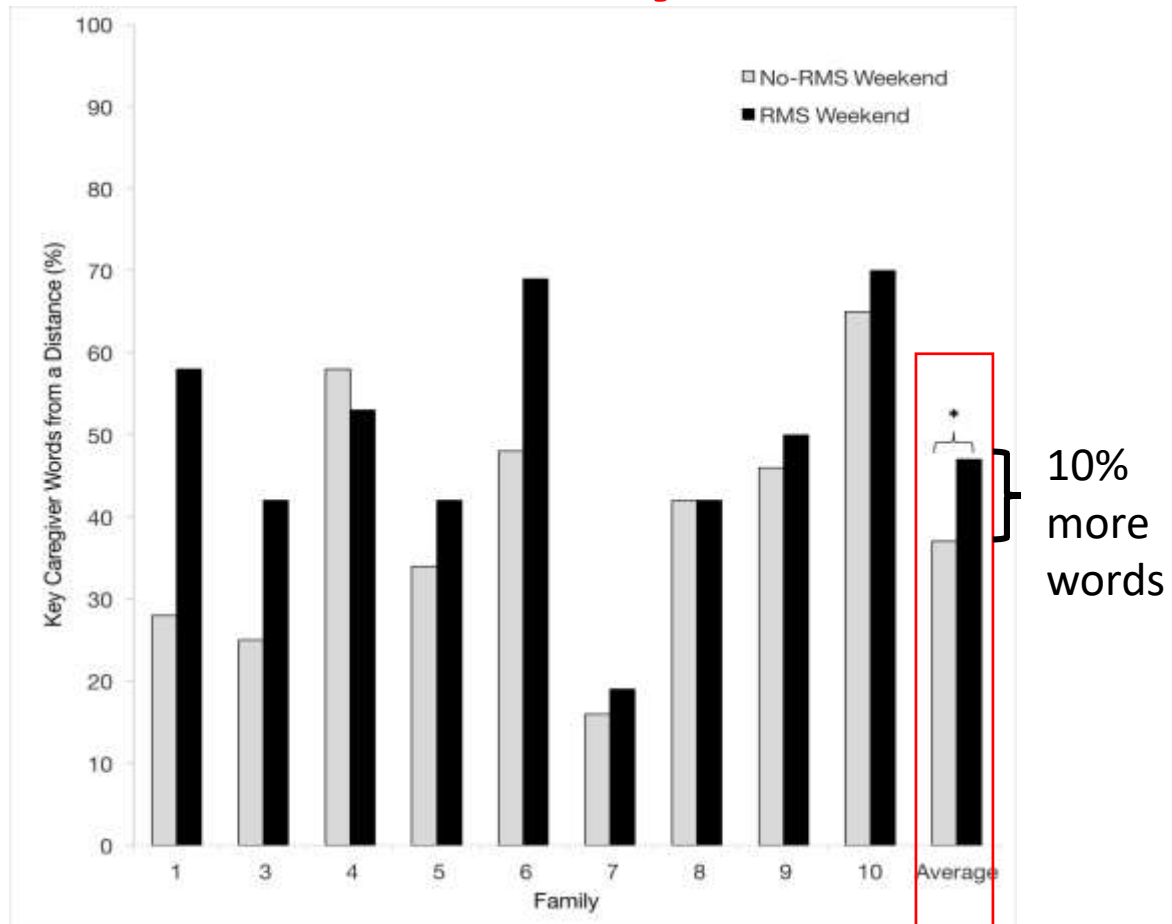


Quality

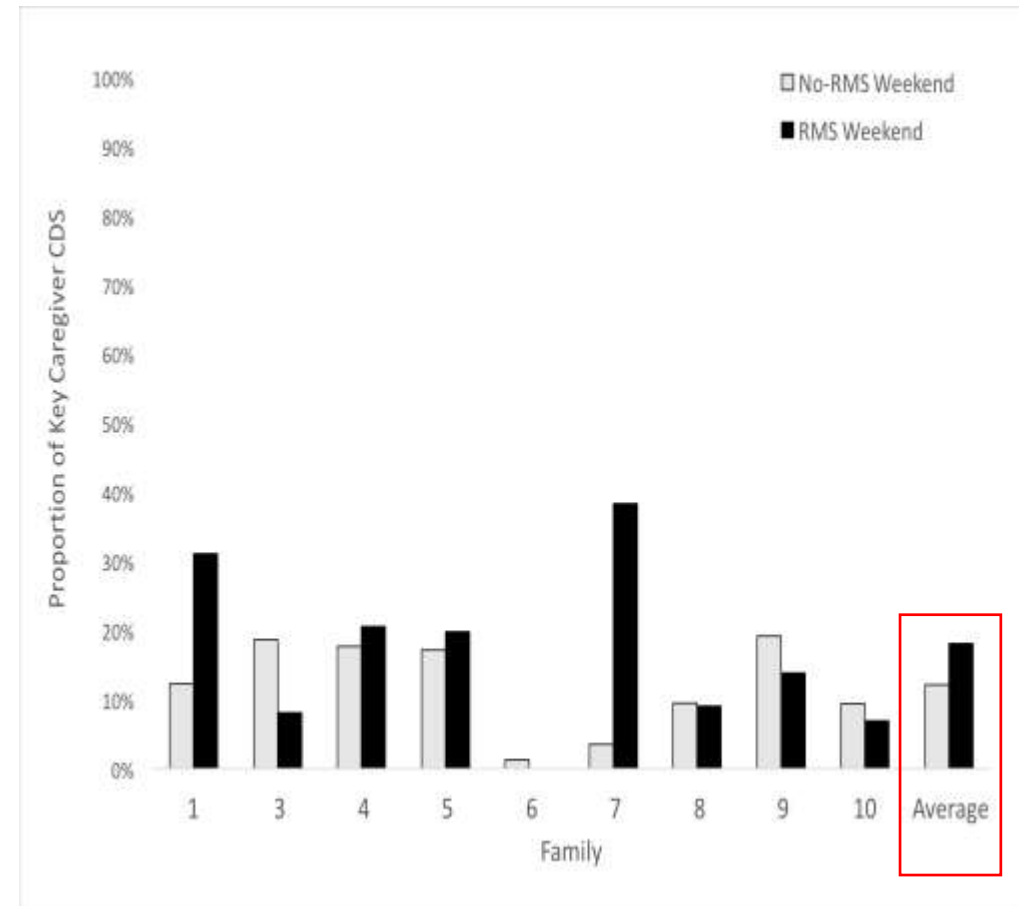


RQ3. Do caregivers produce a greater proportion of words as well as a greater proportion of CDS from a distance when using an RM system than when not?

Quantity

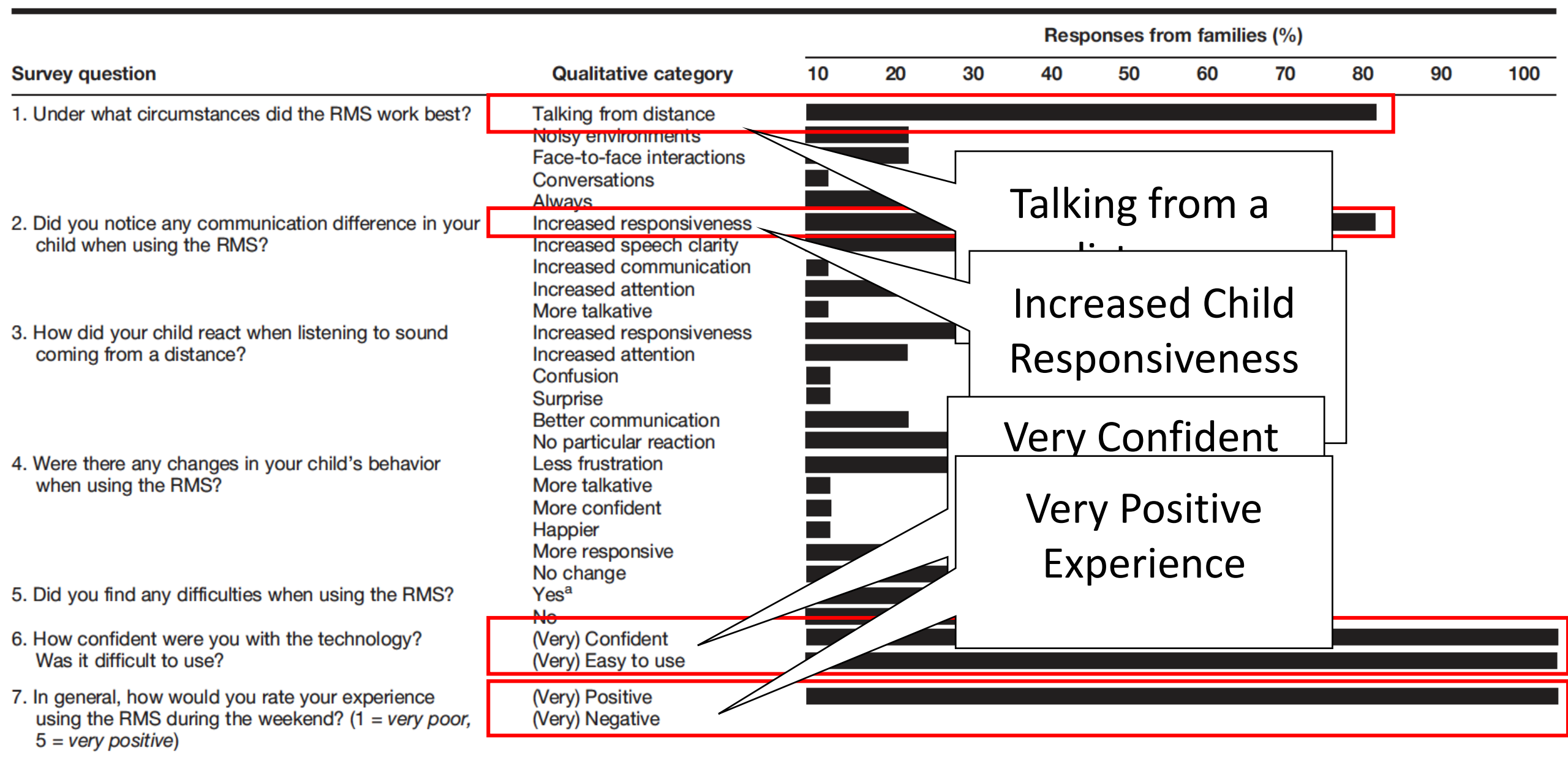


Quality



RQ. Do caregivers reduce the number of repetitions and alerting phrases they use when talking from a distance when using the RM system in the home?

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Note. RMS = remote microphone system.

^aDifficulties with the RMS reported by families included equipment being uncomfortable for the child to wear, difficulty remembering when to mute and unmute the equipment, inconvenience of wearing the extra device (neckloop for bone-anchored and cochlear implant), and siblings wanting to play with the transmitter.

Clinical Implications

When not using the RM system in the home...

Children:

- **Might miss** a significant amount of caregiver talk (~5300 words/day – 42% of caregiver talk)
- **Might miss** a significant amount of child-directed speech (12%)
- This language could potentially be accessible through the use of an RM system, thereby promoting language learning

Clinical Implications

When using the RM System in the home...

Caregivers:

- Produced the same amount of talk as well as the same amount of CDS than when not using an RM system
- Produced **higher amount of talk from a distance** than when not using the RM system
- Produced the same amount of CDS from a distance than when not using the RM system
- Reduced the number of repetitions and alerting phrases they used from a distance
- Indicated high levels of acceptance towards the technology and reported auditory and communication benefits in their children with hearing loss

Conclusion

- **The use of an RM system in the home could provide access to more language to children with hearing loss**
- Exposure to more language quantity and quality is associated with better language skills later in life (Hart & Risley, 1995; Hirshek-Pasek et al., 2015).
- Early access to language is associated with an improved neural language processing as well as the development of cognitive and academic skills (Romeo et al., 2018)
- The use of an RM system in the home could provide auditory, language and communication benefits for children with hearing loss (Curran et al., 2019)

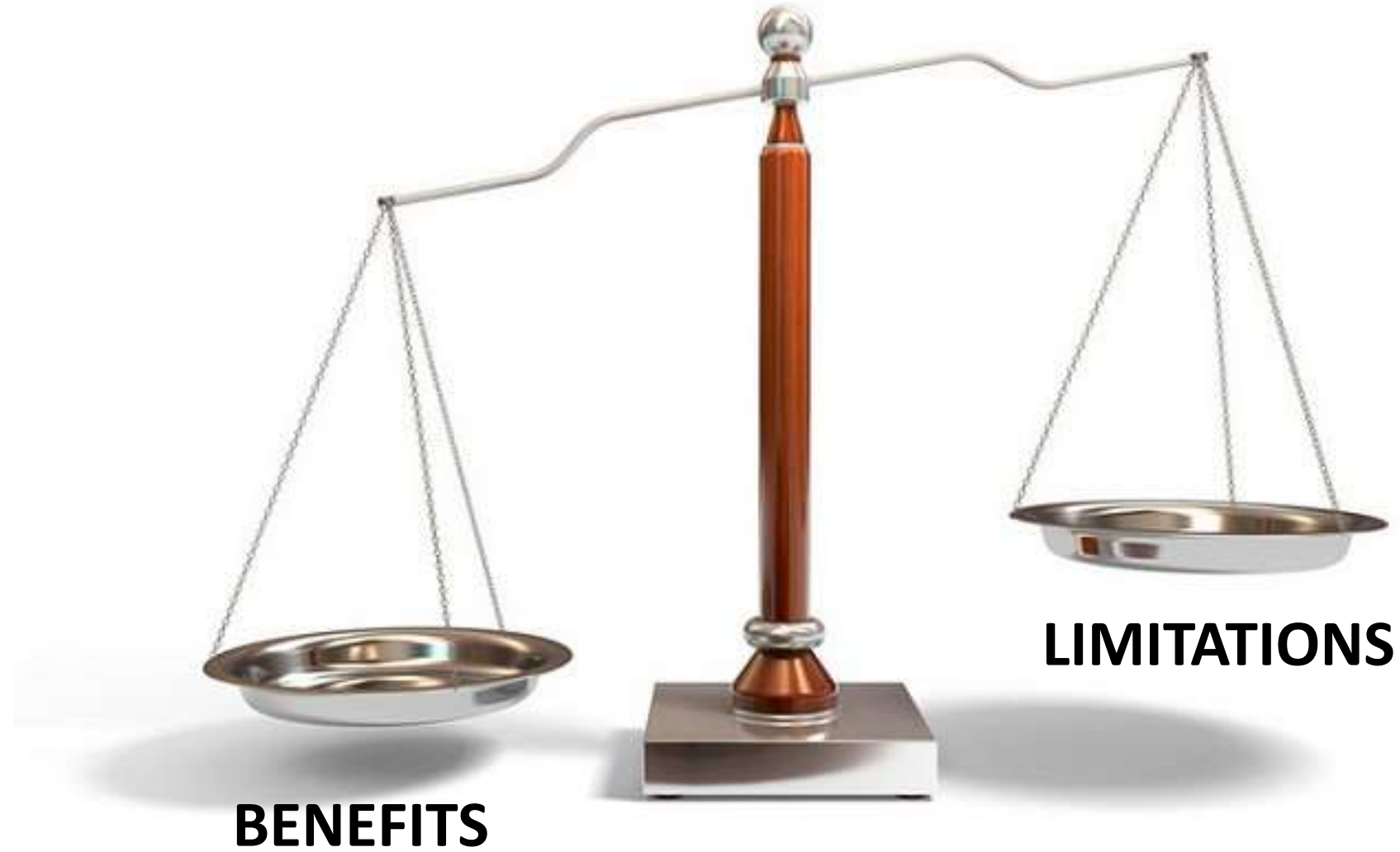
SHOULD CHILDREN WITH HEARING LOSS USE RM SYSTEMS CONSISTENTLY AT HOME?



Caution



- Limited access to speech from other speakers
- Reduced access to visual cues
- Reduced access to auditory distance and localization cues
- Access to excessive or inappropriate speech - Disruptive?



Looking into the future...





Impact of RM System
use at the brain level

PRACTICE vs CLARITY

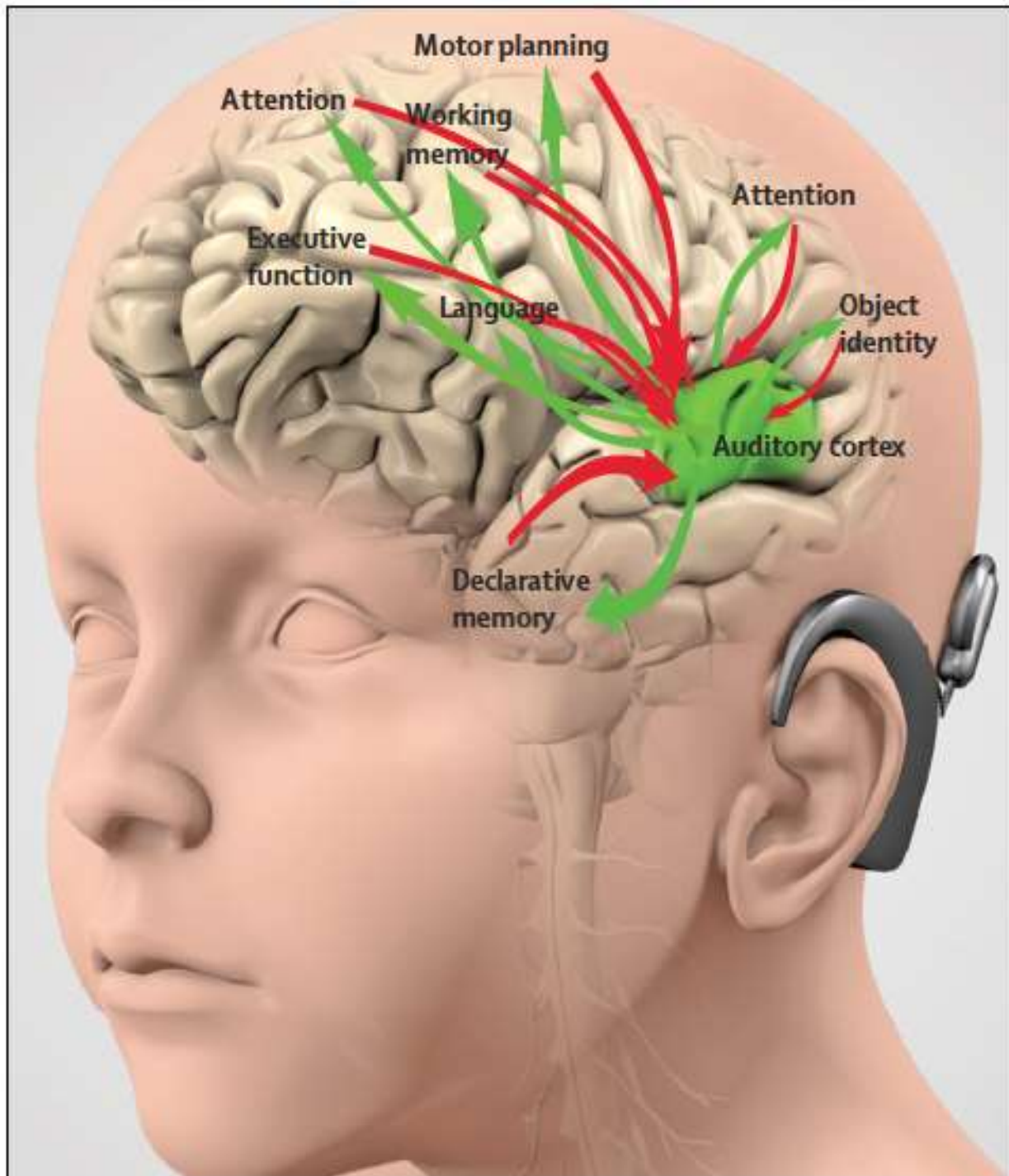


Naïve Brain



Experienced Brain





Connectome Model

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PHONAK

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Families and Children