

Summer 6-24-2014

Hearing Loss and Communication: Evidence for Early Intervention

Louis C. Redpath

Southern Illinois University Carbondale, lredpath@siu.edu

Follow this and additional works at: http://opensiuc.lib.siu.edu/gs_rp

Revised.2

Recommended Citation

Redpath, Louis C., "Hearing Loss and Communication: Evidence for Early Intervention" (2014). *Research Papers*. Paper 540.
http://opensiuc.lib.siu.edu/gs_rp/540

This Article is brought to you for free and open access by the Graduate School at OpenSIUC. It has been accepted for inclusion in Research Papers by an authorized administrator of OpenSIUC. For more information, please contact opensiuc@lib.siu.edu.

HEARING LOSS AND COMMUNICATION: EVIDENCE FOR EARLY
INTERVENTION

by

Louis Redpath

B.S., Southern Illinois University Edwardsville, 2014

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Master of Science

Department of Communication Disorders and Sciences
in the Graduate School
Southern Illinois University Carbondale
August 2014

RESEARCH PAPER APPROVAL

HEARING LOSS AND COMMUNICATION: EVIDENCE FOR EARLY INTERVENTION

By

Louis Redpath

A Research Paper Submitted in Partial

Fulfillment of the Requirements

for the Degree of

Master of Science

in the field of Communication Disorders and Sciences

Approved by:

Dr. Sandie Bass-Ringdahl, Chair

Graduate School
Southern Illinois University Carbondale
06/23/2014

Introduction

Efficient and effective speech and language comprehension and production are a combination of many factors. The sounds that we hear in everyday life are the result of sound pressure waves striking the eardrum and beginning a complex process of the detection and interpretation of sound. Hearing loss in young children and adults impacts how these signals are detected and how they are interpreted by the brain. The inability to detect the auditory signal and/or the transmission of an incomplete signal to the brain may impact the ability to produce speech and develop oral language. To explore this topic, a description of hearing loss and other factors will be presented based on evidence found from peer reviewed articles. Topics of discussion will range from early identification and intervention of hearing loss to child language development.

Impact of Hearing Loss on Phoneme Transmission

Hearing loss results in a person not receiving sound pressure waves to the peripheral hearing mechanism in the same manner as a person with normal hearing. Typical threshold levels (the softest sounds detectable) range from 0dBHL to 20dBHL (Martin & Clark, 2009, p. 53). Speech sounds range from 500-4000 Hz, covering such phonemes as /a/, /u/, /i/, /sh/, /s/, and /m/. If a hearing loss is present at a specific frequency, such as 3000 Hz, he or she may not hear the /s/ or /sh/ phonemes which fall at this frequency unless the signal is amplified to a level which overcomes the hearing deficit.

The /s/ or /sh/ phonemes alone carry little meaning. However, when speech sounds are sequenced together they form morphemes and morphemes form a corresponding thought or image in one's brain (Small, 2012, p. 12). Many speech sounds in an incoming signal will be distorted or absent for those with hearing loss. The degraded signal may cause the person to misunderstand the intended message or hear a different word or morpheme; thereby, altering the words and meaning perceived by the listener. For example, a person may hear /dog/ when the message was actually /dogs/ due to his hearing loss at 3000 Hz. One can imagine how communication would breakdown under these circumstances. Neutralized vowels, such as the /ʌ/ phoneme, are often substituted for phonemes such as /ae/ (Bass-Ringdahl, personal communication, April 2012). Children with hearing loss perceive the /ae/ phoneme differently than their normal hearing peers and may substitute /put/ for /pat/. A variation of the intended message is perceived in these circumstances and communication breakdown often ensues.

Vocalization Development in Children with Normal Hearing

Prelinguistic language development progresses in a predictable sequence in children across the world's languages (Stark, 1980). Vowels and vowel-like productions are the first to emerge in the first six month of life, followed by canonical babbling (Oller & Eilers, 1988). Canonical babbling includes, at a minimum, one vowel and one consonant (e.g., /ba/) and is considered an important milestone in infant vocal development (Oller & Eilers, 1988). Proto words, jargon, and first words are next in the language development sequence. Children use variable intonation and rhythm in the

production of jargon that approximates adult speech. It is important to note that hearing loss can affect a child's ability to perceive variations in intonation. Finally, words emerge around the first year of life. Some children with hearing loss are unable to accurately perceive the speech sounds around them and their language development will reflect this. A delay in any of the stages, especially the onset of babbling, may inhibit later language production (Oller & Eilers, 1988).

Vocalization Development in Children with Hearing Loss

Hearing loss may hinder a child's ability to progress along this oral language development timeline. Children with hearing loss can sometimes learn to produce speech sounds that are visually salient on the speaker's face. Examples of visually salient speech sounds are /m/ and /b/. Other speech sounds are not visible on the lips and can be difficult for children with hearing loss to develop in the absence of complete auditory information. One such example is the /k/ speech sound which is formed in the back of the oral cavity. If a child fails to progress through the typical stages of vocalization development due to the failure to develop canonical babbling, first word production will be significantly affected. Numerous studies have documented significant delays in the onset of babbling and the phonetic inventory in children with hearing loss (Carney & Moeller, 1998). The evidence of later developing canonical babbling in children with hearing loss and its relevance as a precursor for language development illuminate the importance of early identification and intervention.

Importance of Early Language Development

Early language growth is important for later language development. Brady, Marquis, Fleming, and Mclean (2004) suggest that “the best predictors of a child’s future language performance is the child’s current language performance” (Brady, Marquis, Fleming, & Mclean, 2004, p. 663). Research indicates that conversational turns relate to vocal development and provide evidence that children with hearing loss engage in less conversational turns than their typically developing peers. A child can show language delays and be in an environment that does not facilitate language growth; however, hearing screenings and speech and language services can help to overcome this situation. Higher conversational turns relates to more vocal production which allows the child more practice with expressive language (Hart & Risley, 1995). A child who is capable of responding to his/her name or sounds in the environment will likely engage in more conversational turns; hearing loss may inhibit this interaction.

Impact of Early Intervention

Speech language pathologists performing early intervention will assess a child’s early vocalization development including canonical babbling to determine his/her current language ability. From the assessment, one can target typically developing language milestones and perform intervention. It is important to determine a language delay or disorder early in life. Early identification and intervention have been shown to positively effect a child’s ability to acquire language.

Yoshinaga-Itano, Sedey, Coulter, and Mehl (1998) presented important evidence in support of early identification and early intervention in a paper entitled “*Language of*

Early- and Later-identified Children With Hearing Loss". Yoshinaga-Itano et al. (1998) discussed the impact hearing loss can have on a child's academic achievement. According to the authors, hearing loss can cause significant delays in language development and academic achievement. These include the average deaf student graduating from high school with language and academic achievement levels below that of the average fourth-grade hearing student as well as students with reading scores at the fifth-grade level (Yoshinaga-Itano, Sedey, Coulter & Mehl, 1998).

Yoshinaga-Itano et al. (1998) attempted to eliminate certain factors that might influence her independent variable, early identification. Therefore, she controlled cognitive ability, communication mode, age at testing, minority status, degree of hearing loss, gender, socioeconomic status, and the presence or absence of additional disabilities in her investigation.

Yoshinaga-Itano et al. (1998) obtained data for 150 participants who were deaf or hard of hearing and placed them into two groups; the first group represented children identified early for hearing loss (prior to six months) while the second group represented children identified later (after six months). Ninety-six percent of the participants were enrolled in the Colorado Home Intervention Program in order to control the type and frequency on intervention each child obtained.

The authors attempted to obtain a large enough sample population so that contributing factors were equally represented in groups 1 and 2. They performed between group t-tests to statistically show each group represented an equal proportion of participants. For example, socioeconomic status was determined by reviewing the primary caregiver's level of education and Medicaid status. The authors reported no

significant difference between groups 1 and 2. Additionally, the authors reviewed the mode of communication used by the age-of-identification groups. A proportion of both groups used a combination of sign language and spoken language and a proportion of both groups used spoken language only when communicating with their child. Again, no significant differences were found when comparing the distribution of mode of communication among the early and later identified groups. The same method was employed when comparing additional disabilities where no significant differences were found.

However, cognitive status was found to vary significantly between the early identified group 1 and the later identified group 2. Because the authors did not want cognitive status to vary between groups 1 and 2, they further separated the groups into subcategories (i.e., early identified normal cognitive status, early identified lower cognitive status, later identified normal cognitive status, and later identified lower cognitive status). Essentially, the early identified group without cognitive delay was compared to the later identified group without cognitive delay—which represented 85 participants. The same was done for the 65 children presenting with cognitive delay. In this manner, the authors could again compare the two groups based on age of identification alone.

In order to compare the groups, the authors chose to utilize a broad developmental evaluation, the *Minnesota Child Development Inventory* (MCDI). This test evaluates various areas of development. For this investigation, the authors chose the expressive language and comprehension-conceptual (receptive language) portions of the MCDI. The authors converted the results into a language quotient (LQ) which

was found by “dividing the child’s age score on each MCDI subtest by his or her chronologic age and then multiplying by 100” (Yoshinaga-Itano et al., 1998, p 1164). Additionally, a child’s cognitive quotient (CQ) was determined based on the Play Assessment Questionnaire. The authors reported a child’s CQ to be positively correlated with a child’s expressive and receptive LQ obtained from the MCDI. Scores were obtained for all participants and the resulting data were statistically analyzed. Yoshinaga-Itano et al. (1998) compared the difference between participant’s cognitive quotient (CQ) and language quotient (LQ) among the two groups of children with hearing presenting with normal cognition. The only variable that differed between the two groups was age of identification. The group identified before six months presented with less of a discrepancy between CQ and LQ than did the later identified group. The evidence suggests that a child’s LQ was affected by early identification and intervention and not his or her cognitive ability. Furthermore, statistical analyses revealed the effect to be “consistent across all of the demographic subgroups tested” (Yoshinaga-Itano et al., 1998, p 1168). The authors surmised that the participants in their study had higher expressive and receptive language abilities solely based on early identification and intervention.

Impact of Age at Intervention and Family Participation on Child Outcomes

Moeller (2000) set out to expand on the research performed by Yoshinaga-Itano et al. (1998). Moeller agreed that children performed better on language outcomes when early identification and intervention occurred prior to six months of age. However, it was unclear if the language advantage continued as the children grew older. Moeller

conducted a study where language outcomes were measured among children with hearing loss in relation to their age of enrollment in intervention. She gathered data from 112 children and placed them into groups based on age of identification—which included 0<11 months, 11.1-23 months, 23.1-35 months, and more than 35 months. The degree of family involvement was a secondary factor explored. All children were enrolled in the Diagnostic Early Intervention Program (DEIP) for six months before a referral was made to 1 of 2 early intervention programs. The language intervention programs were designed specifically for children who are deaf or hard of hearing and represented auditory/oral communication and total communication (TC) modalities. The author stated that each program “implemented similar curricular approaches for language intervention” (Moeller, 2000, p3).

Moeller (2000) collected data on nonverbal intelligence, language measures in the form of vocabulary skills and verbal reasoning skills, and family involvement. Moeller retrieved data from a clinical psychologist who specialized in obtaining developmental assessments and verbal intellectual measures; a variety of tests were utilized based on clinical judgment and all children were found to have, at minimum, an average intelligence. Language measures were collected at approximately five years of age for each participant; specifically, vocabulary and verbal reasoning skills were assessed and served as the primary focus when comparing age of identification and its relation to language outcomes. Vocabulary skills were assessed using the Peabody Picture Vocabulary Test (PPVT) as a measure of receptive language. Vocabulary reasoning was assessed using the Preschool Language Assessment Instrument (PLAI).

Finally, a family involvement rating was calculated based on clinical judgment with interrater reliability scores calculated to reduce variability.

Moeller compared the above factors to explore the correlation between age of enrollment and language skills at five years of age. Verbal intelligence and a child's vocabulary were seen to be significantly related. Future research could benefit from determining if the age groups tested proportionally represented statistically similar verbal intelligence. Moeller (2000) stated that verbal intelligence for all participants was no less than average (Moeller, 2000, p. 3). It is inferred she took into account verbal intelligence when she stated, "Earlier enrollment in intervention services was associated with significantly stronger language outcomes at 5 years of age", and that verbal intelligence did not skew the results when reporting a positive correlation between age of enrollment and language outcomes (Moeller, 2000, p4). Moeller found that the later a child was enrolled in intervention, the lower his or her vocabulary scores. These results indicate that the average vocabulary of children enrolled earliest approximated that of peers with normal hearing—an outcome that shows children can catch up.

Moeller (2000) continued by presenting the combined effects of early enrollment and parent involvement. She found vocabulary scores were 2 standard deviations below age expectations (range of 56.5 to 62.5) for children identified late and who had low family involvement. Conversely, children who were enrolled early and had strong family involvement had vocabulary scores in the range of 80-90. It is evident that the combined factors of early enrollment and family involvement had a positive effect on a child's vocabulary. Moeller (2000) found a similar trend for verbal reasoning when comparing early enrollment and family involvement. It can be argued that early

enrollment and strong family involvement represent two key factors for higher language outcomes based on the evidence provided.

Clinical Implications

Brady, Marquis, Fleming, and Mclean (2004) explored the relationship of current language level and the prediction of later language development. From their research, clinicians have additional evidence supporting the importance of determining a child's current language. Standardized assessments are paramount in determining delays in speech and language. In addition, an SLP must have knowledge of the typical speech and language development to serve as a basis from which to compare children with delays.

An additional clinical implication derived from the research is the importance of early intervention for children who are hard of hearing. A substantial difference in language development was noted for children enrolled early when compared to those who were enrolled late. Moeller (2000) provides evidence for early intervention programs and will help clinicians who advocate for children with disabilities. This evidence may help to convince lobbyists or politicians not to cut funding for early identification and intervention programs. Parents with children exhibiting speech and language delays may be more motivated to enroll in clinical programs targeted for early intervention. The possibilities and implications of the reviewed research are vast.

Future Research

Moeller (2000) conducted groundbreaking research in the area of early intervention and its implications for children who are deaf or hard of hearing. Her research exemplifies the importance of early enrollment into speech and language programs. A surprising finding found when reviewing her article was that none of the children in her study were identified as having a hearing loss through newborn hearing screenings. She stated that the average age of hearing loss was identified at 18 months and that the children did not receive early intervention services until approximately 22 months of age. The implications of this are that children, prior to identification, were without a complete auditory signal until an average age of 18 months. Now that newborn hearing screening is mandated in the majority of states in the United States of America, it would be important to replicate this study for children identified with hearing impairment shortly after birth. Children identified earlier should, in theory, receive services earlier in life. A study such as this would provide additional evidence as to the importance of early enrollment in speech and language services.

REFERENCES

- Brady, N. J., Marquis, N., Fleming, K., & Mclean, L. (2004). Prelinguistic predictors of language growth in children with developmental disabilities. *Journal of Speech, Language, and Hearing Research, 47*, 663-667.
- Carney, A. E., & Moeller, M. P. (1998). Treatment efficacy: Hearing loss in children. *Journal of Speech, Language and Hearing Research, 41*, 61.
- Hart, B., & Risley, T. R. (1995). Meaningful differences in the everyday experience of young American children. Baltimore, MD: Brookes Publishing Company, Inc.
- Martin, F. N., & Clark, J. G. (2009). *Introduction to audiology*. Boston, MA: Pearson.
- Moeller, M. P. (2000). Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics, 106*, 43.
- Oller, D. K., & Eilers, R. (1988). The role of audition in infant babbling. *Child Development, 59*, 441-449.
- Small, L. H. (2012). *Fundamentals of phonetics: A practical guide for students*. Upper Saddle River, NJ: Pearson.
- Stark, R. E. (1980). Stages of speech development in the first year of life. In G. H. Yeni-Komshaian, J. F. Kavanagh, & C. A. Ferguson (Eds.), *Child phonology: Volume 1. Production* (pp. 73–90). New York: Academic Press.
- Yoshinaga-Itano, C., Sedy, A. L., Coulter, D. K., & Mehl, A. L. (1998). Language of early- and later-identified children with hearing loss. *Pediatrics, 102*, 5.

VITA

Graduate School
Southern Illinois University

Louis Redpath

iredpat@gmail.com

Southern Illinois University Edwardsville
Bachelor of Science, Evolution Ecology Environment, December 2007

Research Paper Title:

Hearing Loss and Communication: Evidence for Early Intervention

Major Professor: Dr. Sandie Bass-Ringdahl