

Spring 5-1-2016

## Early Hearing Loss and Language Outcomes: A Review and Case Study

Sarah Reid  
sareid@uchc.edu

Follow this and additional works at: [https://opencommons.uconn.edu/srhonors\\_theses](https://opencommons.uconn.edu/srhonors_theses)



Part of the [Communication Sciences and Disorders Commons](#)

---

### Recommended Citation

Reid, Sarah, "Early Hearing Loss and Language Outcomes: A Review and Case Study" (2016). *Honors Scholar Theses*. 633.

[https://opencommons.uconn.edu/srhonors\\_theses/633](https://opencommons.uconn.edu/srhonors_theses/633)

Early Hearing Loss and Language Outcomes:

A Review and Case Study

Sarah Elise Reid

University of Connecticut

# EARLY HEARING LOSS AND LANGUAGE OUTCOMES

## Abstract

Early hearing loss is a widespread medical and developmental concern that affects over 1 in 500 infants (Mehl, 1998). Hearing impairments in children have been linked to a variety of adverse developmental outcomes, including poor speech and language ability and difficulties with cognition and social-emotional adjustment. Early intervention has been demonstrated to be one of the most important factors in influencing outcomes for children born with congenital hearing loss (Vohr et al., 2008). This review and case study aims to outline the connection between early hearing loss, intervention, and speech/language abilities by exploring the case of a 13-month-old infant with early hearing loss. KD, the subject of interest, was born with bilateral moderate/severe sensorineural hearing loss and received amplification at three months of age. After undergoing several speech and language evaluations, KD was found to have above average linguistic abilities, suggesting that her early hearing loss has not hindered her development in this area, thus far.

*Keywords:* hearing loss, speech/language outcomes, early intervention, amplification

## Introduction

Early hearing loss is an important public health concern facing children today. In the United States, approximately 15% of children under the age of 18 are hearing impaired (Niskar et al., 1998). Some hearing impairments in children are acquired as a result of head injury, noise exposure, ototoxic pharmaceuticals, or infections, such as chronic otitis media, meningitis, measles, mumps, encephalitis, varicella, and influenza (American Speech-Language-Hearing

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

Association). Other cases of hearing loss are present from birth. Each year, between 8,000 and 12,000 infants are born with congenital hearing loss, equating to, roughly, 22-33 children per day (Vohr, Carty, Moore, & Letourneau, 1998). A study conducted by Mehl and his team (1998) found that one in every 500 infants is born with congenital hearing loss that requires bilateral amplification. Assessments conducted as part of the Rhode Island Hearing Assessment Program provided further support for this rate, finding 2.12 of every 1,000 infants are born hearing impaired (Vohr et al., 1998).

### *Early Hearing Loss & Language Development*

One of the primary concerns regarding early hearing loss is its impact on speech and language development. The connection between early auditory deficits and poor linguistic outcomes has been well documented in scientific literature. Children with congenital hearing loss score well below their typically developing peers on measures of global language development at age three (Ching, 2015). Research demonstrates that reading skills are also adversely affected by early hearing loss, with 97% of hearing impaired children scoring significantly below average on measures of fourth to sixth grade level proficiency (Karchmer & Mitchell, 2011).

Poor language development has been linked to adverse developmental outcomes across multiple domains. Not surprisingly, children who experience language delays attain poor spelling and reading outcomes at the elementary level (Lyytinen, Poikkeus, Laakso, Eklund, & Lyytinen, 2001). Early difficulties with expressive language have also been found to correlate with poor social-emotional adjustment (Irwin, Carter, & Briggs-Gowan, 2002), as well as higher rates of anxiety, depression, and issues sleeping (Carson, Klee, Perry, Muskina, & Donaghy,

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

1998). Additionally, Peterson and Siegal (1998) demonstrated that children with hearing loss who experience language difficulties have delayed development of theory of mind and are often unable to pass false belief tests that their hearing counterparts can. The adverse effects of poor language ability extend into adulthood. Some research suggests that people who experience language delays in childhood have more behavior problems and poorer social competence compared to peers at the age of 30 (Horwitz et al., 2003).

### *Newborn Hearing Screenings*

Historically, only newborns with high-risk conditions, such as low birth weight or history of in utero infections, were screened for hearing loss. While these infants account for a substantial portion of children with hearing impairments, not all children born with congenital hearing loss present with risk factors. Since these infants were not screened for hearing loss at birth, the age of identification of permanent hearing loss used to be relatively high; one study found the average age of diagnosis to be approximately 30 months (Calderon, 2000). In 1993, in an effort to reduce the number of children adversely affected by hearing loss and related language outcomes, the National Institutes of Health began promoting mandatory newborn hearing screenings for all infants, even those without identifiable risk factors. Today, more than 95% of infants in the United States receive newborn hearing screenings shortly after birth (National Institutes of Health, 2013). Mandatory screenings have been very effective in reducing the average age at which hearing loss is discovered and addressed in children. The Rhode Island Hearing Assessment Program analyzed data from eight of its state's hospital systems and found that the mean age of identification of permanent hearing loss decreased from 8.7 months to 3.5 months in just three years following the implementation of universal newborn hearing

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

screenings. The program also found that just four years after the initiative began, the age of intervention by amplification was reduced by 7.6 months (Vohr et al., 1998). Not only have mandatory newborn hearing screenings resulted in earlier identification and intervention for children with congenital hearing loss, but also they have been demonstrated to be extremely cost effective. For example, one study in Colorado determined that the cost of newborn hearing screenings was recovered after only ten years when the financial consequences of later identification and intervention were considered (Mehl, 1998).

### *Early Identification & Amplification*

The earlier identification of children with congenital hearing loss through the universalization of newborn hearing screenings allows for earlier utilization of appropriate interventions, such as amplification and therapy. There is now substantial evidence indicating that earlier interventions are associated with better speech and language outcomes in children diagnosed with hearing loss. Furthermore, research also suggests that the effect of amplification age is stronger in cases of more severe hearing loss (Ching, 2015). In a study by Yoshinaga-Itano et al. (1998), children who were identified before six months of age and given amplification and speech/language therapy had significantly higher receptive, expressive, and total language scores than those identified after six months and placed in interventions. Other research lends support for this trend, finding that children diagnosed with hearing loss before nine months who receive amplification and other services have significantly superior receptive and expressive language skills compared to their later-diagnosed counterparts (Pimperton & Kennedy, 2012). Despite these promising findings on early amplification, research suggests that even with interventions, children with early hearing loss still have difficulty mastering certain

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

facets of language, including verbal intelligence, connected language, and complex syntax (Geers, Mood, Biedenstein, Brenner, & Hayes, 2009). For children with hearing impairments who do experience language delays in toddlerhood, it is estimated that 20-30% of them go on to develop language disorders (Whitehouse, Robinson, & Zubrick, 2011). Further, there is some suggestion that many late-talking children with typical hearing who obtain language scores in the normal range in toddlerhood, will go on to have sub-clinical deficits in vocabulary, grammar, and verbal memory, and could struggle with some aspects of language and literacy into early adulthood (Rescorla, 2009).

While the case for early amplification in children born with congenital hearing loss is strong, there are many barriers patients and families face that hinder their ability to engage in appropriate treatments. Fulcher et al. (2015) outlined some of the more notable challenges. One common barrier identified by clinicians is living in a rural or remote area. When quality treatment centers are not easily accessible, speech language pathologists, audiologists, and other medical professionals often see limited attendance at appointments and poor management of hearing aids and other auditory devices. Additionally, when families have intermittent access to the child's primary service provider, they are more likely to receive conflicting information from local community members or school personnel that can delay progress. Another barrier to early intervention is clinicians' experience and confidence working with very young infants. It is sometimes the case that a lack of familiarity with this population leads clinicians to develop less aggressive treatment plans that impede auditory and linguistic growth. A third common barrier to effective intervention is belonging to a culturally and linguistically diverse family. Family members may have differing views on hearing aids, therapy, or medical intervention in general,

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

and this lack of cohesion may deter families from seeking appropriate treatments for children with hearing loss. Also, how eager, or not, a family is to pursue interventions may be influenced by certain religious beliefs.

### *Other Interventions*

One obvious intervention for children with early hearing loss is amplification. Hearing aids that amplify sounds can be fitted to very young infants and children, and in more extreme cases of hearing loss, cochlear implants may be surgically inserted to directly stimulate the auditory nerve. However, these are not the only interventions employed in the treatment of children with early hearing loss. Amplification must be used in conjunction with other accommodations and therapies in order to obtain maximal benefits for speech, language, and social development. One of these interventions is parental education. Programs that teach parents and caregivers of children with early hearing loss how to better respond to and interact with their pre-linguistic infants often facilitate better speech and language outcomes, as well as an improved ability to generalize intentional communication (Dunst, Trivette, Hamby, & Pollack, 1990) (Yoder & Warren, 1998). For children with early hearing loss, the school environment is also a critical component of effective intervention. Mellon and his colleagues have identified certain key elements of educational settings that promote both academic and social success in children with hearing loss. Smaller inclusion style classrooms in which children with hearing loss have abundant access to typically developing peers who model appropriate language skills and social behaviors are expected to provide the most benefits. Additionally, these settings should have proper acoustical modifications and trained in-class support staff, such as speech-language pathologists. Finally, curriculum should be taught thematically in order to promote

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

vocabulary expansion and literacy, and the development of social, emotional, and motor skills via play-based learning should be a focus for all students (Mellon, Ouellette, Greer, & Gates-Ulanet, 2009).

### *Case Study*

Here we examine the effects of early hearing loss on very early speech and language development, in one infant girl (KD) with bilateral congenital hearing loss. KD's hearing loss was identified early, and she was fitted with bilateral hearing aids and provided with speech/language therapy. The purpose of the present study is to evaluate how the patient's current language ability compares to both her typically developing peers and other infants with hearing loss. Additionally, this study aims to outline the expectations for her speech and language development based on her current status and on previous research regarding infants with hearing loss.

## Clinical Report

### *Background*

The patient of interest, KD, is a 13-month-old female. She was born via cesarean section at 39 weeks at Mission Children's Hospital in Ashville, Tennessee. After failing her newborn hearing screenings, KD was referred to Patricia Roush, AuD of the University of North Carolina, Chapel Hill Neurosciences Hospital, who diagnosed her with bilateral moderate/severe sensorineural hearing loss. KD presented absent otoacoustic emissions (OAE) at multiple frequencies, suggesting hair cell dysfunction within the cochlea. Diagnostic Auditory Brainstem Response (ABR) determined that her auditory nerve function was normal. At three months of age, KD received bilateral amplification in the form of hearing aids. She is currently fitted with

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

Phonack Sky Q70-SP hearing aides that include a Roger FM system. She continues to be closely monitored by the audiology department at the University of North Carolina. KD participates in the university's CASTLE (Center for Acquisition of Spoken Language Through Listening Experiences) REACH program, an auditory-verbal therapy program in which she receives weekly tele-therapy. KD also receives weekly in-home speech and language therapy through Early Intervention. KD's parents are highly involved in her audiological care, and provide her with a supportive and language-rich environment. KD's maternal grandparents, bilingual speakers of Gujarati, are also involved in her care, which provides her with regular exposure to this Indian dialect.

### *Assessments Given*

#### Pre-School Language Scales-Fifth Edition

The Pre-School Language Scale (PLS-5) assesses receptive and expressive language skills in children from birth to age eight. This interactive assessment requires pointing and verbal responses to pictures, objects, and questions presented by the examiner. The child is scored on both auditory comprehension, the ability to understand spoken language, and expressive communication, the ability to produce spoken language. A total language score is also obtained, providing a general estimate of language ability. The completion time is approximately 45-60 minutes (Zimmerman, Steiner, Pond, 2011).

The PLS-5 is evaluated such that the average score is 100, with a standard deviation of 15 points. Most test-takers fall between 85-115, with scores above 115 indicating above average receptive/expressive language skills, and scores below 85 indicating below average receptive/

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

expressive language skills (Zimmerman, Steiner, Pond, 2011). A percentile rank reflecting the percentage of other test-takers who scored at or below the given score is also provided.

### Mullen Scales of Early Learning (Visual Reception Scale)

The Mullen Scales of Early Learning are a series of assessments that evaluate cognitive ability and motor development in children from birth to 68 months of age. KD was administered the Visual Reception Scale subtest, which measures the ability to process visual information using patterns, memory, and sequencing. The completion time for KD's age group is approximately 15 minutes (Mullen).

The Mullen Scales of Early Learning Visual Reception Scale is evaluated such that the average score is 50, with a standard deviation of ten points. Most test-takers fall between 40-60, with scores above 60 indicating above average visual discrimination/memory, and scores below 40 indicating below average visual discrimination/memory. A percentile rank reflecting the percentage of other test-takers who scored at or below the given score is also provided (Mullen).

### Informal Language Sample

The production of specific speech sounds follows a developmental timeline. The first set of phonemes, termed the Early 8, emerge between ages one and three, with consistent production expected at age three. The second set of phonemes, termed the Middle 8, emerge between ages three and six and a half, with consistent production expected by age five. The last set of phonemes, the Late 8, emerge between ages five and seven and a half, with consistent production expected by age seven and half (Shriberg & Kwiatkowski, 1980).

An informal language sample was gathered from KD during unstructured play. The sample was audio recorded and then analyzed for her use of these phonemes in the context of

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

everyday interactions. Since KD is 13 months of age, her use of the Early 8 phonemes is of particular interest in evaluating her language development.

### Results

KD's results for the PLS-5 are as follows: Auditory Comprehension Standard Score—116, Percentile Rank—86%; Expressive Communication Standard Score—117, Percentile Rank—87%, Total Language Standard Score—118, Percentile Rank—88%. These results indicate that KD's receptive language skills, expressive language skills, and overall language ability are above average compared to her peers, scoring equal to or above 86%, 87%, and 88% of other test-takers, respectively.

KD's results for the Mullen Scales of Early Learning Visual Reception Scale are as follows: Visual Reception Standard Score—62, Percentile Rank—88%. These results indicate that KD has above average visual reception development compared to her peers, scoring equal to or above 88% of other test-takers. The results of both the Preschool Language Scales and the Mullen Scales of Early Learning-Visual Reception Scale are summarized in Figure 1.

KD's results for phoneme production are as follows: Early 8 Phonemes—6 of 8 speech sounds present, no evidence of /p/ and /h/ sounds within the sample; Middle 8 Phonemes—0 of 8 speech sounds present; Late 8—0 of 8 speech sounds present. These results indicate that KD is developing typically, as she is currently able to produce 75% of the speech sounds that are expected of her by three years of age. This finding is summarized in Figure 2.

### Discussion

The results from each of the speech and language tests administered to KD place her in the “above average” range. Thus, at this time, it appears that KD's early hearing loss has not

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

negatively impacted her speech and language development. Based on the existing literature, KD's early amplification at three months of age is likely a key contributor to her typical linguistic development at thirteen months of age. Previous research by Vohr and colleagues (2008) supports this conclusion. They evaluated the language outcomes of infants born with moderate-profound hearing loss at the 12-16 month age range. Findings revealed that children who were received amplification and other therapies at or before three months of age performed significantly better on measures of phrases understood, words understood, words produced, and early, later, and total gesturing compared to children with later intervention. Indeed, early intervention (at or before 3 months) was found to be an independent predictor, above socio-economic status, maternal communication skills, and parental involvement, for word and gesture production. KD received amplification at three months of age, which places her in this "early intervention" time -window that was found to be associated with better early language outcomes.

It is also of use to evaluate where KD's speech and language development falls compared to her hearing impaired and typically developing peers. Stika and colleagues (2015) conducted a study in which they administered the Mullen Scales-Visual Reception and the Preschool Language Scale-4, two of the tests given to KD, to hearing impaired and control infants with a mean age of 13.2 months. For the Mullen Scales-Visual Reception test, the hearing impaired group had a mean score of 52.6 (SD=9.7) and the control had a mean score of 55.4 (SD=9.3). On this test, KD obtained a score of 62. KD's score is higher than the average score obtained in that study for both hearing-impaired children and typically developing children. For the Preschool Language Scales-4, the hearing impaired group had mean scores of 99.1 (SD=12.2), 94.5 (SD=9.2), and 103.8 (SD=14.1), for total, receptive, and expressive language skills,

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

respectively. The control infants had means of 102 (SD=10.1), 96.3 (SD=10), and 107.3 (SD=9.5) for total, receptive, and expressive language skills, respectively. For the Preschool Language Scales, KD scored higher than average for both hearing impaired and non-hearing impaired infants in all three categories of the test. These results are visualized in Figure 3. Not only does KD appear more like typically developing infants than those with hearing loss, her scores appear to be consistently higher than the average scores observed for non-hearing impaired children of similar age.

While KD's current speech and language abilities are considered to be in the normal range, her present success does not necessarily ensure that she will continue to develop normally. Children learn to produce around ten new words per month from the time they begin speaking until approximately 18 months of age. During the 17-20 month period, there is a rapid increase in the rate of word acquisition as children approach a vocabulary of 50 words by the 24-month mark (Rescorla, 2000). KD's current word production is very typical of children her age, however, there is always a risk that she may not experience the rapid linguistic growth that is expected as she approached two years of age. If KD does not continue with normal language development into the 24-31 month range, she is more likely to experience difficulties with vocabulary, grammar, and verbal memory as she transitions into early adulthood (Rescorla, 2009). KD's language development over the next several months will be indicative of future language outcomes, and therefore, the course of her language development over this period should be monitored closely.

Given KD's early amplification and speech-language intervention, it is anticipated that KD will maintain the progress she has made thus far. Previous research has found that infants

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

who receive amplification by three months of age, like KD, typically outperform their later-amplified counterparts, and that, for most children without any familial risk for language problems, this progress is maintained throughout childhood. Ninety-six percent of children with early-identified hearing loss who receive early amplification and therapy are expected to achieve normal speech ability by five years of age, and virtually all of them demonstrate appropriate receptive language abilities (Fulcher, Purcell, Baker, & Munro, 2012).

In order to maintain and promote speech and language success, KD will continue her participation in auditory verbal therapy. It is also recommended that her hearing aids and Roger FM system continue to be used, properly cared for, and updated/fitted frequently to ensure she is receiving the necessary auditory input for appropriate linguistic development. As KD approaches school age, it is encouraged that she be placed in an inclusion style classroom in which she has abundant exposure to typically developing peers, as well as ample access to the accommodations and services that she will likely require, such as speech therapy, room modifications, alternate testing procedures, and visual curriculum supplements. Ultimately, KD's speech and language skills thus far are excellent, and she is expected to continue to achieve average or above average language outcomes.

### Conclusion

Thus far, KD's speech and language development appears to be following a very typical trajectory. Children born with congenital hearing loss often do not achieve such marked linguistic success, and KD's progress is rather commendable. This case is incredibly valuable for the field of speech and language development because it exemplifies the importance of early identification and intervention for children born with hearing loss. Early hearing loss is a

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

widespread issue that can have serious consequences for language skills, behavior, and social-emotional health. However, if identified early and appropriate actions are taken, children with early hearing loss can secure healthy and robust speech and language abilities that will serve them well throughout their lives.

### Supplementary Materials

#### Summary of Results

Test	Average Score	KD's Score	Interpretation
PLS-5 Auditory Comprehension	100 (85-115)	116	Above Average

EARLY HEARING LOSS AND LANGUAGE OUTCOMES

PLS-5 Expressive Communication	100 (85-115)	117	Above Average
PLS-5 Total Language Score	100 (85-115)	118	Above Average
Mullen Scales of Early Learning Visual Reception Scale	50 (40-60)	62	Above Average

Figure 1. KD scored in the “above average” range for all tests administered.

**Informal Language Sample Results**

Early 8 Phoneme	As In...	Present	Absent
/m/	“mama”	✓	
/b/	“baby”	✓	
“y”	“you”	✓	
/n/	“no”	✓	
/w/	“we”	✓	
/d/	“dada”	✓	
/p/	“pop”		✓
/h/	“hi”		✓

Figure 2. KD produced 6 of the 8 Early 8 Phonemes.

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

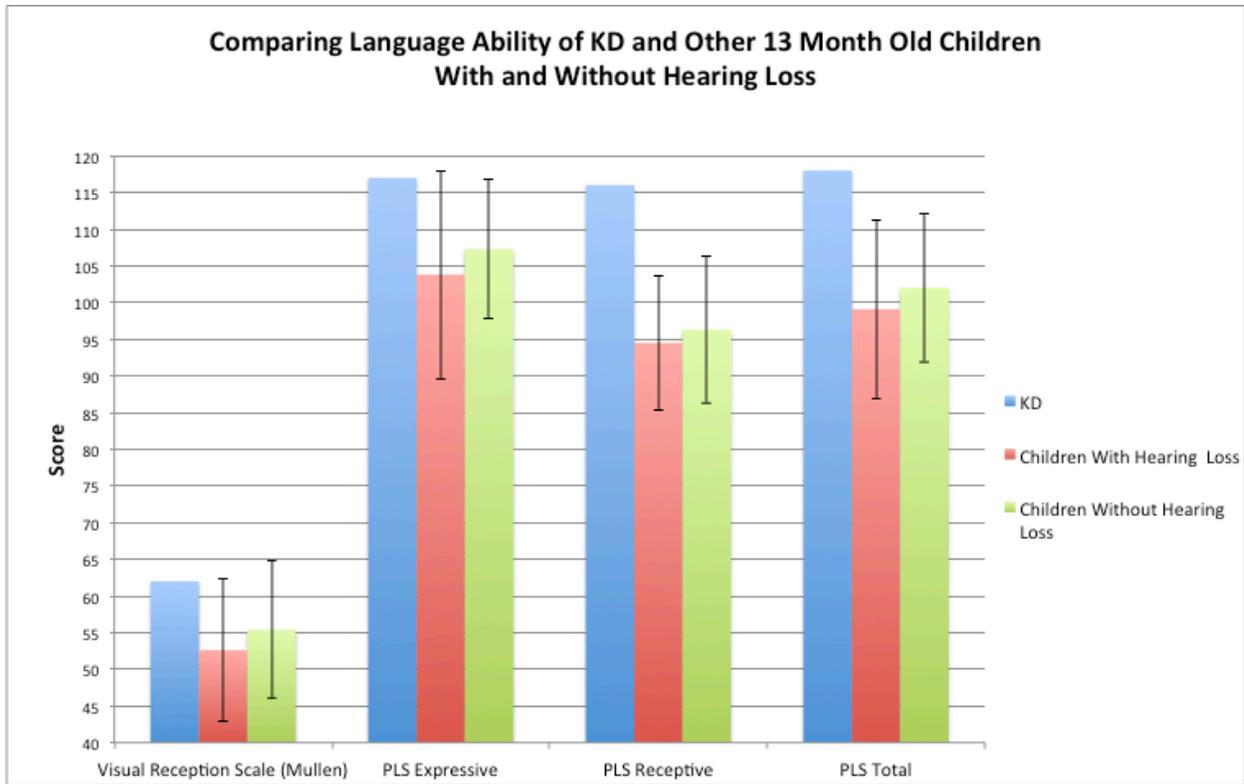


Figure 3. KD outperformed other 13-month-old children with and without hearing loss.

**References**

- American Speech-Language-Hearing Association. *Causes of Hearing Loss in Children*. Retrieved from <http://www.asha.org/public/hearing/Causes-of-Hearing-Loss-in-Children/>.
- Calderon, R. (2000). Parental involvement in deaf children's education programs as a predictor of child's language, early reading, and social-emotional development. *Journal of Deaf Studies and Deaf Education*, 5(2), 140-155.
- Carson, D. K., Klee, T., Perry, C. K., Muskina, G., Donaghy, T. (1998). Comparisons of children with delayed and normal language at 24 months of age on measures of behavioral difficulties, social and cognitive development. *Infant Mental Health Journal*, 19(1), 59-75.
- Ching, T. (2015). Is early intervention effective in improving spoken language outcomes of children with congenital hearing loss?. *American Journal of Audiology*, 24(3), 345-349.
- Dunst, C. J., Trivette, C. M., Hamby, D., Pollock, B. (1990). Family systems correlates of the behavior of young children with handicaps. *Journal of Early Intervention*, 14(3), 204-218.
- Fulcher, A. N., Purcell, A., Baker, E., Munro, N. (2015). Factors influencing speech and language outcomes of children with early identified severe/profound hearing loss: Clinician-identified facilitators and barriers. *International Journal of Speech-Language Pathology*, 17(3), 325-333.
- Fulcher, A., Purcell, A. A., Baker, E., Munro, N. (2012). Listen up: Children with early hearing loss achieve age-appropriate speech/language outcomes by 3 years-of-age. *International Journal of Pediatric Otorhinolaryngology*, 76(12), 1785-1794.
- Geers, A. E., Moog, J. S., Biedenstein, J., Brenner, C., Hayes, H. (2009). Spoken language scores of children using cochlear implants compared to hearing age-mates at school entry. *Journal of Deaf Studies and Deaf Education*, 14(3), 371-385.
- Horwitz, S. M., Irwin, J. R., Briggs-Gowan, M. J., Bosson-Heenan, J. M., Mendoza, J., Carter, A. S. (2003). Language delay in a community cohort of young children. *Journal of the American Academy of Child & Adolescent Psychiatry*, 42(8), 932-940.
- Irwin, J. R., Carter, A. S., Briggs-Gowan, M. J. (2002). The social-emotional development of "late-talking" toddlers. *Journal of the American Academy of Child & Adolescent Psychiatry*, 41(11), 1324-1332.

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

- Lyytinen, P., Poikkeus, A. M., Laakso, M. L., Eklund, K., Lyytinen, H. (2001). Language development and symbolic play in children with and without familial risk for dyslexia. *Journal of Speech, Language, and Hearing Research, 44*(4), 873-885.
- Mehl, A. L. (1998). *Pediatrics, 101*(1), 4.
- Mellon, N. K., Ouellette, M., Greer, T., Gates-Ulanet, P. (2009). *Trends in Amplification, 13*(4), 223-240.
- Mitchell, R. E., Karchmer, M. A. (2011). Demographic and achievement characteristics of deaf and hard of hearing students. *The Oxford Handbook of Deaf Studies, Language, and Education, 1*(2).
- Mullen, E. M. (YEAR). Mullen Scales of Early Learning. Pearson Clinical. Retrieved from <http://www.pearsonclinical.com/childhood/products/100000306/mullen-scales-of-early-learning.html#tab-details>.
- National Institutes of Health. (March 29, 2013). Newborn Hearing Screening. Retrieved from <https://report.nih.gov/nihfactsheets/ViewFactSheet.aspx?csid=104>.
- Niskar, A. S., Kieszak, S. M., Holmes, A., Esteban, E., Rubin, C., Brody, D. J. (1998). Prevalence of hearing loss among children 6 to 19 years of age: The third national health and nutrition examination survey. *JAMA, 279*(14), 1071-1075.
- Peterson, C. C., Siegal, M. (1995). Deafness, conversation, and theory of mind. *The Journal of Child Psychology and Psychiatry, 36*(3), 459-474.
- Pimperton, H., Kennedy, C. R. (2012). The impact of early identification of permanent childhood hearing impairment on speech and language outcomes. *Archives of Diseases in Childhood, 97*(7), 648.
- Rescorla, L. (2009) Age 17 language and reading outcomes in late talking toddlers: Support for a dimensional perspective on language delay. *Journal of Speech, Language, and Hearing Research, 52*(1), 16-30.
- Rescorla, L., Mirak, J., Singh, L. (2000). Vocabulary growth in late talkers: Lexical development from 2;0 to 3;0. *Journal of Child Language, 27*(2), 293-311.
- Shriberg, L. D., Kwiatkowski, J. (1980). *Natural process analysis: A procedure for phonological analysis of continuous speech samples*. New York: Macmillan.

## EARLY HEARING LOSS AND LANGUAGE OUTCOMES

Stika, C. J., Eisenberg, L. S., Johnson, K. C., Henning, S. C., Colson, B. G., Ganguly, D. H., DesJardin, J. L. (2015). Developmental outcomes of early-identified children who are hard of hearing at 12 to 18 months of age. *Early Human Development*, 91(1), 47-55.

Vohr, B. R., Carty, L. M., Moore, P. E., Letourneau, K. (1998). The Rhode Island hearing assessment program: Experience with statewide hearing screening (1993-1996). *The Journal of Pediatrics*, 133(3), 353-357.

Vohr, B., Jodoin-Krauzyk, J., Tucker, R., Johnson, M. J., Topol, D., Ahlgren, M. (2008). Early language outcomes of early-identified infants with permanent hearing loss at 12 to 16 months of age. *Pediatrics*, 122(3), 535-545.

Whitehouse, A. J., Robinson, M., Zubrick, S. R. (2011). Late talking and the risk for psychosocial problems during childhood and adolescence. *Pediatrics*, 128(2), 324-332.

Yoder, P. J., Warren, S. F. (1998). Maternal responsivity predicts the prelinguistic communication intervention that facilitates generalized intentional communication. *Journal of Speech, Language, and Hearing Research*, 41(5), 1207-1213.

Yoshinga-Itano, C., Sedey, A. L., Coulter, D. K., Mehl, A. L. (1998). Language of early-and later-identified children with hearing loss. *Pediatrics*, 102(5), 1161-1172.

Zimmerman, I. L., Steiner, V. G., Pond, R. E., (2011) *Preschool language scales-5<sup>th</sup> edition*, Pearson Clinical. Retrieved from <http://www.pearsonclinical.com/language/products/100000233/preschool-language-scales-fifth-edition-pls-5.html>.