



## Hearing Protection: The Role of Speech Therapist in the Early Intervention of Hearing Impairment

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**Received:** September 16, 2021

**Published:** September 30, 2021

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### Abstract

Hearing screening has been a mandatory routine test that is recommended to ensure the early detection of hearing loss and it is done directly after birth. Early intervention is important to combat the negative effects of hearing loss on language and communication development. This paper aims at exploring the importance of early detection of HL and its positive outcomes, the role of SLP as well as the importance of early intervention on language development and communication skills. This review ends with justification for future research needed to define the nature, consequences, and remediation of hearing problems in infants.

**Keywords:** Hearing Loss; Hearing Impairment; Hearing Aid/S; Speech Therapy/Therapist; Language; Communication

### Abbreviations

SLP: Speech and Language Therapist; ENT: Ear, Nose and Throat Specialist/Doctor (otolaryngologist); HL: Hearing Loss; PLS-4: Preschool Language Scale; PPVT: Peabody Picture Vocabulary Test; DEAP: Diagnostic Evaluation of Articulation and Phonology; CDI: Child Development Inventory; PEACH: Parents' Evaluation of Aural/oral performance of Children; AVT: Auditory Verbal Therapy

### Introduction

Hearing loss is one of the most frequent congenital defects affecting about 700 million people of the world's population by 2050. In other words, 1 in every ten person will have disabling hearing loss. In US, 2-4 newborns in every 1000 have been registered to have disabling hearing loss [1]. A 2015 study revealed that HL result in major negative outcomes on the development of language, communication skills and affects the academic performance of the child [2]. Assessing the hearing skills of the child

directly after birth can prevent the delay in language and communication skills and can help in the early intervention of the needed therapies (hearing aids, speech therapy sessions...). Thus, the earlier the detection and intervention, the better the results are [3]. SLPs have important role in helping children with hearing loss to develop language skills and to catch up with their peers.

### Ear anatomy

The ear is divided into three main parts; the outer ear, middle ear and inner ear. The outer ear/auricle is made up of cartilages and skin, and it is composed of three main parts: the pinna (collects sound waves directly to the ear canal), the external acoustic meatus/ear canal (a sigmoid shaped tube that reaches the tympanic membrane) and the tympanic membrane/eardrum, which separates the outer ear and the middle ear. The middle ear is located between the outer ear and the inner ear, and it is made up of the eardrum and three tiny bones (malleus, incus and stapes); known as the ossicles; which help in the amplification of the sound.

Whereas the inner ear; which is responsible for the hearing and balance; contains the cochlea (responsible for hearing) and semi-circular canals (responsible for the balance) [4].

### How does sound propagate?

When the sound waves propagate in the outer ear to the eardrum, it causes vibrations. Then these vibrations travel to the inner ear, as the eardrum and the three small bones amplify the propagated vibrations. These vibrations reach the brain as electrical signals by the help of the tiny hairs that are attached in the nerve cells in the cochlea in the inner ear. Finally, the brain transforms the electrical signals into sound [5].

### Hearing impairment: Definition, causes and types

A hard of hearing person is a person who's having hearing loss in one or both ears; unilateral or bilateral hearing loss. Hearing loss or hearing impairment could be defined as losing part or all your ability to hear and perceive sounds. Hearing loss can occur due to exposure to loud noises (explosion, occupational noises), recurrent ear infection, excessive earwax, tumors, malformation of the outer ear, ruptured eardrum, presbycusis and much more [5].

As the ENT or audiologist assess the patient's hearing abilities using several formal and standardized examination tools (Audiogram, Auditory Brainstem Response (ABR) ...), he /she can conclude the severity and type of hearing loss. The ENT/audiologist addresses the hearing severity according to the minimum sound that can be heard in your better ear. The severity of hearing loss ranges from mild hearing loss to profound hearing loss and is measured in decibels (dB). Moreover, hearing loss is divided to three types: conductive, sensorineural and mixed hearing loss [6].

### Effects of HL on language development

The ability to hear and perceive sounds is important for the development of language skills (receptive and expressive), communication skills and learning abilities. Children with hearing loss face major difficulties, where delay among language skills; receptive and expressive skills; delay in the development of pre-verbal skills; attention to sounds, verbal imitation, babbling.... low academic performance level due to the language deficits that result in learning difficulties, communication difficulties as well as psychological problems; social isolation, anxiety, social phobia... can be observed.

Moreover, HL can cause delay in the development of the lexical repertoire, and this can be attributed to the delay in the receptive

and expressive oral language skills. The acquisition of vocabulary is slower in comparison to typical developing children. These children can learn concrete words (cat, bird, boy, girl) but show problems in learning abstract words (childhood, brilliant, beauty) and function words (the, are, a, an), as well as words that multiple meanings. Also, the comprehension of complex and long sentences in children with HL is delayed, and they tend to understand and use simple sentences or short phrases. They also have problems in hearing word endings (-s/-ed), which lead to the misuse of verb tense, pluralization, non-agreement of subject and verb, and possessives.

Because of the poor stress, inflection, or tempo of speech, these children when trying to express their needs may sound like they're mumbling. Also, they might show high vocal tone when speaking, or they might speak with loud voice or soft voice since they have difficulty hearing their own voices. Moreover, children with HL can't hear quiet speech sounds like "s," "sh," "t," "d," and "k," thus they don't use them in their speech. As a result, speech may be difficult to comprehend [7].

In a study conducted on 133 children aged 3 years old with HL to study the relation between language abilities and everyday functioning. The author used to assess language abilities in these children the following assessment tools; (PLS-4), (PPVT), (DEAP) and (CDI). As well as the (PEACH) questionnaire was used to evaluate the everyday functioning by interviewing the parents. It was concluded that children who showed language delay exhibited difficulties in everyday functioning [8].

### Methods

An advanced methodological search accessed the following data bases: Google Scholar, PubMed, Medicine Net, Medscape, ASHA, MAYO Clinic, Pediatrics and JAMA Otolaryngology-Head and Neck Surgery. Searches were limited to English Language articles from 1998 to present and children with hearing loss categories. Articles on services to other therapeutic services were excluded (psychomotor and occupational therapy).

In addition to library search, a search was undertaken from health technology assessment websites, web-based data bases as well as websites of hearing loss societies in Australia and US. The latter web search was undertaken to identify policy or position statements related to the subject categories. Articles retrieved

from the search were screened to determine their relevance to the current project. Study articles were further categorized into descriptive versus comparative and were reviewed with consideration to the strength of the study design. Articles representing the strongest evidence in each subject category were retained and are reported in this paper. Relevant methodologically sound comparative studies reported in the systematic reviews/meta-analyses but not previously identified in this project's literature search were requested. This resulted in the inclusion of limited number articles as they were judged of sufficient importance to the project. All articles retrieved by 2000 were reviewed for relevancy and considered for inclusion.

Thirteen articles that met the final inclusion criteria were used for this article. The articles were grouped under three categories based on the purpose of the study: early identification, early intervention and role of SLP.

## Results and Discussion

### Importance of early identification of HL

In order to highlight the importance of early identification of HL, a study was conducted to compare the language abilities in of earlier- and later-identified deaf and hard of hearing children. The study was performed through comparing the receptive and expressive language skills of 72 deaf or hard-of-hearing children whose hearing losses were identified by 6 months of age with 78 children whose hearing losses were identified after the age of 6 months, using the "Minnesota Child Development Inventor". The children under study received early intervention services for 2 months after being identified with HL. The study showed that children who were identified by 6 months of age (earlier identification) exhibited better language scores than children identified after 6 months of age (later identified). This show that better language development is associated with early identification of hearing loss and early intervention [9].

### Influence of hearing aids on language development

Upon identifying the hearing loss in a child, the audiologist will recommend hearing aid as the primary sensory aid. The hearing aid recommended by the audiologist is customized to fit the degree and severity of HL, as well as the type of HL, the size and shape of the ear. The efficacy of HAs on the development of language and speech was noted in a study by Tomblin, J. Bruce. This study was

done on 180 children aged between 3 - 5 years, diagnosed with mild to severe HL. The study supported that hearing aids have major effectiveness on the development of language and speech in children with HL. The degree of hearing improvement achieved by HAs was linked to enhanced speech and language development in children. These findings back up the idea of providing well-fitting HAs to children with HL and suggest early HA fitting and provision to children with mild HL [10].

### Efficacy of speech therapy sessions on language development

As mentioned earlier, children with HL can have problems in developing oral language skills, communication skills as well as learning difficulties. Upon the identification of HL, addressing the type and severity of the HL, the Speech and Language Therapist provide intervention sessions to improve language and communication skills to the child with hearing loss. In order to investigate the relation between age of enrollment in intervention and language development in children aged 5 years and who are deaf and hard-of-hearing, a study done by Moeller, Mary Pat supported that children who were enrolled earlier in speech therapy intervention showed better language scores [11].

Auditory Verbal Therapy (AVT) is one of the speech therapy treatment approaches used by SLPs to develop spoken language in children with hearing problems. The efficacy of (AVT) in children with HL was highlighted in a study done in 2006. The study revealed that this treatment approach has positive outcomes on developing age appropriate language skills in children who are older than three years of age and catch up with their peers. Also, the study indicated that these children can learn to recognize words accurately even in the presence of background noise. This indicates the importance of AVT in the development of language skills in hard of hearing children [12].

SLPs have important role in the early intervention of children with HL; where the role of the SLP is to address the appropriate communication techniques and strategies, provide speech therapy services to hearing-impaired children, their families and caregivers. As well as evaluating and establishing the appropriate communication devices, counseling the parents and supporting them. Kristina Blaiser aimed to study the role of the SLP in the early intervention of children with HL, through investigating the evidence behind benefits of early parent-child interactions and outlines strat-

egies and the importance of intervention sessions in supporting communication development with infants and toddlers. The study highlighted that the SLP should observe and analyze the parent-infant communication and interaction and understand and analyze how the HL is impacting the language development and overall development of these children. Moreover, the SLP have important role in supporting the parents, because they are the primary facilitators of their child's communicative development [13].

### Conclusion

Hearing Loss has devastating impact on the development of language skills in children and toddlers. Delay among developing vocabulary, and syntax as well as problems in communication skills and learning skills can be observed. This review aimed at highlighting the importance of early detection of HL and its impact on the development of language, the positive outcomes of early intervention in these children as well as the role of SLPs in enhancing language and communication skills.

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