



University of Colorado
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Training Module for Hearing Device Use for Children with Developmental Disabilities

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OBJECTIVE

To create a training module that aims to help increase hearing device use for children with developmental disabilities in an audiovisual format. The training module will be available for access through the University of Colorado Leadership Education in Neurodevelopmental Disabilities (LEND) Program website.

INTRODUCTION

In the United States, it is estimated that 1 to 3 out of 1000 children have hearing differences.⁴ Children who are deaf and/or hard of hearing (DHH) show improved developmental changes in auditory behaviors and speech intelligibility when they use their hearing devices.^{9,14} For families who are interested in pursuing a spoken language method of communication, the use of hearing devices is important to facilitate language acquisition. Newborn hearing screening has helped clinicians identify children with hearing differences at an earlier age. Earlier identification of reduced hearing and intervention increases likelihood of successful outcomes.⁷ Children with hearing differences can also have co-occurring developmental disabilities such as autism spectrum disorder (ASD), cerebral palsy, or intellectual disability.¹⁸ Literature suggests that children with hearing differences and developmental disabilities wear their hearing devices for significantly fewer hours than children without developmental disabilities.²⁰ As a result, they have poorer language outcomes in comparison to their peers without developmental disabilities.^{3,5,6} There are several factors that may contribute to reduced device use including sensory sensitivities, parental stress and depression, poor device fitting and verification, and lack of perceived benefit.^{2,11,13} Efforts are made to support typically developing children improve hearing device use through parent education intervention and additional counseling.¹ However, there is a lack of research focused on supporting hearing device use for children with developmental disabilities. Additional supports informed by a developmental, family systems, and behavioral perspective are needed to improve device use and outcomes for children with developmental disabilities.⁸

APPROACH

An initial review of literature was conducted regarding hearing device use among children with developmental disabilities. Through this literature search, a lack of research focused on supporting hearing device use for children with developmental disabilities was identified. The search was conducted on several databases including EBSCO, PubMed, and Google Scholar using the initial search terms “hearing device”, “hearing aid”, “cochlear implant”, “bone conduction hearing device”, “children”, “developmental disabilities”, “autism”, and “Down syndrome”. Peer-reviewed articles including human subjects that were published in English from 2000-2023 were included in the literature search. Limited articles discussed the frequency of hearing device use for children with developmental disabilities and discussed factors contributing to hearing device use. There was also a lack of articles that discussed strategies to improve hearing device use for children with developmental disabilities. As a result of few articles describing strategies to increase hearing device use for children with developmental disabilities, the literature search was expanded to include topics related to behavioral change and developmental disabilities. Secondary search terms included “developmental disabilities”, “children”, “behavior”, and “strategies”. The search populated articles describing strategies to increase medical compliance for children with developmental disabilities. Key concepts were distilled from the literature as follows: sensory sensitivities, systematic desensitization, the use of visual schedules in daily routines, and behavior management strategies for children with developmental disabilities. Based on these findings, a caregiver focused training module to support hearing device use for children with developmental disabilities was developed.

RESULTS

The themes distilled from the secondary literature review were: sensory sensitivities, systematic desensitization, the use of visual schedules in daily routines, and behavior management strategies for children with developmental disabilities. These concepts were included in the training module for caregivers to help support hearing device use.

Children with developmental disabilities may experience sensory sensitivities such as sound sensitivity and tactile sensitivity. Sound sensitivities can be a factor that contributes to lower hearing device usage for this population. Abnormal executive functioning may lead to hypersensitivity to sound for children with developmental disabilities.¹⁰ In addition, loudness recruitment experienced by individuals with hearing differences can impact hearing device usage due to a quick growth of loudness.¹⁷ Tactile sensitivities can also reduce hearing device usage if an individual has particular tactile sensitivities with their head or ears making contact with objects.

The literature review included studies that utilized in vivo exposure and systematic desensitization methods along with social stories, distraction, and positive reinforcement. Systematic desensitization is used for individuals with developmental disabilities to complete various tasks such as ambulatory polysomnography and electrophysiological testing.^{15,16} The use of systematic desensitization may help improve children with developmental disabilities with overcoming their aversion to using hearing devices. In addition, in vivo exposure can be utilized to desensitize children to certain sounds and situations that typically cause a negative reaction.¹⁰ These strategies paired with an antecedent strategy such as priming the child with a social story may help lessen aversion to wearing hearing devices. Additionally, the use of distraction or a competing sensory experience can be utilized by caregivers when putting on their child's hearing devices. The training module summarizes these strategies and gives families examples of how to apply them to their child's situation.

Children with developmental disabilities often have difficulties adjusting to changes in their routine and consistent routines can help increase predictability and reduce anxiety.¹² Therefore, a potential strategy that may improve hearing device use is the incorporation of visual schedules that include putting on and taking off hearing devices. Visual schedules are a helpful tool that families have used to communicate daily routines and tasks.¹⁹ The training module includes examples of visual schedules and icons that families may use for their own visual schedules at home.

The final section of the training module discusses behavior management strategies for children with developmental disabilities. The first strategy uses positive reinforcement to increase the likelihood of favorable behaviors, such as wearing their hearing devices, by providing wanted items, actions, or reactions. It is important to keep in mind that positive reinforcement for children with developmental disabilities may be different than what some children may find reinforcing. The training module also includes an example of a “listening scavenger hunt” that may be a fun activity for children while they wear their hearing devices. Another behavior management strategy discussed in the module is the use of negative reinforcement, which takes away aversive things in order to promote wanted behaviors. This is not to be confused with punishment, which removes favorable items to decrease the likelihood of unwanted behaviors. Antecedent strategies are also utilized to maximize the probability of success by removing any potential barriers. A combination of these behavior management strategies may help improve hearing device use for children with developmental disabilities.

IMPLICATIONS

A review of the literature revealed that little has been outlined about why children with developmental disabilities have more difficulty than their peers with wearing their hearing devices consistently. Even less information is provided regarding strategies to help increase hearing device use. Intervention informed by the strengths and needs of children with developmental disabilities has promise to increase device use for children in this population. This training module serves as a knowledge foundation for families to understand factors that may impact their child's hearing device usage and strategies to overcome those barriers.

ACKNOWLEDGEMENTS

This project was supported in part by the Health Resources and Services Administration (HRSA) under the Leadership Education in Neurodevelopmental Disabilities (LEND) Grant 5 T73MC11044 and by the Administration on Disabilities (AOD) under the University Center of Excellence in Developmental Disabilities (UCDEDD) Grant 90DDUC0106-01-00 of the U.S. Department of Health and Human Services (HHS). This information or content and conclusion are those of the author and should not be construed as the official position or policy of, nor should HRSA, HHS or the U.S. Government infer any endorsements.

REFERENCES

- Ambrose, S. E., Appenzeller, M., Al-Salim, S., & Kaiser, A. P. (2020). Effects of an intervention designed to increase toddlers' hearing aid use. *The Journal of Deaf Studies and Deaf Education*, 25(1), 55-67.
- Beers, A. N., McBoyle, M., Kakande, E., Santos, R. C. D., & Kozak, F. K. (2014). Autism and peripheral hearing loss: a systematic review. *International Journal of Pediatric Otorhinolaryngology*, 78(1), 96-101.
- Cajigas, L., Hoffman, J., & Qutlmer, A. L. (2015). Outcomes and benefits of pediatric cochlear implantation in children with additional disabilities: a review and report of family influences on outcomes. *Pediatric Health, Medicine and Therapeutics*, 45-63.
- Centers for Disease Control and Prevention. (2022, July 20). *Research and tracking of hearing loss in children*. Centers for Disease Control and Prevention. Retrieved January 24, 2023, from <https://www.cdc.gov/ncbddd/hearingloss/research.html>
- Ching, T. Y., Dillon, H., Marnane, V., Hou, S., Day, J., Seeto, M., ... & Yeh, A. (2013). Outcomes of early- and late-identified children at 3 years of age: Findings from a prospective population-based study. *Ear and hearing*, 34(5), 535.
- Cupples, L., Ching, T. Y., Crowe, K., Seeto, M., Leigh, G., Street, L., ... & Thomson, J. (2014). Outcomes of 3-year-old children with hearing loss and different types of additional disabilities. *Journal of Deaf Studies and Deaf Education*, 19(1), 20-39.
- Cupples, L., Ching, T. Y., Button, L., Leigh, G., Marnane, V., Whitfield, J., ... & Martin, L. (2018). Language and speech outcomes of children with hearing loss and additional disabilities: identifying the variables that influence performance at five years of age. *International Journal of Audiology*, 57(sup2), S93-S104.
- Daneishi, A., & Hassanzadeh, S. (2007). Cochlear implantation in prelingually deaf persons with additional disability. *The journal of laryngology & otology*, 127(17), 635-638.
- Kaga, K., Shindo, M., Tamai, F., & Tanaka, Y. (2007). Changes in auditory behaviors of multiply handicapped children with deafness after hearing aid fitting. *Acta Oto-Laryngologica*, 127(sup559), 9-12.
- Lucker, J. R., & Doman, A. (2015). Neural mechanisms involved in hypersensitive hearing: helping children with ASD who are overly sensitive to sounds. *Autism research and treatment*, 2015.
- McCreery, R. W., Walker, E. A., & Spratford, M. (2015). Understanding limited use of amplification in infants and children who are hard of hearing. *Perspectives on Hearing and Hearing Disorders in Childhood*, 25(1), 15-23.
- Loudness Recruitment and Hyperacusis. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, 28, e936373-1.
- Primau, M., Gershon, A., Talbot, L., Cotto, I., Lotspeich, L., Hardan, A., ... & O'Hara, R. (2016). Individuals with autism spectrum disorders have equal success rate but require longer periods of systematic desensitization than control patients to complete ambulatory polysomnography. *Journal of Clinical Sleep Medicine*, 12(3), 357-362.
- Roesler, C. P., Flax, J., MacRoy-Higgins, M., Fermano, Z., Morgan-Byrne, J., & Benasich, A. A. (2013). Sensory desensitization training for successful net application and EEG/ERP acquisition in difficult to test children. *Communication Disorders Quarterly*, 35(1), 14-20.
- Shi, L., Zhao, R., Li, X., Sun, W., & Liu, X. (2022). A Review of the Neurobiological Mechanisms that Distinguish Between Loudness Recruitment and Hyperacusis. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, 28, e936373-1.
- Van Naarden Braun, K., Christensen, D., Doernberg, N., Schieve, L., Rice, C., Wiggins, L., ... & Yeargin-Allsopp, M. (2015). Trends in the prevalence of autism spectrum disorder, cerebral palsy, hearing loss, intellectual disability, and vision impairment, metropolitan Atlanta, 1991-2010. *PloS one*, 10(4), e0124120.
- Wiley, S., Gustafson, S., & Rozniak, J. (2014). Needs of parents of children who are deaf/hard of hearing with autism spectrum disorder. *Journal of Deaf Studies and Deaf Education*, 19(1), 40-49.
- Wiseman, K. B., & Warner-Czyz, A. D. (2018). Inconsistent device use in pediatric cochlear implant users: Prevalence and risk factors. *Cochlear Implants International*, 19(3), 131-141.