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AUDITORY-VERBAL THERAPY OUTCOMES IN PEDIATRIC COCHLEAR IMPLANT USERS: A NARRATIVE REVIEW

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Abstract

Cochlear implants (CIs) provide access to sound for children with severe-to-profound hearing loss, but functional outcomes depend on consistent rehabilitation and family participation. Auditory-Verbal Therapy (AVT) is a listening-based intervention that aims to develop spoken language through structured auditory input, active caregiver involvement, and everyday communication practice. This narrative review examines outcomes of AVT in pediatric cochlear implant users, focusing on speech perception, language development, speech production, literacy, and academic participation. Evidence suggests that children who receive early implantation and sustained AVT can achieve favorable auditory and spoken-language outcomes, although progress varies across individuals and domains. Factors such as age at implantation, duration of therapy, family engagement, device use, and access to services influence results. While AVT is a valuable rehabilitation option for families prioritizing listening and spoken language, methodological limitations in the current literature and unequal access to services highlight the need for individualized planning, standardized outcome reporting, and expanded service availability.

INTRODUCTION

Hearing loss in early childhood can affect the development of speech, language, communication, social interaction, and academic participation. Without timely identification and intervention, children may experience delays in vocabulary, grammar, phonological awareness, and conversational skills (Moeller, 2000; Yoshinaga-Itano, 2003). Cochlear implants have transformed outcomes for many children with severe-to-profound hearing loss by providing access to auditory information that hearing aids cannot sufficiently amplify (Geers et al., 2003).

However, the implant alone does not guarantee age-appropriate spoken-language development. Children must learn to detect, discriminate, identify, and comprehend sounds, and then use this information for meaningful communication. Rehabilitation programs are therefore essential to support auditory learning, speech production, language growth, and functional communication in daily life (Moeller, 2000).

Auditory-Verbal Therapy (AVT) is one widely used approach for children with cochlear implants whose families prioritize listening and spoken language. AVT emphasizes auditory input as the primary pathway for learning language, encourages consistent device use, and involves parents as active communication partners who apply strategies during everyday routines (Dettman et al., 2013; Dornan et al., 2007). This narrative review explores the outcomes of AVT in pediatric cochlear implant users, examines factors that influence progress, and discusses implications for clinical practice and future research.

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Methodology

This narrative review synthesized published literature on the outcomes of Auditory-Verbal Therapy in children with cochlear implants. The review focused on auditory perception, speech production, receptive and expressive language, literacy, academic participation, family involvement, and factors associated with rehabilitation outcomes.

A literature search was conducted in databases including PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar. Search terms included auditory-verbal therapy, auditory verbal intervention, listening and spoken language, cochlear implants, pediatric cochlear implant users, speech perception, language outcomes, and children with hearing loss. Boolean operators were used to combine concepts, for example: "auditory-verbal therapy" AND "cochlear implant" AND children.

Studies were screened initially by title and abstract. Potentially relevant articles were then assessed in full text. Information extracted from each study included author and year, country, study design, sample characteristics, age at implantation, duration of implant use, intervention type, outcome measures, principal findings, and limitations. Because this is a narrative review, studies were synthesized thematically rather than statistically pooled.

The review included studies involving children with severe-to-profound hearing loss who use cochlear implants and receive AVT or closely related listening-and-spoken-language programs. Studies examining speech perception, auditory performance, language development, speech intelligibility, literacy, academic participation, or social communication were considered. Observational studies, cohort studies, comparative studies, longitudinal studies, systematic reviews, and relevant clinical research were included. Literature published in English was prioritized.

Studies involving adults only, children using hearing aids without cochlear implants (unless findings were directly relevant to early auditory intervention), and papers discussing cochlear implantation without reporting rehabilitation or communication outcomes were excluded. Because AVT is frequently combined with other services, studies were interpreted according to the extent to which they isolate AVT from other rehabilitation components.

Discussion

Speech perception and auditory development

Speech perception is one of the most frequently examined outcomes in pediatric cochlear implant research. Children receiving AVT are trained to attend to environmental sounds, detect changes in speech, identify words, and understand connected language without depending primarily on visual cues. This progression is clinically important because the cochlear implant provides access to sound, but it does not automatically give the child the ability to interpret speech. Auditory learning requires repeated exposure, structured practice, and meaningful interaction with communication partners.

Several studies have reported favorable auditory outcomes among children enrolled in auditory-verbal or auditory-based programs. Dettman et al. (2013) reported stronger speech perception outcomes in children participating in an auditory-verbal program when compared with matched groups receiving other communication approaches. In that study, the auditory-verbal group achieved higher mean scores on consonant–nucleus–consonant word recognition and performed favorably on sentence perception measures. These findings suggest that consistent emphasis on auditory input may help children develop open-set speech perception, particularly when intervention begins early and continues over an adequate period.

Nevertheless, comparative findings are not entirely consistent. A major difficulty is that studies often compare children from different communication programs without random assignment. Families who select AVT may already be highly motivated, may have greater access to specialist services, or may provide more intensive language interaction at home. These characteristics can independently influence speech

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perception and spoken-language development. Therefore, the apparent advantage of AVT may reflect both the intervention itself and the characteristics of the families who are able to access and maintain it. Auditory development is also influenced by the amount of experience a child has with the cochlear implant. A child who has used the device for four years cannot reasonably be compared with a child who has used it for one year unless duration of device use and hearing age are considered. Future studies should therefore report outcomes according to chronological age, age at implantation, duration of implant use, and hearing age. Such reporting would make it easier to determine whether observed improvements are associated with AVT, maturation, device experience, or a combination of these factors.

Receptive and expressive language

Language development is a central outcome of AVT because the approach aims to help children use audition as the primary pathway for learning spoken language. Receptive language refers to understanding vocabulary, grammatical structures, and spoken instructions, whereas expressive language includes vocabulary use, sentence formation, narration, and conversational communication. Evidence suggests that children who receive early auditory-based intervention can make substantial gains in both areas, although progress is often uneven.

Nicholas and Geers (2007) found that age at cochlear implantation was associated with spoken-language development. Children implanted at a younger age generally showed more favorable language outcomes than children implanted later. Early access to auditory information may allow children to benefit from periods of heightened neuroplasticity and to receive language input during developmental stages when the brain is rapidly organizing speech and language systems (Sharma et al., 2002). However, early implantation should not be interpreted as a guarantee of age-appropriate language. Children still require consistent device use, high-quality language exposure, and ongoing rehabilitation.

Recent evidence further suggests that the duration of AVT may be relevant. A 2025 study reported that children who received three years of AVT demonstrated higher core-language and expressive-language scores five years after implantation than children who received no AVT or only one year of AVT. In that study, approximately 83% of children in the three-year AVT group fell within the normal range for core language, compared with 47% in the group without AVT. The corresponding expressive-language figures were approximately 80% and 53%, respectively. However, these findings should be interpreted as an association rather than definitive proof of a causal effect because treatment duration may be related to family resources, attendance, motivation, and the child's initial progress.

In contrast, a comparative study of children enrolled in sign-and-spoken-language, auditory-oral, and auditory-verbal programs found no significant differences in language outcomes after adjustment for relevant covariates. Age at diagnosis and family involvement were more strongly associated with post-implant language scores than the communication program itself (Geers et al., 2014). This finding is important because it indicates that the quality and timing of intervention may be more influential than the program label alone. It also supports a family-centered approach in which clinicians adapt rehabilitation to the child's needs, family priorities, linguistic background, and available resources.

The relationship between AVT and language outcomes is therefore best understood as multidimensional. AVT may provide an effective structure for developing listening and spoken language, but the child's progress depends on the intensity and quality of language interaction across the entire day. Weekly therapy sessions are unlikely to compensate for limited communication opportunities at home. Parents and caregivers must be supported to use responsive interaction, expansion, repetition, questioning, and rich conversational input during daily routines.

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Speech production and intelligibility

Speech production is another important area in which AVT may produce functional benefits. Children who receive regular auditory input and practice may develop improved vocal control, consonant production, prosody, and speech intelligibility. The ability to monitor one's own speech through audition is particularly important because children learn to compare their spoken output with the language models provided by adults.

The development of intelligible speech is not uniform across all children with cochlear implants. Some children achieve speech that is easily understood by unfamiliar listeners, whereas others continue to demonstrate articulation errors, reduced prosodic variation, or difficulty producing specific consonants. Outcomes may be influenced by the age at implantation, pre-implant hearing experience, residual hearing, motor-speech development, device functioning, and the presence of additional developmental conditions. Evidence regarding the duration of auditory-based intervention suggests that longer therapy exposure may be associated with better speech outcomes. A recent longitudinal study reported that children receiving two years of AVT demonstrated better auditory perception and speech intelligibility than children receiving one year of therapy. The longer-treatment group also showed stronger expressive language and speech-production outcomes, although receptive-language results were more similar between groups. These findings indicate that auditory perception and expressive speech may continue to benefit from sustained intervention even after basic auditory skills have emerged.

However, speech intelligibility should not be used as the only indicator of rehabilitation success. A child may communicate effectively despite residual articulation differences, particularly when the child demonstrates appropriate turn-taking, vocabulary, comprehension, and pragmatic abilities. Outcome assessment should therefore include both standardized measures and functional communication indicators, such as the child's ability to participate in family conversations, classroom activities, peer interactions, and telephone communication.

Academic and literacy outcomes

Improved auditory access and spoken-language development may contribute to participation in mainstream educational settings. Children who can understand classroom instructions, follow discussions, ask questions, and communicate with teachers are more likely to benefit from ordinary classroom instruction. AVT may support these abilities by encouraging listening, spoken-language use, and caregiver involvement from an early stage.

Although some studies associate auditory-verbal intervention with favorable educational and literacy outcomes, the evidence is less direct than the evidence for speech perception and language. Academic achievement is influenced by many factors, including the quality of educational placement, teacher knowledge, classroom acoustics, access to assistive listening technology, reading instruction, executive functioning, and social-emotional adjustment. Therefore, it would be inappropriate to claim that AVT alone ensures mainstream placement or age-appropriate academic performance.

Reading deserves particular attention. Spoken-language skills can provide an important foundation for phonological awareness, vocabulary, decoding, and reading comprehension. However, children with cochlear implants may continue to have trouble with complex syntax, inferencing, figurative language, and the interpretation of unfamiliar vocabulary. These difficulties may become more visible as academic language becomes increasingly abstract in later primary and secondary education. For this reason, rehabilitation should gradually extend beyond basic listening and speech production to include narrative language, literacy, vocabulary depth, metalinguistic awareness, and classroom discourse.

Educational support should also continue after a child demonstrates good everyday communication. A child may perform well in quiet one-to-one conversations but struggle in a noisy classroom, during group discussion, or when several speakers talk rapidly. Continuous monitoring and collaboration among

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audiologists, speech-language pathologists, teachers, parents, and special educators are therefore necessary.

The role of age at implantation

Age at implantation is one of the most consistently reported predictors of pediatric cochlear implant outcomes. Early implantation may allow children to access spoken language during sensitive periods of auditory and linguistic development. Sharma et al. (2002) described age-related changes in cortical auditory development and highlighted the importance of early auditory stimulation. Similarly, early-intervention research has shown that children who receive timely identification and intervention tend to demonstrate stronger language outcomes than children whose hearing loss is identified or treated later (Yoshinaga-Itano, 2003).

The effect of age should not be considered in isolation. Earlier implantation is often accompanied by earlier diagnosis, stronger access to habilitation services, more consistent device use, and more opportunities for parent coaching. In addition, children implanted early may have fewer years of auditory deprivation. Thus, age at implantation may function as both a biological and a service-related variable.

Older children can still benefit substantially from cochlear implantation and AVT. Their progress may be influenced by pre-existing language, communication strategies, cognitive abilities, and previous hearing-aid experience. Clinicians should avoid presenting early implantation as the only pathway to success. Instead, rehabilitation goals should be individualized according to the child's developmental history and functional communication needs.

Family involvement and the home environment

Family involvement is a fundamental component of AVT. Parents are not simply observers of therapy; they are expected to become active communication partners who incorporate auditory and language-learning strategies into everyday routines. Moeller (2000) demonstrated the importance of family participation in early intervention and language development among children with hearing loss. A supportive home environment can increase the amount of meaningful language input available to the child and can help transfer skills from the clinic to daily life.

Family involvement includes more than attending therapy appointments. It may involve ensuring consistent device use, completing hearing checks, practicing listening activities, responding to the child's communication attempts, and creating opportunities for conversation. Parents who understand the purpose of each therapeutic activity are more likely to apply strategies naturally during play, meals, shopping, reading, and social interaction.

At the same time, clinicians should avoid interpreting missed sessions or limited participation as a lack of parental commitment. Families may face transportation difficulties, financial limitations, work responsibilities, competing caregiving demands, limited knowledge about hearing loss, or emotional stress. A family-centered model should identify these barriers and provide practical solutions rather than assigning blame. Telepractice, flexible scheduling, group counseling, home-based coaching, and culturally appropriate educational materials may improve continuity of care where conventional services are difficult to access.

Intensity, duration, and continuity of therapy

The effectiveness of AVT may depend on the intensity and continuity of intervention. Children require repeated opportunities to hear and use language across contexts. Therapy that is irregular, short-term, or interrupted may limit the development of stable auditory and spoken-language skills. Conversely, a longer intervention period may allow clinicians to address increasingly complex goals, including conversation, grammar, literacy, and classroom communication.

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Appointment attendance may also be an important marker of rehabilitation exposure. Recent research reported that higher attendance at post-activation appointments was consistently associated with better receptive- and expressive-language outcomes. However, the authors noted that this relationship may reflect not only greater rehabilitation exposure but also broader family and social factors. This distinction is important because attendance is both a treatment variable and a possible indicator of family resources, organization, and access to care.

Therapy intensity should not be measured only by the number of clinic visits. The quality of interaction at home, daily device use, school support, and opportunities for communication are equally important. Future research should record these variables in a standardized manner. Studies should also examine whether intensive early intervention should be followed by less frequent maintenance therapy or whether certain children benefit from continued high-intensity support during school years.

Socioeconomic and service-related barriers

Access to AVT is uneven across regions and social groups. Specialized therapists may be concentrated in large cities, while families living in rural or low-resource areas may have limited access to audiology, speech-language pathology, implant programming, and parent counseling. The cost of the implant, batteries, repairs, transportation, therapy sessions, and educational support may create substantial financial pressure.

These barriers are particularly relevant in developing countries, where rehabilitation services may be limited and families may need to travel long distances for follow-up. Inconsistent access can affect device functioning, therapy attendance, parental training, and the child's exposure to spoken language. Percy-Smith et al. (2018) emphasized that social and environmental factors are relevant to the well-being of children with cochlear implants, indicating that clinical outcomes should be understood within the wider family and community context.

Telepractice may provide one possible solution, but it should not be treated as a complete replacement for face-to-face care. Remote services may help with parent coaching, progress monitoring, and consultation, particularly when qualified therapists are unavailable locally. However, telepractice requires reliable internet access, suitable equipment, caregiver availability, and clinician training. Programs should also consider language, cultural practices, privacy, and the needs of families who have limited digital literacy.

Methodological limitations in the evidence

The strength of conclusions about AVT is limited by weaknesses in the current research base. Many studies use retrospective, observational, or cohort designs. Randomized controlled trials are difficult to conduct because families cannot easily be assigned to a communication approach, and ethical considerations may arise when a family has a strong preference for a particular method. Nevertheless, the absence of randomization increases the possibility of selection bias and confounding.

Another limitation is variation in how AVT is defined and delivered. Some studies describe a structured auditory-verbal program, whereas others use broader terms such as auditory-based intervention, listening and spoken language therapy, or auditory habilitation. These approaches may differ in therapist qualifications, session frequency, parental coaching, treatment duration, and use of visual cues. Without clear descriptions, it is difficult to determine which components are responsible for observed outcomes.

Outcome measures also vary considerably. Some studies assess speech perception using word or sentence tests, whereas others focus on standardized language scores, parent questionnaires, speech intelligibility ratings, or educational placement. Differences in assessment tools make direct comparisons difficult. A child may perform well on a structured word-recognition task but have trouble understanding speech in

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noise. Comprehensive research should therefore combine laboratory-based assessments with real-world functional measures.

Publication bias is another possible concern. Studies reporting positive outcomes may be more likely to be published than studies showing limited or mixed effects. In addition, small samples can produce unstable estimates and may not represent the wider population of children with cochlear implants. Many studies also exclude children with additional disabilities, developmental disorders, or significant socioeconomic disadvantage. As a result, findings may not generalize to the full clinical population.

Implications for clinical practice

The evidence supports the use of Auditory-Verbal Therapy as one appropriate rehabilitation option for children whose families prioritize listening and spoken-language development. Clinicians should explain that the cochlear implant and AVT work together: the device provides access to sound, while therapy and daily interaction support the child's interpretation and use of auditory information. Clinical programs should incorporate several essential elements to optimize outcomes, including early referral immediately following the diagnosis of hearing loss to ensure timely intervention, reliable cochlear implant programming with consistent device monitoring to maintain optimal auditory access, and the establishment of individualized auditory, speech, and language goals tailored to each child's developmental level and communication needs. Direct parent coaching during therapy sessions is critical to empower caregivers with strategies they can implement at home, while daily opportunities for listening and spoken-language practice should be integrated into everyday routines to maximize language exposure. Regular assessment of speech perception, language development, speech intelligibility, and functional communication enables clinicians to track progress and adjust intervention plans accordingly. Effective programs also require collaboration with preschool and school professionals to support educational participation and classroom success. Finally, therapy should be adapted to align with the family's language, culture, available resources, and priorities, ensuring that intervention is both meaningful and sustainable within the child's natural environment. Auditory-Verbal Therapy should not be presented as universally superior for every child or family, as some children may benefit from combined communication approaches, sign-supported communication, visual support, or bilingual-bicultural education. The central clinical objective should be effective communication and participation, and families should receive balanced information about available options and be supported in making informed decisions.

Future research directions

Future studies should use larger, multicenter samples and provide detailed descriptions of intervention content. Researchers should report the therapist's qualifications, session frequency, treatment duration, caregiver participation, device-use patterns, and educational environment. These details would improve reproducibility and allow comparisons across programs.

Longitudinal research is especially needed to determine whether early gains in auditory and spoken-language skills are maintained during school years. Studies should examine outcomes in vocabulary, grammar, narrative ability, literacy, academic achievement, social participation, and quality of life. Researchers should also include children from low- and middle-income countries, multilingual families, rural communities, and children with additional developmental needs.

A further priority is the development of standardized outcome sets for AVT research. These should include both clinician-administered assessments and caregiver- or teacher-reported measures. Research should also examine speech understanding in noise, which is highly relevant to classroom and social participation but is not always captured by traditional testing.

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Scope of Studies

The scope of this narrative review encompasses published literature examining the outcomes of Auditory-Verbal Therapy (AVT) in children with severe-to-profound hearing loss who use cochlear implants. The review includes studies that investigate auditory perception, speech production, receptive and expressive language development, speech intelligibility, literacy, academic participation, and social communication among pediatric cochlear implant users enrolled in AVT or closely related listening-and-spoken-language programs. Observational studies, cohort studies, comparative studies, longitudinal investigations, systematic reviews, and relevant clinical research were considered for inclusion. Literature published in English was prioritized to ensure accessibility and consistency in interpretation. Studies involving adults only, children using hearing aids without cochlear implants (unless findings were directly relevant to early auditory intervention), and papers discussing cochlear implantation without reporting rehabilitation or communication outcomes were excluded. Given that AVT is frequently implemented alongside other habilitation services, studies were interpreted according to the extent to which they delineate AVT-specific components from broader rehabilitation elements. This delineation ensures that conclusions drawn from the review reflect the specific contribution of AVT within the multifactorial context of pediatric cochlear implant rehabilitation.

Conclusion

Auditory-Verbal Therapy is a valuable rehabilitation approach for children with cochlear implants whose families prioritize listening and spoken language. Evidence indicates that early implantation, sustained AVT, consistent device use, and active family involvement are associated with favorable outcomes in speech perception, language development, and functional communication. However, progress varies across children and domains, and outcomes are influenced by biological, environmental, and service-related factors.

Methodological limitations in the current literature, including nonrandomized designs, variable definitions of AVT, and heterogeneous outcome measures, limit the strength of causal conclusions. Unequal access to specialized services further complicates the interpretation and generalizability of findings. Future research should use larger, well-described samples, standardized outcome sets, and longitudinal designs to clarify which components of AVT contribute most to long-term communication and participation.

Clinically, AVT should be offered as one option within a family-centered, individualized rehabilitation framework. The goal is not adherence to a particular method but effective communication, educational participation, and quality of life for the child. Expanding access to qualified services, supporting families in everyday communication, and integrating school-based accommodations will be essential to maximizing the benefits of cochlear implantation and auditory-verbal intervention.

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