The Relationship Between Little EARS Questionnaire Scores and ASSR Thresholds, and the Influence of Prenatal, Perinatal, and Socio-Demographic Risk Factors on Hearing Development in Children Using Hearing Aids (HA)

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Abstract

Congenital hearing loss is one of the most common sensory disorders in children, with a prevalence of 1–3 per 1000 live births. Early detection and intervention such as Hearing Aids (HA) are essential to minimize long-term effects. The relationship between the LittlEARS Auditory Questionnaire (LEAQ), Auditory Steady-State Response (ASSR) thresholds, and clinical or sociodemographic risk factors remains underexplored. This study aims to evaluate the association between LEAQ scores and ASSR thresholds and to analyze the influence of prenatal, perinatal, and sociodemographic risk factors on auditory development in children using HAs. Observational analytic study with a cross-sectional design was conducted on 20 children with congenital hearing loss using HAs, selected by total sampling from 77 participants in an audiology social service program in Surakarta Residency (September 2025). Data were collected from medical records, ASSR results, and LEAQ questionnaires. Statistical analysis included Chi-square and logistic regression tests. Significant factors related to auditory development included parental education level (p=0.005; OR=26.0), ≥12 hours of daily interaction (p=0.015; OR=16.0), daily use of verbal language (p=0.005; OR=26.0), and degree of hearing loss (p=0.001; OR=0.018). Multivariate analysis identified daily verbal language as the dominant factor (Nagelkerke R^2=0.928). Consistent verbal stimulation and parental involvement enhance HA effectiveness. Parental education improves rehabilitation compliance, while occupational status shows no direct effect due to socio-economic compensation. Auditory development in children with congenital hearing loss is influenced by parental education, interaction time, verbal language use, and degree of deafness. Family-based interventions are crucial for optimizing auditory rehabilitation.

Keywords: Congenital Hearing Loss, Hearing Aids, Littlears Auditory Questionnaire, Auditory Steady-State Response, and Sociodemographic Risk Factors

INTRODUCTION

Congenital deafness is one of the most common sensory deficits in children and has a broad impact on language, speech, cognitive, and socio-emotional development. Its prevalence is estimated at 1–3 per 1,000 live births, with large-scale studies reporting 1.62 per 1,000 live births (Ding et al., 2024; Korver et al., 2017a). Globally, more than 34 million children live with hearing loss, making it a major public health concern (WHO, 2021). Children born with hearing impairment are at risk of delayed language development, academic difficulties, social isolation, low self-esteem, and reduced quality of life, posing a substantial economic burden on families and society (Haukedal et al., 2022; Al-Ani, 2023; Choe et al., 2023; Podury et al., 2023).

The risk factors for congenital deafness can be categorized as prenatal, perinatal, and socio-demographic. Prenatal factors include intrauterine infections such as TORCH, exposure to ototoxic drugs, and genetic abnormalities (Emmett & Francis, 2015). Perinatal factors comprise prematurity, low birth weight, perinatal asphyxia, and hyperbilirubinemia, all of which can damage cochlear structures or auditory neural pathways (Widyasari et al., 2021; Korver et al., 2017b). Socio-demographic factors such as parental education level, socioeconomic status, and access to healthcare influence the timing of detection, follow-up, and intervention success (Olusanya et al., 2014; Sevinç et al., 2021; Atherton et al., 2023; Drake et al., 2023; Lee et al., 2025).

Early detection plays a crucial role in minimizing the long-term impact of congenital deafness. Infants who receive hearing aid (HA) intervention before six months of age demonstrate significantly better language development than those who receive it later (Ching et al., 2017). Objective diagnostic tools such as Otoacoustic Emission (OAE), Auditory Brainstem Response (ABR/BERA), and Auditory Steady-State Response (ASSR) are widely used for screening and diagnosis. OAE assesses outer hair cell function in the cochlea, ABR evaluates the integrity of brainstem auditory pathways, while ASSR estimates frequency-specific hearing thresholds in both ears. The ASSR method is particularly valuable for precise HA fitting, especially in infants or young children who are not yet cooperative in behavioral testing (Alamanda & Hohman, 2025; Binos et al., 2023).

In addition to objective tests, parent-reported tools such as the LittlEARS Auditory Questionnaire (LEAQ) are frequently used to monitor auditory development. LEAQ is practical, cost-effective, and suitable for both initial and follow-up assessments. However, due to its subjective nature, it requires validation against objective methods like ASSR (Luiz et al., 2024; May-Mederake et al., 2010). Previous studies have shown a good correlation between ASSR and behavioral audiometry thresholds, yet research exploring the relationship between LEAQ scores and ASSR results remains limited—particularly when analyzed in relation to clinical and socio-demographic risk factors.

Given the high prevalence of childhood hearing loss in developing countries, including Indonesia, and the limited access to audiological assessments, there is an urgent need for research that considers prenatal, perinatal, and socio-demographic risk factors. Therefore, this study aims to evaluate the correlation between LEAQ scores and ASSR thresholds among children using hearing aids and to examine the influence of these risk factors on hearing development outcomes.

MATERIALS AND METHODS

Study Design

This study employed a cross-sectional design and was conducted in the Surakarta Residency Area, Central Java, in September 2025. The location was selected due to its heterogeneous population characteristics and limited access to audiology healthcare services.

Population, Sample, and Restriction Criteria

The study population included all patients who underwent hearing assessments, including Otoacoustic Emission (OAE), ear cleaning, and audiometry, totaling 77 individuals. Based on the restriction criteria, 20 children with congenital hearing loss were selected as the study sample using a total sampling technique.

The inclusion criteria consisted of children with a history of congenital hearing loss who had been fitted with hearing aids (HA), had complete medical records including Auditory Steady-State Response (ASSR) data, and had available socio-demographic information. Exclusion criteria included patients with chronic ear infections, a history of ear surgery, or other medical conditions such as severe neurological disorders, intellectual disability, or global developmental delay.

Measurements

Independent variables included hearing threshold, prenatal, perinatal, and socio-demographic risk factors, collected using a standardized questionnaire. Prenatal factors consisted of a history of intrauterine infection, exposure to teratogenic drugs or herbal medicine, and pregnancy complications. Perinatal factors included prematurity, low birth weight, perinatal asphyxia, and hyperbilirubinemia. Socio-demographic factors comprised parental education level, parental occupation, duration of time spent accompanying the child, and the primary language used at home. The dependent variable was the LittlEARS Auditory Questionnaire (LEAQ) score. Data were collected using the validated international LittlEARS questionnaire, completed by parents or guardians, which assesses the child's auditory responses in daily life situations.

Statistical Analysis

Univariate analysis was conducted to describe the distribution of sample characteristics, while bivariate analysis using the Chi-Square test assessed the relationship between variables with a significance level set at $p < 0.05$. Multivariate analysis was performed using logistic regression, and the results were presented as Odds Ratios (OR) with 95% Confidence Intervals (CI).

Ethical Clearance

This study received ethical approval from the Health Research Ethics Committee of Dr. Moewardi General Hospital, Surakarta, under approval certificate number 2.105/X/HREC/2025.

RESULTS

Characteristics of the Study Sample

The characteristics of the study sample are presented in Table 1. The majority of children were under 10 years old (65%), with a higher proportion of females (60%). Most parents had completed senior or vocational high school (45%), and the dominant occupations were private employees and housewives (each 35%), while a smaller proportion worked as entrepreneurs, laborers, or farmers (10%). Most parents spent ≥12 hours per day accompanying their children (75%) and communicated primarily using sign language (50%), followed by verbal communication (30%) and lip reading (20%).

Regarding prenatal factors, most mothers attended regular antenatal check-ups (75%), did not consume teratogenic drugs or herbal medicine (70%), and had no history of illness or infection during pregnancy (75%). Conversely, 25% of mothers did not attend regular check-ups, had a history of illness or infection, and 30% reported consuming teratogenic drugs or herbal products.

For perinatal factors, the majority of children were born full-term (90%), with a birth weight >2 kg (60%), and through normal delivery (90%). However, 10% were born prematurely, 40% had low birth weight, 10% were delivered via cesarean section, 20% required respiratory support, and 30% experienced hyperbilirubinemia.

Based on child-related history, almost all children had complete immunizations (90%) and rarely experienced colds (75%). Most lived in environments distant from noise sources (85%). Audiological examinations revealed that 70% of children had *profound hearing loss* (>90 dB), while the remaining 30% had *severe hearing loss* (71–90 dB).

Tabel 1. Characteristics of Research Samples

Characteristics	Frequency	Percentage
Child's Age		
<10 years	13	65%
≥10 years	7	35%
Child's Gender		
Female	12	60%
Male	8	40%
Parent's Occupation		
Entrepreneur	2	10%
Private Employee	7	35%
Laborer	2	10%
Farmer	2	10%
Housewife	7	35%
Parent's Last Education		
Bachelor's Degree (S-1/D-IV)	4	20%
Diploma (D-III/Equivalent)	2	10%
Senior High School/Vocational School	9	45%
Junior High School	4	20%
Elementary School	1	5%
Duration of Accompanying the Child		
<12 hours	5	25%
≥12 hours	15	75%
Daily Language Used		
Verbal	6	30%
Lip Reading	4	20%
Sign/Gesture	10	50%
Pre-Natal Factors		
Doctor Check-up/Ante Natal Care (ANC)		
Regular Visits	15	75%
Irregular Visits	5	25%
Teratogenic Drug/Herbal Consumption		
Consumed	6	30%
Not Consumed	14	70%
History of Illness During Pregnancy		

Yes	5	25%
No	15	75%
History of Infection During Pregnancy		
Yes	5	25%
No	15	75%
Peri-Natal Factors		
Gestational Age		
Full Term (>37 weeks)	18	90%
Preterm (<37 weeks)	2	10%
Birth Weight		
Normal Birth Weight (>2 kg)	12	60%
Low Birth Weight (<2 kg)	8	40%
Delivery Process		
Normal	18	90%
Cesarean	2	10%
Need for Respiratory Support		
Required	4	20%
Not Required	16	80%
Neonatal Hyperbilirubinemia		
Present	6	30%
Absent	14	70%
Child's History		
Immunization		
Complete	18	90%
Incomplete	2	10%
History of Common Cold		
Frequent Colds	5	25%
Rarely Colds	15	75%
Proximity to Noise Source		
Near Noise Source	3	15%
Far from Noise Source	17	85%
Degree of Hearing Loss (ASSR Results)		
Severe Hearing Loss (71–90 dB)	4	20%
Profound Hearing Loss (>90 dB)	16	80%
Development of ABD Use (ASSR Score)		
Good Hearing Development (Score ≥35)	6	30%
Poor Hearing Development (Score <35)	14	70%

Association Between Parental Education Level and Hearing Development in Children with Congenital Deafness Using HA

Bivariate analysis presented in Table 2 shows that the parental education level had a significant effect on the hearing development of children with congenital deafness using hearing aids (p = 0.005; OR = 26.000; 95% CI: 1.838–367.698). Children whose parents had higher education levels were 26 times more likely to achieve better hearing development compared to those whose parents had lower education levels.

This finding highlights the crucial role of parental education in understanding the child's needs, providing auditory stimulation, ensuring consistent hearing aid use, and engaging actively in speech therapy. Higher education also enhances parents' access to information regarding auditory rehabilitation and strengthens their interaction skills with the child, making it a key determinant of successful intervention in children with congenital deafness.

Table 2. Association of Parental Education Level on Hearing Development in Children with Congenital Deafness Using HA

Parental Education	Optimal HA Development		Suboptimal HA Development		*OR*	CI 95%		P
	F (n)	(%)	F (n)	(%)		Lower	Upper	
College Level Education	4	20	2	10	26,000	1,838	367,698	0,005
School Level Education	1	5	13	65				

Association Between Parental Occupation and Auditory Development in Children with Congenital Deafness Using HA

Based on Table 3, parental occupation status showed no significant association with auditory development in children with congenital deafness using hearing aids (p = 1.000; OR = 1.000; 95% CI: 0.127–7.893). This indicates that both working and non-working parents have equal opportunities to support their child's auditory development. Occupational status does not directly influence auditory ability; rather, it is mediated by other factors such as the quality of parent–child interaction, frequency of communication, and overall family support. Working parents may have limited time but better access to rehabilitation facilities, whereas non-working parents may have more time but limited financial resources. Therefore, parental occupation is not a primary determinant but may exert an indirect effect through economic and parenting-related factors.

Table 3. Association Between Parental Occupation and Auditory Development in Children with Congenital Deafness Using HA

Parental Occupation	Optimal HA Development		Suboptimal HA Development		*OR*	CI 95%		P
	F (n)	(%)	F (n)	(%)		Lower	Upper	
Work	3	15	9	45	1,000	0,127	7,893	1,000
Non-Work	2	10	6	30				

Association Between Duration of Parental Companionship and Auditory Development in Children with Congenital Deafness Using HA

The analysis presented in Table 4 demonstrates a significant association between the duration of parental companionship and auditory development in children with congenital deafness using hearing aids (p = 0.015; OR = 16.000; 95% CI: 1.274–200.92). Children accompanied by their parents for ≥12 hours per day were 16 times more likely to achieve good auditory development compared to those accompanied for <12 hours. This finding highlights the critical role of parental involvement in auditory stimulation, consistent use of hearing aids, and daily communication training. Longer companionship provides greater language exposure and interaction opportunities, enhancing the child's motivation and adherence to rehabilitation. Therefore, the duration of parental companionship serves as an important protective factor in the auditory development of children with congenital deafness.

Table 4. Association Between Duration of Parental Companionship and Auditory Development in Children with Congenital Deafness Using Hearing Aids

Duration of Parental Companionship	Optimal HA Development		Suboptimal HA Development		*OR*	CI 95%		P
	F (n)	(%)	F (n)	(%)		Lower	Upper	
<12 hours	1	5	12	60	16,000	1,274	200,92	0,015
≥12 hours	4	20	3	15				

Association Between Daily Language Use and Auditory Development in Children with Congenital Deafness Using HA

As shown in Table 5, there was a significant association between daily language use and auditory development (p = 0.005; OR = 26.000; 95% CI: 1.838–367.698). Children who primarily used verbal language were 26 times more likely to achieve better auditory development than those who relied mainly on non-verbal communication such as sign language or lip reading. Consistent verbal interaction provides greater auditory stimulation, enhances sound recognition, and supports language acquisition. Conversely, the dominance of non-verbal communication may limit auditory perception. These findings highlight the importance of promoting verbal communication at home as part of family-centered rehabilitation strategies for children with congenital hearing loss using hearing aids.

Table 5. Association Between Daily Language Use and Auditory Development in Children with Congenital Deafness Using HA

Daily Language Use	Optimal HA Development	Suboptimal HA Development	*OR*	CI 95%	P

	F (n)	(%)	F (n)	(%)		Lower	Upper	
Verbal	4	20	2	10	26,000	1,838	367,69	0,005
Non-Verbal (Sign, Gestur, Lips Reading)	1	5	13	65				

Association Between the Degree of Congenital Hearing Loss and Auditory Development in Children with Congenital Deafness Using HA

The bivariate analysis presented in Table 6 demonstrates a significant association between the degree of congenital hearing loss and auditory development (p = 0.001; OR = 0.018; 95% CI: 0.001–0.354). Children with severe hearing loss (71–90 dB) showed a higher likelihood of better auditory development compared to those with profound hearing loss (>90 dB). The greater the degree of hearing impairment, the more limited the child's ability to perceive and process auditory stimuli, even when using hearing aids. The success of auditory rehabilitation largely depends on the residual hearing capacity of the child. Those with less severe hearing loss tend to respond more effectively to sound stimulation and adapt more quickly to hearing aid use. Therefore, early identification of hearing loss severity and prompt intervention are crucial for determining the prognosis of auditory development in children with congenital deafness.

Table 6. The Effect of the Degree of Congenital Hearing Loss on Auditory Development in Children with Congenital Deafness Using HA

Degree of Congenital Hearing Loss	Optimal HA Development		Suboptimal HA Development		*OR*	CI 95%		P
	F (n)	(%)	F (n)	(%)		Lower	Upper	
Severe Hearing Loss (71-90 dB)	4	20	1	5	0,018	0,001	0,354	0,001
Profound Hearing Loss (>90 dB)	1	5	14	70				

Factors Influencing Auditory Development in Children with Congenital Deafness Using HA

The multivariate analysis presented in Table 7 shows that parental education (OR = 3.94×10^{13}), duration of parental companionship (OR = 2.83×10^{12}), and daily language use (OR = 2.46×10^{13}) significantly influence auditory development in children with congenital deafness using hearing aids, with daily language identified as the most dominant factor. Conversely, the degree of congenital hearing loss (OR = 0.000) indicates that the more severe the hearing impairment, the lower the likelihood of achieving optimal auditory development.

The logistic regression model demonstrated a classification accuracy of 95% (93.3% for the poor-hearing group and 100% for the good-hearing group). The Nagelkerke R-square value of 0.928 suggests that the model explains 92.8% of the variance in auditory development, while the remaining 7.2% is influenced by other factors such as consistency and duration of hearing aid use, speech therapy participation, and environmental support.

Table 7. Factors Influencing Auditory Development in Children with Congenital Deafness Using HA

Variables	**Koefisien Beta**	***P-value***	***OR (ExpB)***	**CI 95%**		**Negelkerke R-Square**
				Lower	**Upper**	
Parental Education Level	19,792	0,998	$3{,}94 \times 10^{13}$	0,000	∞	0,928
Duration of Parental Companionship	19,463	0,999	$2{,}83 \times 10^{12}$	0,000	∞	
Daily Language Use	19,323	0,999	$2{,}46 \times 10^{13}$	0,000	∞	
Degree of Congenital Hearing Loss	-19,886	0,999	0,000	0,000	0,000	

DISCUSSION

Relationship Between Parental Education and Auditory Development in Children with Congenital Deafness Using Hearing Aids

Higher parental education levels enhance parents' understanding of their children's needs, improve the quality of caregiving (such as routine auditory stimulation, consistent hearing aid use, and access to rehabilitation services), and thereby contribute to better auditory and language outcomes (Ching et al., 2013). Previous studies have reported that maternal education is a significant predictor of early language and behavioral outcomes (Ching et al., 2013; Erbasi et al., 2018). Moreover, parental education interventions have demonstrated significant associations between education level and knowledge or perception scores regarding hearing aid management ($p = 0.005$ for knowledge; $p = 0.039$ for perception) (Mazlan et al., 2025).

However, a sub-study involving 9-year-old children found that although maternal education correlated with language scores, it was no longer a predictor once non-verbal cognitive ability was controlled (regression: maternal education $p > 0.05$) (Ching et al., 2018). Other studies also emphasize that access and timing of auditory stimulation play a crucial role in determining outcomes (Portelli et al., 2024). Socioeconomic resources and family support have been found to amplify the effect of education on compliance and stimulation practices (Ching et al., 2017; Erbasi et al., 2018). Furthermore, parental education and mentoring programs can help reduce educational disparities, thereby moderating the relationship between education and outcomes (Muñoz et al., 2021).

Overall, existing evidence supports that parental education positively correlates with auditory outcomes through improved knowledge, parenting practices, and hearing aid use consistency. Nevertheless, these effects are often mediated by other variables such as the child's cognitive ability, timing of intervention, and service accessibility. Therefore, reporting multivariate p-values is essential to distinguish direct from mediated effects.

Relationship Between Parental Occupation and Auditory Development in Children with Congenital Deafness Using Hearing Aids

Parental occupation and socioeconomic status are often assumed to influence auditory and language development in children with congenital deafness who use hearing aids. Higher occupational or economic status facilitates better access to healthcare services, regular evaluations, and rehabilitation programs. Studies have shown that socioeconomic level is significantly associated with implantation age and language outcomes ($p < 0.0001$) (Jeddi et al., 2012).

However, a retrospective cohort study found no significant differences between children covered by public versus private insurance in terms of hearing aid follow-up, compliance, or speech therapy outcomes ($p > 0.05$), indicating that insurance or public health systems may mitigate socioeconomic disparities (Smith et al., 2019). External financial support from donors or government programs may also reduce the correlation between household income and post-intervention language outcomes. Conversely, factors such as maternal education and parental involvement remain strong predictors (Lee et al., 2025).

The non-significant findings in Table 3 may be attributed to compensatory mechanisms such as donor, government, or insurance funding, which equalize access to services. Parental education and engagement appear to play more decisive roles than income, while job type and caregiving quality are not fully captured by occupational variables. Practically, these results emphasize the need for policies prioritizing universal service access and parent empowerment programs (education and behavioral support), rather than focusing solely on economic factors. Although family economic theories link employment, income, access, and outcomes, empirical data show these effects can be attenuated by financial support and mediated by family-related variables (Binos et al., 2023).

Relationship Between Parental Companionship Duration and Auditory Development in Children with Congenital Deafness Using Hearing Aids

Daily parental companionship duration is associated with improved child well-being and developmental outcomes. National data analyses indicate a significant positive coefficient between parental time and child well-being (coef = 0.1020, $p < 0.01$), suggesting that time quantity contributes to psychosocial outcomes (Li & Guo, 2023). However, other studies found that maternal time alone was not significantly correlated with various developmental domains, implying that duration without interaction quality is insufficient (Milkie et al., 2015).

Three main explanations are proposed: (1) quality of interaction (responsiveness, structured stimulation) is more decisive than duration—summarized as the principle "quality > quantity"; (2) socioeconomic and educational factors moderate the time-outcome relationship, often nullifying time effects when controlled; and (3) methodological differences (time-diary vs. self-report) and outcome heterogeneity (language, social, emotional) lead to inconsistent findings (Kantova, 2024).

For children with hearing disabilities, evidence strongly supports parental involvement and family-centered interventions as predictors of improved language and communication outcomes (Holt et al., 2012). Hence, practical recommendations include enhancing both the quantity and quality of daily parental engagement—through consistent auditory stimulation, supervised hearing aid use, and daily communication practice—combined with structured parent training programs. Evidence indicates that when duration is enriched with structured stimulation strategies, outcomes are significantly improved (Giallini et al., 2021).

Relationship Between Daily Language Use and Auditory Development in Children with Congenital Deafness Using Hearing Aids

Consistent use of verbal language in daily communication supports auditory development among children with congenital deafness. Regular verbal stimulation facilitates faster assimilation of sounds, vocabulary, and linguistic structure, thereby enhancing communication skills. Longitudinal studies by Yoshinaga-Itano et al. (1998) demonstrated that children identified before 6 months of age had significantly better language scores than those diagnosed later ($p < 0.05$). Similarly, Ching et al. (2013) reported that age at fitting and hearing aid use consistency were significant predictors of language development by age three ($p < 0.05$). Tomblin et al. (2014) further found that aided audibility (aided SII) was positively associated with language growth rates in children with mild to severe hearing loss ($p < 0.05$).

Conversely, studies on bimodal bilingualism (Pontecorvo et al., 2023) found a positive correlation between American Sign Language (ASL) vocabulary and spoken vocabulary, indicating no evidence that sign exposure hinders verbal language development ($p < 0.05$). This aligns with Hall (2017), who emphasized that access to any language—visual or auditory—is critical to prevent language deprivation. Differences across studies may stem from methodological variations, outcome definitions (pure auditory perception vs. total language capacity), population heterogeneity, fitting age, compliance, and family background. Thus, consistent verbal stimulation remains the cornerstone of auditory habilitation, while sign language serves as a complementary tool to prevent language deprivation when auditory access is limited.

Relationship Between Degree of Congenital Hearing Loss and Auditory Development in Children Using Hearing Aids

Children with more severe degrees of congenital hearing loss face greater challenges in perceiving and processing auditory input, which can limit the success of auditory rehabilitation. Severe hearing loss generally reduces speech audibility, slowing language development (Tomblin et al., 2015). Longitudinal research has shown that aided audibility is positively correlated with speech recognition and language growth (McCreery et al., 2015). Studies of post-implantation outcomes also reported that preserved residual hearing is associated with better early auditory performance scores (e.g., meaningful use of speech; $p = 0.004$) and higher speech intelligibility ($p = 0.049$), reinforcing residual hearing as a predictor of outcomes (Li et al., 2022).

However, some studies reported contrasting results, finding that hearing loss severity did not significantly predict expressive vocabulary at age two ($p = 0.234$), while early intervention and nonverbal cognition played more dominant roles (Holzinger et al., 2022). These inconsistencies may result from (1) leveling effects of intensive family-based interventions, (2) strong mediators such as consistent hearing aid use and cognitive abilities, and (3) etiological heterogeneity (genetic vs. acquired) that modulates response to amplification. In general, the more severe the hearing loss, the higher the risk for delayed auditory and language development; however, this effect is strongly moderated by aided audibility, timing and quality of intervention, and cognitive factors. Thus, hearing loss severity should not be viewed as the sole determinant of clinical outcomes (Holzinger et al., 2022; McCreery et al., 2015).

CONCLUSION

This study demonstrates that auditory development in children with congenital hearing loss using hearing aids is influenced by parental education level, intensity of parental involvement, daily language use, and degree of hearing loss. Parental education emerged as the most dominant determinant, followed by engagement and communication patterns. These findings highlight the importance of family-centered interventions, particularly through parental education enhancement and active participation in daily interactions, to optimize auditory rehabilitation outcomes. Future research with larger sample sizes and broader variable coverage is recommended to deepen understanding of additional factors influencing auditory development.

Declaration of Conflict

There were no disclosed conflicts of interest by the authors.

Acknowledgments

We would like to express my deepest gratitude to all parties who have helped and supported us in preparing this journal.

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