

ORIGINAL ARTICLE

Parental Impact on Socio-Emotional Development of Deaf and Hard-of-Hearing Children with Cochlear Implants: A Mixed-Methods Study

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ABSTRACT

Introduction: This study explores the relationships between parenting styles, parenting stress, child-parent relationships, and the socio-emotional functioning of Deaf and Hard-of-Hearing (DHH) children with cochlear implants (CI) through a mixed-methods approach. **Methods:** In the quantitative phase, 36 parents of CI children aged four to six completed questionnaires via purposive sampling. Subsequently, in the qualitative phase, 12 parents participated in in-depth interviews. **Results:** The findings suggest that practicing authoritative parenting, which was the most common parenting style among the participants, was associated with higher socio-emotional skills in CI children. CI children might still exhibit undesirable behaviour, and this often stimulates parents to evaluate and enhance their parenting skills. Parenting stress was found to be higher among the participants, attributed to various challenges such as guilt, self-doubt, time management, and work-related stress. However, proactive strategies like positive self-talk and sharing success stories of cochlear implantation were identified as potential mitigating factors for parenting stress. Parental investment in building a close relationship and engaging in activities together, with the degree of closeness serving as a vital mediator, further enhances socio-emotional skills in CI children. **Conclusion:** This research provides valuable insights for future studies on the socio-emotional development of CI children and the role of parenting. The results suggest the need for early prevention programs tailored to the unique needs and challenges of parents with CI children. Additionally, clinicians in CI teams should be aware of the potential for high levels of parenting stress and strive to provide appropriate support for the socio-emotional functioning of CI children.

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outcomes depends on multiple factors, including child-specific attributes, the implant technology, and the child's environment, particularly parental involvement (4).

INTRODUCTION

Sensorineural hearing loss affects 1.1-6 per 1,000 live births (1). For children experiencing severe-to-profound hearing loss, cochlear implants (CIs) provide direct auditory nerve stimulation. Unlike traditional devices that amplify sound, CIs bypass damaged auditory mechanisms, directly stimulating auditory nerves through electrical impulses. Research on CI children provides critical insights into their distinctive developmental trajectories, encompassing auditory, language, and socio-emotional domains (2). Early auditory deprivation caused by severe congenital hearing loss can disrupt both language acquisition and socio-emotional development (3). CIs mitigate this deprivation by enabling auditory input, significantly influencing developmental outcomes. However, the success of CI

While many studies have focused extensively on speech and language development in CI children, socio-emotional development remains an underexplored yet essential area (5-7). Unique auditory experiences of CI users may affect their ability to perceive speech nuances, interpret emotional cues, and engage effectively in social interactions. Challenges such as difficulty understanding speech in noisy environments and barriers in communication with peers often result in reduced social inclusion. Investigating socio-emotional development is essential for developing targeted interventions to enhance social skills, emotional regulation, and overall well-being.

Parents play a central role in the developmental trajectories of children, particularly for those with hearing loss. Parental involvement significantly influences

auditory as well as socio-emotional outcomes. Previous research has highlighted a correlation between the time parents spend engaging with their CI children and their functional auditory skills (8). Despite advancements in CI technology leading to improved speech and language outcomes, CI children continue to face socio-emotional challenges, with reported difficulty rates ranging from 8% to 41.3% (9, 10). This study employs a mixed-methods approach to explore how parental factors impact the socio-emotional development of Deaf and Hard-of-Hearing (DHH) children with CIs, specifically among those aged four to six years who are preparing for school entry.

Bronfenbrenner's social-ecological model emphasizes the influence of both personal and interpersonal factors on socio-emotional development, highlighting the family as a primary context of socialization (11). Baumrind's typology of parenting styles—authoritative, authoritarian, and permissive—offers a theoretical framework for understanding how parental behaviours influence child outcomes. Research indicates that many parents of DHH children adopt an authoritative parenting style, characterized by high responsiveness and demands, which has been associated with positive developmental outcomes (12). Conversely, authoritarian parenting, marked by punitive measures and low responsiveness, has been linked to poorer socio-emotional skills (13). Although permissive parenting among parents of CI children has been less frequently studied, this style—characterized by high responsiveness but low demands—may also impact socio-emotional development (14).

Raising a child with hearing loss involves unique challenges, including decisions related to CI implantation, language development strategies, education, and habilitation. These stressors often lead to elevated parenting stress, potentially negatively affecting child-parent interactions and subsequent socio-emotional development (15, 16). High levels of parenting stress can result in inconsistent or less responsive parenting, disrupting the quality of the child-parent relationship—a key mediator of socio-emotional outcomes (17, 18). Research on DHH children highlighted lower frequencies of meaningful child-parent interactions and challenges in sustaining effective communication, further complicating the socio-emotional development process (19).

A notable gap exists in the literature regarding the specific relationships among parenting factors, and socio-emotional development of DHH children with CIs. Addressing this gap is crucial for tailoring interventions that promote optimal outcomes for this unique population. Hence, this study employs a mixed-methods design to provide a comprehensive understanding to examine parental factors affecting socio-emotional outcomes in CI children. Hypotheses

include the expectation that

- 1) Authoritative parenting style will correlate with lower socio-emotional difficulties in CI children
- 2) Parenting stress and close child-parent relationship will mediate the link between authoritative parenting style and socio-emotional difficulties.

MATERIALS AND METHODS

Design

The mixed-methods approach, combining quantitative surveys with qualitative interviews, was selected to capture both the breadth of relationships among variables and the depth of parental experiences in raising CI children, thus providing richer insights than either method alone. This study received ethical approval from the Universiti Kebangsaan Malaysia (UKM) Research Ethical Committee (approval number UKM PPI/111/8/JEP-2018-605).

Phase 1

Participants

Purposive sampling with the snowball method was used to recruit an initial representative group of parents whose children were enrolled in the UKM Cochlear Implant Program. Established in 1995, the UKM CI Program was Malaysia's and Southeast Asia's first and remains the country's largest CI programme. Participants were recruited during the year 2019-2021, a period that coincided with the Malaysian Government Movement Control Order (MCO), implemented from March 2020 onwards to contain the Covid-19 pandemic. Out of an initial 120 potential participants contacted, 36 parents completed the questionnaires, representing a relatively low response rate of approximately 30%. Although the exact reasons for the low response rate remain unclear, it could be partially attributed to disruptions caused by the successive periods of MCO, which significantly impacted the daily lives and priorities of Malaysian families, including those initially contacted for participation who may have had other pressing concerns. Parents participation in the study was entirely voluntary.

All the 36 parents had preschool children aged four to six years old with CI. Parent participants (N=36) ranged from 28 to 60 years old, divided into four age groups (Group I: below 30 aged; Group II: 31-35 aged; Group III: 36-40 aged; Group IV: above 40 aged). The majority of the participants were in Group III (36%), followed by Group II and Group IV (28% each), with only 8% in Group I. Ethnically, the sample comprised predominantly Chinese (75%), followed by Malay (17%), Indian (5%), and other ethnicities (3%). About 17% of parents had completed secondary education, 25% held Pre-University and Diploma qualifications, and 58% had undergraduate degrees. The median monthly income of the families was approximately RM 7,000, placing the sample within Malaysia's family middle-income (M2

tier - M40) category (20). The majority of parents (83%) were employed, with 17% unemployed.

Children aged 4 (n=10), 5 (n=11), and 6 (n=15) constituted the age range of 4 to 6 years. About 61% of them were males, and 39% females. Most children (69%) had bilateral CI fittings (implants in both ears), followed by bimodal fittings (a CI in one ear and a conventional hearing aid in the other, 17%) and unilateral CI fittings (an implant in one ear only, 14%). Around 58% of the children were implanted before the age of three, with an average duration of CI use of 2.66 ± 1.16 years at the time of the study. The remaining children were implanted at the age of three or older.

Instruments

The measurement instruments had been translated into English, Malay, and Mandarin. Back-translation ensured conceptual and linguistic equivalence of the Malay and Mandarin versions against the original English instruments. Tools were revised to determine their reliability using SPSS software, version 28. There are five different parts (Part A– Demographic Information, B- Parental Authority Questionnaire–Short Version, C- Child-Parent Relationship Scale–Short Form, D- Parenting Stress Index–Short form, and E- Strength & Difficulties Questionnaire) of the questionnaires that were distributed to the participants:

Demographic information obtains basic details of the participants (i.e., age, ethnic, marital status, occupational, family monthly income, educational level, etc.) and their CI children (i.e., name, age, gender, age of cochlear implantations, unilateral, bilateral or bimodal CI fitting, etc.)

PAQ-SV is used to measure the parenting styles: authoritative, authoritarian, and permissive (21). This questionnaire consists of 20 questions on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha of 0.79 were reported in this study and indicated this trilingual questionnaire's good internal reliability coefficients.

CPRS-SF is a measure assessing parental perceptions of the quality of their child-parent relationship (22). It is a 15-item questionnaire evaluating parents' reported attitudes towards their child and parenting in two dimensions (i.e. Closeness and Conflict) using a 5-point Likert type. It has also been proven to have adequate validity in an Asian context as the original two-factor model was a good fit for the data (23). An acceptable internal reliability coefficient with Cronbach's alpha of 0.81 was obtained for this study when employing this trilingual questionnaire.

PSI-SF is developed to measure parenting stress in the child-parent relationship (24). It consists of 36 statements, each rated on a 1 to 5 scale (1=strongly

disagree, 5=strongly agree). It has three subscales: Parental Distress, Difficult Child, and Child-parent Dysfunctional Interaction. The utilization of this trilingual questionnaire was noted to have good internal reliability coefficients with Cronbach's alpha of 0.89.

SDQ is a brief behavioural screening questionnaire used to measure the socio-emotional competency of DHH children (25). It has 25 items with three response categories: 0 (not true), 1 (somewhat true), 2 (certainly true). All items are divided into five scales pertaining to the positive and negative effects of emotional and behavioural difficulties (emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behaviour). Cronbach's alpha for this study was $\alpha=0.71$, which indicated adequate internal reliability coefficients.

Procedure

An official letter requesting permission to collect data was sent to the UKM CI Program team, securing approval from relevant authorities. Relevant instruments were prepared. A list of potential parents whose children using CI was approached through WhatsApp messages, which included an introductory cover letter explaining the details of research. Subsequently, a follow-up call via WhatsApp was initiated with potential parents to ensure they clearly understood the research objectives and procedures and to guide them through the consent process. Parents who agreed to participate were provided with a link to an online consent form. To uphold participant anonymity and confidentiality, individualized links to the online questionnaire were generated and sent via WhatsApp Messages to those who had completed the consent form. Data collection occurred online, with participants requested to submit their responses within one week. All the collected data were then analyzed by using SPSS software version 28.

Results

Descriptive statistics. All variables were normally distributed. Most participants demonstrated authoritative parenting style (58.3%) and high clinical-level parenting stress (72.2%) that need additional follow-up according to the cut-off scores of PSI-SF (percentile scores that fall between 90 and 100) (24). Most participants (94.4%) perceived that they had a close relationship with their CI children as per reported in the closeness scale of CPRS-SF (22). Participants feel that the relationship with their CI children was characterized by warmth, affection, and open communication. 72.2% of participants believed that their children's socio-emotional skills were in the normal range, which is considered typical or expected for their age.

Correlation Analysis. Correlation results among the variables indicated that the authoritative parenting style had significant positive relationships with parenting stress ($r=0.36$, $p<0.05$) and closeness ($r=0.36$, $p<0.05$).

Meanwhile, authoritative had significant negative relationships with conflict ($r=-0.34$, $p<0.05$) and poor socio-emotional skills of CI children ($r=-0.56$, $p<0.01$), which indicates that an increase in authoritative practice is associated with lower level of conflict and better socio-emotional skills outcomes in CI children. There were no significant relationships between authoritarian and permissive with poor socio-emotional skills of CI children, warranting no further analysis. Only significant variables in correlations were included in the regression analysis (26). The relationship between parenting stress and closeness was positively correlated ($r=0.50$, $p<0.01$), which suggests that as parenting stress increases, the level of closeness between parents and CI children also tends to increase. Parenting stress had a significant negative relationship with conflict ($r=-0.56$, $p<0.01$) and poor socio-emotional skills of CI children ($r=-0.48$, $p<0.01$). This indicates that when parents experience more stress, it's linked to a reduced occurrence of conflict with CI children and lower levels of poor socio-emotional skills in these children. In other words, higher levels of parenting stress is associated with better socio-emotional skills of these children.

Multiple Regression Analysis

Table I shows the predictive power of each predictor by using standard multiple regression analyses. Four predictors (authoritative, parenting stress, closeness, and conflict) contributed 46.5% to the CI children's poor socio-emotional skills. It was noted that all four predictors of poor socio-emotional skills of CI children were significant, $F=6.74$, $p=0.001$. Yet, authoritative ($\beta=-0.40$, $t=-2.76$, $p<0.05$) was identified as a stronger predictor compared to parenting stress ($\beta=-0.24$, $t=-1.47$, $p>0.05$), closeness ($\beta=-0.35$, $t=-1.92$, $p>0.05$) and conflict ($\beta=-0.15$, $t=-0.78$, $p>0.05$). The multicollinearity analysis showed acceptable tolerance (>0.2) and VIF values (<5) for all non-significant predictors, confirming their non-significance reflects true weaker relationships with the dependent variable rather than collinearity problems.

Table I: Multiple Regression Analysis

Variable	Poor socio-emotional skills of CI children						
	Model Summary		ANOVA		Result		
	R ²	Std. Error of the Estimate	F	Sig	β	t	Sig
Authoritative, parenting stress, closeness, conflict	0.47**	3.844	6.74	0.001	-	-	-
Authoritative					-0.40	-2.76	0.010
Parenting stress					-0.24	-1.47	0.153
Closeness					-0.35	-1.92	0.064
Conflict					-0.15	-0.78	0.440

* $p<0.05$ (2-tailed); ** $p<0.01$ (2-tailed)

Note. This is the summary of standard multiple regression analysis of authoritative, parenting stress, closeness, and conflict on poor socio-emotional skills of CI children

Mediation Analysis

Figure 1 illustrates the direct effect and indirect impact of authoritative (X) on poor socio-emotional skills of CI children (Y) through closeness (M) as the mediator. The a indicates that there was a significant relationship between authoritative and closeness ($\beta=12.40$, $p=0.0321$, $p<0.05$). The b indicates that parents with a closer relationship with their CI child contributed to better socio-emotional skills of these children, even after controlling for the authoritative ($\beta=-0.42$, $p=0.0157$, $p<0.05$). The association between authoritative and poor socio-emotional skills of CI children has been increased from (-22.69** to -17.47**) by inclusion of closeness in the model. The mediation analysis was conducted using bootstrapping analysis (with the bootstrap re-sampling value of 5000) to investigate the indirect effect of the authoritative on the poor socio-emotional skills of CI children through closeness (mediator). Table II shows

that the bootstrapped estimate of the actual indirect effect ($\beta=-5.21$) lay between -12.38 and -0.45 with 95% confidence. Because zero is not in the 95% confidence interval, it can be concluded that the indirect effect is significantly different from zero at $p<0.05$. This result indicates a significant indirect effect of the authoritative on poor socio-emotional skills of CI children through closeness. On the other hand, parenting stress and conflict did not show any indirect effects.

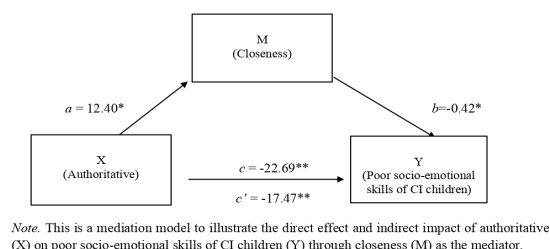


Figure 1: Mediation Analysis Model

Table II: Bootstrapped Indirect Effect

Authoritative	Poor socio-emotional skills of CI children			
	β	S.E.	Percentile Lower	Percentile Upper
	-5.21*	3.09	-12.38	-0.45

Notes: * $p<0.05$, ** $p<0.01$; $N=5000$ Bootstrapping resamples

Note. This is the bootstrapped indirect effect of authoritative (X) on poor socio-emotional skills of CI children (Y) through Closeness (M).

Phase II

A further in-depth exploration in Phase 2 interview offered a more nuanced understanding of parental factors among parents with CI, ultimately leading to more tailored and effective support for these families.

Participants

All participants from phase 1 were invited to participate in the focus group discussions, aiming to gain a deeper understanding of the issues under investigation. By employing focus groups involving parents of DHH children with CIs, this study sought to explore the various layers of influence outlined in Bronfenbrenner's Socio-Ecological System theory. This theoretical framework emphasizes the critical role of parental modelling and support within the microsystem, contributing insights toward strategies that enhance children's socio-emotional development. However, many parents were not able to participate in focus group discussion due to the pandemic and requested alternative online participation methods. Their reluctance to engage in in-person interviews was likely driven by concerns about potential virus exposure. So, an amendment to the research protocol was approved, allowing participants to complete individual online interviews. Despite these adjustments, only one-third of the Phase 1 participants agreed to continue to the Phase 2 of the study.

Procedure

Focus groups and individual online interviews, informed by Phase 1 findings, were conducted to elicit additional, in-depth information from the participants. This approach promoted a natural and fluid conversational exchange. All sessions were facilitated by the first author, who holds a master's degree in clinical psychology. Each session began with participant introductions and the establishment of ground rules, followed by structured interviews. Strict adherence to ethical guidelines and respect for participant perspectives were prioritized. All interviews were audio-recorded, with written consent obtained from each participant (27). To ensure reliability and minimize bias, the first author maintained a reflective journal throughout data collection, documenting self-reflections, emerging insights, and awareness of potential assumptions. These reflective entries were regularly discussed during peer review to reinforce rigorous and unbiased data analysis, enhancing the consistency of the findings (28).

Analytical strategy

All audio recordings were transcribed verbatim and reviewed multiple times by the first author before analysis. Transcripts were anonymized, and participants were assigned coded initials to preserve confidentiality. An iterative six-phase thematic analysis was conducted on the anonymized transcripts using Atlas.ti 9 software (29). An inductive approach was adopted to analyze the raw data without imposing any predetermined theoretical classification. A constant comparative approach was employed, with individual statements initially coded and grouped into 13 categories, subsequently refined into five main themes. Given the relatively small sample size, conducting a formal statistical assessment of inter-rater reliability was impractical, as it requires an adequately sized dataset to yield meaningful and reliable results. To enhance the dependability and credibility of the findings, however, the second author independently coded and analyzed all transcripts. Both authors reached a consensus and addressed any ambiguities regarding the main themes after engaging in a discussion.

Results

Demographic. Twelve parents from Phase 1 (4 males, 8 females) participated in online interviews due to pandemic restrictions. Most participants ($n=9$) were aged 31-40 years, held bachelor's degrees or higher ($n=8$), and were employed ($n=10$).

Extracted themes

The analysis conducted on the 12 participants allowed us to distinguish 5 main themes, among which we identified themes refer to (a) Changes of DHH children's socio-emotional response after the CI; (b) Changes of parenting challenges in having DHH CI children; (c) Parenting skills after their children's cochlear

implantation; (d) Parenting coping skills after their children's cochlear implantation; and (e) Parents' hope and advice.

Theme One - Changes of children's socio-emotional responses after CI. A majority of parents (n=11/12) agreed that the DHH children showed significant positive improvement after cochlear implantation. They mentioned that the children showed improvement in social abilities, such as better sound awareness to enforce the initiation in interaction with peers, were able to give responses and follow verbal instructions. Some of the children also demonstrated leadership skills to become a class monitor to oversee class discipline and comfort peers who may be experiencing challenges in adjusting to the school environment. A parent (FSB, 6yo, boy) mentioned: "I think she made him (CI child) a class monitor."

Most parents felt grateful that their children are able to express their own feelings to let others understand their experienced feelings. Parent (FDO, 5yo, boy) highlighted that: "The spoken language of his (CI child) language is quite clear so generally people do understand what he's saying or trying to tell". Another parent (MBB, 4yo, boy) reported that her CI child had gained more access to sounds and speech (through his CI), allowing him to actively participate in music performance, engage with surroundings, and integrate more fully into the hearing world around him. (Translation) "Now he (CI child) moves when he hears music. Before...you can imagine, before it was a completely silent world, you know. Now he is even invited to many performances."

A subset of parents (n=7) expressed the concerns that DHH children after CI still exhibited undesirable behaviours. These CI children were seen as being active and mischievous, and they struggled with noise tolerance, leading parents to perceive difficulties in their socio-emotional regulation abilities. "He (CI child) will shout back or he may sulk at a corner or he may cry." (FDO, 5yo, boy). Low confidence level was also observed when interacting with peers. "but in the kindergarten he (CI child) is quiet, quiet, quiet for some reasons" (MLB, 6yo, boy).

Theme Two - Changes of parenting challenges in having DHH CI children. Despite their children receiving cochlear implantation, a group of parents (n=8) continue to grapple with feelings of guilt towards their other children and self-doubt. These emotions can act as obstacles, potentially affecting their dedication to ensuring that their DHH children attend subsequent therapy sessions. "I (Parent) feel guilty for my other kids." (MSG, 6yo, girl)

In addition, parents (n=9) also encountered challenges in cultivating the positive characteristics in their CI children. These difficulties arose from the need to address

and discipline the children's undesirable behaviour while simultaneously waiting for the child's receptive abilities to develop through consistent therapy and increased exposure to auditory functioning. "Whenever she (CI child) felt uneasy with the surroundings, she would shout." (MMAG, 4yo, girl)

Moreover, effective time management skills are also another crucial challenge for parents (n=8) in executing their daily commitments while providing adequate support for their DHH children. Parents opted to develop a daily routine and allocated time for their children's therapy sessions, medical appointments, and other leisure activities to establish stable and strong relationships. By doing so, they can ensure that their children receive consistent and high-quality care, which is essential for their future success and well-being. (Translation) "You still need to free up some time to spend with them, do crafts, not just teach them to read, write neatly." (MVTB, 5yo, boy)

Furthermore, parents (n=10) also expressed their worries in finding supportive school placements for their child's hearing difficulties besides experiencing their own work-related stress. These difficulties can have a profound impact on parents' self-efficacy in dealing with social prejudices for special needs. Additionally, these parents struggled with forming realistic expectations regarding their child's progress with a CI. "Now I have a slight stress coming back again because of the fear of him (CI child) going to school, how's the treat from the other people." (MLB, 6yo, boy)

Theme Three - Parenting skills after children cochlear implantation. Many parents (n=9) engaged in self-reflection and sought to improve their parenting skills after their child received CI. Post-implantation, children may still exhibit undesirable behaviours, and this often stimulates parents to evaluate and enhance their parenting skills especially communication, ultimately resulting in better support for their children. Parents may also endeavour to create a more supportive environment for their child, allowing them to interact with their social environment and establish crucial social connections. "Everyone is different, nobody is the same and then everyone is unique." (MAB, 5yo, boy)

Parents (n=7) also reflected that with the cochlear implantation, allows the children to hear and understand explanations better. Detailed verbal explanations were required to make sure the children comprehend better why their misbehaviour was incorrect and may lead to a reduction in misbehaviour over time. "But now his CI is on, whenever he misbehaves and I bring him time-out. Once he cried enough and he sort of calmed down, then I could explain to him right and wrong." (MDSC, 4yo, boy)

Moreover, parents (n=8) exhibited a high level of

confidence in fostering a close relationship with their CI children. Parents actively invested effort in nurturing and maintaining strong bonds by engaging in various activities together. "Play together, we... cook together, watch TV together." (MMA, 4yo, girl). Parents also dedicated their personal time and made sacrifices in order to spend quality time with their CI children. "Over the weekends I will bring him (CI child) out then both of them out together as a family." (FDOB, 5yo, son)

Theme Four - Parenting coping skills after children cochlear implantation. Parents of children (n=10) who had undergone cochlear implantation might still experience difficulties accepting their CI children's language development progress that fell below their expectations. To cope with their emotional distress, parents utilized goal-directed, positive self-talk proactively and reactively regulate their own negative emotions. "I am frustrated. Please do not put too high expectations, but believe that it can be achievable." (MMAG, 4yo, girl)

Support and encouragement from success stories of other CI children with similar issues can also provide hope and reinforce parents' (n=8) commitment to their child's therapy plan, striving parents to establish and maintain healthy bonds and relationships with their children by continuously improving their own coping and parenting skills, thereby fostering belief in their child's future success. "So be persistent, keep doing, don't give up." (ML, 6yo, boy)

Theme Five - Parents' hope and advice. The majority of parents (n=8) aspired to see their CI children make progress and achieve comparable levels of success to their peers in terms of academic and social development. In this regard, parents often aim to cultivate independence in their CI children so that they can effectively navigate social challenges in their daily lives. (Translation) "We can elevate his (CI child) understanding and comprehension to a level where he can protect himself naturally when he goes to school." (MYB, 6yo, boy)

Parents of CI children (n=4) also recognized the significance of jointly deciding with professionals regarding their child's treatment and therapy plans. Engaging in continuous self-reflection to improve parenting practices is also crucial, as parents play a vital role in enhancing the socio-emotional well-being of their children. "Because a lot of things we learn, we're learning along the way, especially with professionals." (FSB, 6yo, boy)

Integration of results

While parents generally reported normal socio-emotional functioning in CI children, aligning with qualitative themes of post-implantation improvements, challenges like noise tolerance and self-regulation persisted.

Quantitative analysis revealed that authoritative parenting was significantly associated with better socio-emotional skills, mediated by child-parent closeness—a finding richly elaborated in interviews where parents described using explanatory communication and relationship-building activities. Counterintuitively, quantitative data linked higher parenting stress to better outcomes; qualitative insights clarified this was likely due to stress stemming from parents' deep investment in rehabilitation and optimal parenting practices, rather than being detrimental. These mixed findings underscore both the benefits of CI technology and the continued need for socio-emotional support.

DISCUSSION

This mixed-methods study examined parenting factors affecting socio-emotional development of DHH children with CIs by integrating quantitative and qualitative findings. Contrary to previous research reporting predominantly negative outcomes, parents in this study highlighted positive socio-emotional skills among their CI children (2, 30). These positive outcomes included enhanced prosocial behaviour, increased sound awareness, improved interaction skills, emotional expression, and greater receptivity to learning opportunities. Some CI children also displayed leadership qualities, such as serving as class monitors or providing emotional support to peers adjusting to the school environment. These findings align with prior observation that most families with DHH children tend to adopt an authoritative parenting style (12).

Parents in this study actively engaged in reflective practices aimed at improving their parenting skills following their child's cochlear implantation, with a particular emphasis on fostering effective child-parent communication and cultivating supportive environments. These strategies were viewed as essential for facilitating social interaction and helping their children establish meaningful connections. However, consistent with existing literature, the majority of parents reported experiencing heightened parenting stress, a phenomenon frequently observed among parents of children with special needs (15). Participants frequently described challenges pertaining to consistently applying effective parenting strategies during interviews. Furthermore, the pandemic period may have further exacerbated parental stress levels. Nevertheless, parents still remained confident in their ability to nurture close relationships with their CI children, emphasizing the significance of investing quality time to strengthen parent-child bonds. Such dedicated interactions were identified as crucial for sustaining positive and supportive child-parent relationships.

Despite the advancement of the CI hearing technology, CI children continue to face challenges in listening and responding effectively in noisy environments. These

difficulties can hinder their full participation in social interactions as perceived by their hearing peers (31, 32). Existing studies generally report that bilateral auditory configurations whether bilateral CI (two CIs) or bimodal fittings (one CI and one hearing aid) offered improved hearing in noisy settings compared to unilateral CI fitting (33). However, even with bilateral configurations, CI users typically exhibit poorer frequency resolution than individuals with normal acoustic hearing, contributing to their ongoing struggles with speech perception in background noise. Parents in this study mentioned that their CI children often experienced intolerance to noisy environments, which in turn affected their emotional regulation and occasionally led to impulsive behaviours. Persistent misunderstandings from peers due to hyperactivity or difficulties with self-regulation can undermine the confidence of DHH children, further impeding their ability to engage actively and positively in social settings. Concerns persist regarding below-average socio-emotional school readiness skills in CI children compared to those with normal hearing (34). These findings reinforce the view that, while CI offers substantial benefits, the socio-emotional development of CI children remains a complex and multifaceted process. Challenges related to noise sensitivity, emotional regulation and social engagement persist even after successful implantation (31, 32, 35). Persistent struggles with noise tolerance may not only lead to emotional dysregulation and impulsivity but may also further complicate social interactions (36). Moreover, these issues may be exacerbated by vestibular dysfunctions, which are prevalent in DHH children and can lead to heightened self-regulation difficulties and hyperactivity, negatively impacting their confidence in social participation (37).

The type of CI fitting, including those with different electrode configurations, signal processing strategies, or electrode arrays, may differentially affect children's development outcomes and daily functioning. Additional factors such as the age at implantation, duration of deafness, residual hearing, auditory nerve health, and individual cognitive and linguistic abilities are likely contributors to these differences (38, 39). Variations in surgical technique and habilitation protocols may also influence developmental trajectories (40). Despite these ongoing obstacles, parents in this study reported most CI children demonstrated positive socio-emotional skills. These outcomes may be attributed to early implantation, which facilitates language development during critical developmental windows (41). Nonetheless, persistent concerns about below-average socio-emotional readiness for school entry remain (34). These findings underscore the multifactorial nature of socio-emotional development in CI children and emphasize the need to consider both environmental and individual factors when designing interventions to support their well-being.

Consistent with previous research, most families with DHH children in this study practice an authoritative parenting style, characterized by active self-reflection and a commitment to improving parenting practices following their child's cochlear post-implantation (12). These parents cultivated supportive environments by using metaphorical language to normalize hearing differences and promote peer acceptance. By encouraging their children to express opinions and by responding to their emotional needs, authoritative parents foster secure attachments, contributing to the children's emotional well-being (42). To manage misbehaviour, strategies such as providing detailed explanations and employing time-out techniques are utilized, avoiding the use of corporal punishment (43, 44). Interestingly, higher levels of reported parenting stress were associated with better socio-emotional skills in these children. This may reflect the considerable demands placed on parents who invest heavily in positive parenting strategies, including navigating complex decisions related to hearing management, language development, educational planning, habilitation process, frequent professional appointments, and overseeing CI device functionality (46, 47). Additional resources of parenting stress included feelings of guilt about perceived inequities in attention given to siblings, the efforts to nurture their children's positive attributes, and the emotional labour required to maintain close child-parent relationships. Coping strategies employed by these parents included positive self-talk, setting realistic goals, and maintaining regular communication with professionals and support networks (47-49).

It is important to consider the possibility of self-report bias in the findings, especially among highly invested parents who may overreport either their levels of stress or their child's developmental progress. Such bias may arise due to social desirability bias (providing socially acceptable responses) or effort justification (rationalizing high personal investment via positive outcome reporting). Despite these challenges, parents were confident in their ability to foster close emotional bonds with their CI children. They emphasized the significance of spending quality time together, both of language development and overall family well-being (34). Emotional closeness was seen as instrumental in helping CI children develop social skills, as it allowed parents to better interpret and respond to their children's needs, particularly in the context of communication difficulties. Early cochlear implantation supports optimal speech and language development, with active parental involvement playing a critical role in improving socio-emotional outcomes and enhancing family quality of life (8, 50).

Limitations and Implications

All data collected in this study were based on participants' subjective reports of their experiences, which presents challenges in establishing whether data saturation was

attained to provide further insights or information to the study. The small sample size further limited the scope of the quantitative analysis to descriptive statistics, thereby reducing the statistical power needed to detect smaller effects or conduct more complex analyses. Additionally, the low response rate introduces the risk of sampling bias, as participating parents may differ systematically from non-participants (e.g., higher stress or engagement), thereby limiting the generalizability of the findings. This sample size also prevented definitive establishment of formal data saturation in qualitative analysis. However, theme saturation was assessed via iterative coding and team-based discussions that tracked the recurrence and variation of themes across interviews. While no novel themes emerged during the final interviews, it is possible that broader or more diverse sampling might reveal additional insights or nuances. Future studies should consider multi-site recruitment strategies to engage larger and more culturally diverse samples across regions and CI service providers, thereby enhancing external validity. It is also important to note that the participants in this study were recruited from a single CI program service provider. As CI programs may differ in structure, resources and parent experiences, findings from this study may not be generalizable across all CI programs. Potential survey fatigue could discourage participation if the same population is repeatedly approached within a single institution. Finally, recruitment challenges and diminished participant motivation during the COVID-19 pandemic raise concerns about non-response bias, potentially limiting the representativeness of the findings for key variables.

A second limitation is the reliance on caregiver reports, which often from just one parent to assess the socio-emotional skills of children with CI. While caregiver-based questionnaires (e.g., Strengths and Difficulties Questionnaire, SDQ) are convenient and useful for screening, they may introduce reporter bias. Parents might struggle to evaluate their child's socio-emotional functioning objectively due to personal perceptions, emotional involvement, or a desire to portray their child favourably. Although the SDQ is brief and easy to administer, it is not a diagnostic tool and does not measure socio-emotionality in depth. Incorporating direct observations and input from additional caregivers (e.g. the other parent or teachers), would yield a more comprehensive and balanced assessment of the child's socio-emotional functioning. The cross-sectional design of this study limits the ability to infer causality between parenting factors and children's socio-emotional outcomes. Future longitudinal research tracking CI families over time could better establish developmental trajectories and clarify the direction of effects.

A key limitation is the sample's lack of racial/ethnic diversity, with 75% identifying as Malaysian Chinese. The prevalence of authoritative parenting observed may reflect cultural norms in Malaysian Chinese families,

which balance discipline and emotional support, which unlike more authoritarian styles traditionally linked to Asian parenting. However, the predominantly Chinese sample limits generalizability, as socio-cultural values influence parenting practices and children's socio-emotional development. Future studies should include Malay, Indian, and indigenous communities to better capture cultural variations. While closeness indicates to be a better predictor, further research is needed to examine how parenting styles and stress affect children's socio-emotional functioning across diverse ethnic, socio-economic, and educational backgrounds. Investigations should also explore how Malaysian preschool environments, multicultural households, and social support systems mediate these relationships. Expanding diversity in future research would strengthen the applicability of findings across populations.

CONCLUSION

The present study highlights the significant influence of authoritative parenting style on the socio-emotional skills of DHH children using CI. Parents demonstrated a general authoritative parenting practice and reported typical levels of socio-emotional skills in their CI children. They employed metaphors and detailed verbal explanations to promote normalcy, acceptance, and understanding in their children, despite occasional undesirable behaviours. Parenting stress, attributed to challenges such as guilt, self-doubt, fostering positive traits, time constraints, finding suitable school placements, and work-related demands, can be mitigated through proactive strategies like goal-directed, positive self-talk and sharing success stories of cochlear implantation. Parental investment in building a close relationship by engaging in activities together, with the degree of closeness serving as a vital mediator, further enhances socio-emotional skill development in CI children.

These findings provide valuable insights for future research on the socio-emotional skills of CI children in the context of parenting. Clinicians in CI teams can benefit from increased awareness of this specific population to better support their socio-emotional functioning. While the research outcomes are generally positive, clinicians should remain mindful of the potential for high levels of parenting stress. Early intervention programs integrating positive parenting strategies, child-parent bonding activities, and stress resilience training are recommended for pilot testing in community audiology clinics.

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