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Assessment of Behavioral Problems in Children with Hearing Loss

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Abstract

Objective—To compare the prevalence of disruptive behavior problems between preschool-aged children with hearing loss and normal hearing.

Study design—Cross-sectional study

Setting—Tertiary academic center

Patients—Caregivers of children (2–5 years old) with normal hearing (NH) (n=39), hearing loss using hearing aid(s) (HA) (n=29), or cochlear implant(s) (CI) (n=21).

Intervention(s)—Demographic information and a mental health history were obtained. Child behavior and language development were assessed.

Main outcome measure(s)—The Young Child-Diagnostic Interview Schedule for Children-IV (YC-DISC-IV) and the MacArthur-Bates Communication Development Inventory (CDI-III)

Results—Distributions of race, socioeconomic status, insurance status, and parental home situation (single vs. two parent family) were similar across all groups. Parents of children with hearing loss were significantly more likely to report behavior problems (HA=41%, CI=38%) than parents of NH children (10%; p=0.002). Children with hearing loss were significantly more likely to meet diagnostic criteria for oppositional defiant disorder (HA=48%, CI=48%) than NH children (23%; p=0.02). More NH children (8%) than hearing impaired children (0%) had accessed mental health services (p=0.08). NH children were found to have more advanced language development

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than hearing-impaired children ($p<0.01$), but controlling for CDI-III percentiles, the observed behavioral differences remained.

Conclusions—Controlling for language development, children with hearing loss have higher prevalence of and impairment from disruptive behaviors than their NH peers. These children are less likely to receive appropriate behavioral interventions. Further research is warranted to investigate the impact of disruptive behaviors on speech and hearing rehabilitation. Methods to improve access to effective behavioral interventions in this population are needed.

INTRODUCTION

Hearing loss is one of the most common birth defects in the US, with approximately 1.6 in 1,000 infants born deaf or hard of hearing (DHH) each year.¹ The consequences of delayed diagnosis and failure to obtain timely intervention for infants with hearing loss include significant delays in language, cognitive, and social development, with detriments to educational and employment outcomes later in life.² Fortunately, hearing aid (HA) amplification prior to 6 months of age has profound effects on language expressive measures and social adjustment,^{3,4} and numerous studies demonstrate positive effects of cochlear implantation (CI) on language development^{5–11} and social skills.¹²

Despite the positive effects of early intervention for hearing loss, expected accompanying benefits to child behavior have not been observed.¹³ In the normal hearing (NH) population, untreated disruptive behavior problems in preschool-aged children can lead to a lifetime trajectory of school problems, substance use, antisocial behaviors, and poor health-related quality of life.^{14,15} Prevalence studies of behavioral problems in DHH children have reported inconsistent results. For example, several studies have suggested high prevalence (40–50%) of behavioral problems in this population based on standardized parent- and child-report measures,^{16,17} and DHH children have demonstrated a 2- to 3-fold increase in emotional and behavioral problems compared to a normative sample.¹⁸ In contrast, other studies using similar assessment tools have found no difference in the prevalence of behavioral problems between DHH children and NH children.^{19,20} Few studies have used structured clinical diagnostic interviews to assess for behavioral disorders,²¹ however, and most focus on behavioral disorders among school-aged rather than preschool-aged children. Given the importance of early intervention for both language development and behavioral outcomes,^{22,23} assessment of potential disparities in behavioral problems in very young DHH children is warranted.

Our study sought to provide novel information on disruptive behavior problems in preschool-aged DHH children using gold standard behavioral assessment instruments. We also examined key family functioning constructs including parenting sense of competence and parenting stress. Using a cross-sectional study design, we compared the prevalence of disruptive behaviors in preschool-aged DHH children with CI or HA to that of NH peers. We hypothesized that children with CI and HA would have higher prevalence of disruptive behavior problems and that the level of parenting stress would be elevated in the DHH groups compared to the NH group. Conversely, we hypothesized that the level of parenting sense of competence would be lower in the DHH groups compared to the NH group.

MATERIALS AND METHODS

IRB approval was obtained prior to initiating the study (IRB#140877F6A) and all participants provided written informed consent. Parents/guardians of children aged 2 to 5 years old were recruited between July 2015 and September 2016. Parents/guardians of NH children were recruited from a pediatric Otolaryngology clinic (non-hearing healthcare appointments only) and from two pediatric primary care clinics in an academic medical center. Potential participants in the NH group were identified in two ways: in the otolaryngology clinic, NH children were identified from clinic records and schedules and approached during clinic visits to assess interest and eligibility; in the primary care clinics, recruiters approached all families in the waiting rooms during varied days/times to assess interest and eligibility. Parents of DHH children were recruited from ambulatory hearing healthcare clinics in an academic medical center, private hearing and speech centers, and a state-funded pediatric hearing healthcare clinic. Potential participants in the DHH group were identified by medical records or by the parent/guardian responding to recruitment flyers placed in these clinics.

Inclusion criteria were: (a) parent/guardian is age 18 years or older and the custodial guardian; (b) the child is aged 2–5 years and lives full-time in the parent/guardian's home; (c) if DHH, the child must have had unilateral or bilateral CI or HA for at least six months; and (d) parent/guardian can speak, understand, and read English. Parents/guardians of children diagnosed with severe developmental disorders (e.g., autism) other than hearing impairment or speech delay were excluded. Eligibility was assessed by medical record review and parent report. If eligible and interested, the parent/guardian completed the informed consent process before initiating study procedures. Among the 85 NH and 75 DHH potential respondents assessed for eligibility, parents/guardians of 57 NH and 64 DHH children were eligible. Of these, 43 (75%) and 50 (78%) enrolled, respectively.

An assessment session was conducted with each parent/guardian. Participants completed a self-report background questionnaire providing information on family demographics and the child's behavioral health history, including prior mental health treatment. Multiple behavioral assessment measures were administered, including the Disruptive Behaviors module of the Young Child Diagnostic Interview Schedule for Children, Version IV (YC-DISC-IV) computerized interview,²⁴ Parenting Sense of Competence Scale (PSCS),²⁵ Impact on Family Scale (IFS),²⁶ Parenting Stress Index-Short Form (PSI-SF),²⁷ and the MacArthur-Bates Communicative Development Inventory-III (CDI-III).²⁸ Participants received monetary compensation following completion of study procedures.

Measures

Young Child Diagnostic Interview Schedule for Children, Version IV, Disruptive Behavior Module—The YC-DISC-IV is a structured clinical diagnostic interview that can be administered by non-clinicians to assess psychiatric disorders in young children.²⁴ It was derived from the original Diagnostic Interview Schedule for Children and modified for parents of preschool-aged children. The computerized instrument is administered by a trained interviewer and includes standardized questions about diagnostic criteria for multiple childhood disorders. The Disruptive Behavior Module of the YC-DISC-IV includes items

assessing frequency, severity, and temporal onset of symptoms of attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD). ADHD is defined by inattention and/or hyperactive-impulsive symptoms that interfere with a child's social and/or academic functioning.²⁹ ODD is characterized by angry and irritable mood, argumentative and defiant behavior (especially toward authority figures), and vindictiveness that impair functioning across settings (e.g., home and school).^{29,30} CD refers to a persistent pattern of severe behaviors that may include aggression toward animals and other humans, destruction of property, theft, and violation of rules.²⁹ Within each disruptive behavior disorder, the YC-DISC-IV also includes items measuring impairment in functioning from identified symptoms, including impairment in interactions with caretakers, family, and peers, as well as in daily functioning at school (or daycare) and home. Scoring is performed using SAS macros provided by the YC-DISC-IV developers, yielding categorical assignments to diagnostic groups (e.g., ODD diagnosis in past 3 months, ODD diagnosis with impairment in past 3 months, subthreshold ODD in past 3 months).^{24,31,32}

Parenting Sense of Competence Scale—The PSCS is a 16-item validated measure of two dimensions of parenting: satisfaction and efficacy.²⁵ Parents respond to each item using a 6-point Likert-type scale indicating levels of agreement from “strongly agree” to “strongly disagree.” Higher PSCS scores suggest higher levels of parenting satisfaction and efficacy.

Impact on Family Scale—The IFS was designed to assess the impact on families of caring for children with chronic health conditions.²⁶ This validated instrument is comprised of a total of 31 items within 4 domains: financial burden, social interactions within and outside of the home, personal strain felt by the parent, and sense of lack of mastery resulting from stress. Items are measured on a 4-point scale ranging from strongly agree to strongly disagree. Lower IFS scores indicate higher levels of negative impact.

Parenting Stress Index-Short Form—The PSI-SF is a 36-item parent-report instrument derived from the full-length Parent Stress Index.²⁷ Parents/guardians rate items on a 1 (strongly disagree) to 5 (strongly agree) Likert-type scale within three subscales: parental distress, parent-child dysfunctional interaction, and difficult child.

MacArthur-Bates Communicative Development Inventory-III—The CDI-III words and sentences form is a well-validated instrument that provides a measure of a child's language development in children from 30 to 37 months.²⁸ Though some children in the current study were above that age range, the original CDI has been validated for use in children with CIs over 30 months of age.³³ In the vocabulary portion of the instrument, parents select words that their child is able to say at time of testing from a list of 100 sample words. In the Sentence portion, parents are provided with 12 pairs of sentences (e.g., “Why he run away?” and “Why did he run away?”) and asked to select which sounds most like the way their child talks. Each section is scored as the percentage of the total possible words/sentences that parents endorse as vocabulary or sentence structures used by their child, and percentiles are assigned based on population norms.

Statistical Analyses

Analyses were performed using SPSS version 22 (IBM Corp, Armonk, NY, USA) and SAS version 9.4 (SAS Institute, Cary, NC). Bivariable analyses compared values on each measurement instrument between NH and DHH children. To adjust for potential effects of language development, multiple logistic regression modeling was used, including CDI-III percentiles in the models. The threshold for statistical significance for all analyses was set at $p < 0.05$.

RESULTS

Overall, 93 parents/guardians of NH children ($n = 43$), DHH children with HA ($n = 29$), and DHH children with CI ($n = 21$) were enrolled. Four respondents in the NH group were excluded due to missing YC-DISC-IV data resulting from technology failure, leaving 39 parents/guardians of NH children in the analyses (total $N = 89$). Degree of hearing loss and type of auditory rehabilitation were heterogeneous to maximize external validity: within the HA group, 8 had unilateral and 21 had bilateral aids, while within the CI group, 2 had a unilateral implant, 12 had bilateral implants, and 7 used a CI with a HA. Child age, child sex, child race, type of health insurance, household makeup, annual household income, and parent/guardian level of education did not differ between the NH and DHH groups (TABLE 1).

In response to a binary item asking parents if they were concerned that their child may have emotional or behavioral problems, parents/guardians of DHH children were significantly more likely to respond affirmatively (HA = 41%, CI = 38%) than parents/guardians of NH children (10%; $p = 0.002$). Despite these concerns, fewer DHH children (0%) had received mental health services compared to NH children (8%), though the difference was not statistically significant ($p = 0.08$). Comparisons between DHH and NH children's diagnostic category assignments from the Disruptive Behavior Module of the YC-DISC-IV are shown in TABLE 2. These data demonstrate that, based on the results of a structured clinical diagnostic interview, a higher percentage of DHH children in this sample met the ODD diagnostic criteria with symptomatic impairment, compared to NH children. Conversely, a higher percentage of NH children were in the sub-threshold range for ODD compared with DHH children.

Language assessment was performed with the CDI-III. As expected, median language percentiles differed significantly between DHH and NH children in both vocabulary testing (HA = 20%, CI = 2.5% and NH = 50%, $p = .002$) and sentence testing (HA = 20%, CI = 5% and NH = 50%, $p = .003$). To control for the effects of language development on behavior, multiple logistic regression was performed to determine whether observed differences in the prevalence of ODD between NH and DHH children remained after accounting for the large disparities in language proficiency (TABLE 2). Results demonstrated that DHH children had significantly higher odds of meeting ODD diagnostic criteria in the past 3 months even when CDI-III percentiles were included in the model. Additionally, DHH children had higher odds than NH children of experiencing impairment associated with ODD symptoms, regardless of whether they met the diagnostic criteria or were categorized in the sub-threshold range for ODD, though this comparison did not meet the level of statistical significance.

No differences were observed between DHH and NH children in terms of meeting the diagnostic criteria for CD or sub-threshold CD in the past year (HA = 7%, CI = 14%, NH = 11%, $p = 1.00$). Additionally, no differences were noted between DHH and NH children with regard to meeting the diagnostic criteria for diagnosis of ADHD (HA = 45%, CI = 29%, NH = 38%, $p = 0.96$) or subthreshold ADHD in the past 3 months (HA= 28%, CI=29%, NH=23%, $p=0.60$).

Group differences in parenting and family factors were also assessed by comparing scores on the PSCS, PSI-SF, and IFS. No significant differences were found between parents/guardians of DHH and NH children in parenting sense of competence (satisfaction and efficacy), impact of child behavior issues on the family, or parent stress.

DISCUSSION

Assessment of behavioral health problems in young DHH children is complex. Children with hearing loss often have additional comorbidities such as developmental delay secondary to birth trauma, prematurity, or low birth weight, increasing their risk for behavioral problems.³⁴ However, in DHH children without development delays, behavioral problems have been identified in areas of hyperactivity, aggression, peer interactions, and isolation.^{35,36} These behavioral issues often go unrecognized and untreated. Theunissen et al. demonstrated that school-aged DHH children who used either HA or CI were more likely to exhibit behavioral problems and aggression than NH children, based on multiple parent- and self-report instruments.³⁶ Our results extend these findings to preschool-aged DHH children using the YC-DISC-IV structured clinical diagnostic interview, in which more than twice as many DHH children with HA or CI met the diagnostic criteria for ODD (48% of those with HA, 48% of those with CI) compared to NH children (23%), based on parent endorsements of ODD symptoms in the past 3 months. For comparison, estimates of the prevalence of ODD in the general pediatric population range from 2% to 16%.³⁷ Though not statistically significant, results also strongly suggested that compared to NH children, DHH children were more likely to experience impairment from ODD symptoms, whether at the sub-threshold or diagnostic level.

Studies of NH children have suggested that language impairment is associated with development of disruptive behaviors.^{30,38,39} In DHH children without developmental delay, the etiology of increased behavioral problems is unclear, but language delay and difficulties with communication are thought to have a strong influence. Barker et al. specifically assessed the role of language and communication in behavioral problems among NH and DHH children, finding that DHH children have more difficulties with language, attention and behaviors.⁴⁰ While Barker et al. found that language development was associated with behavioral problems, the DHH children in their sample had no auditory rehabilitation. In the current study, we found that DHH children with auditory rehabilitation have elevated disruptive behavior problems, even after controlling for the effect of language development.

Disruptive behavior problems in DHH children are often attributed to poor communication skills.³⁹ Even in the NH population, language skills and psychiatric dysfunction are negatively correlated.⁴¹ Thus, it seems intuitive to conclude that early hearing intervention,

which has been shown to improve language skills, would also prevent or ameliorate behavioral problems. However, as argued by Stevenson et al., early hearing identification intervention alone may not be sufficient to address behavior problems in DHH children.¹³ These authors demonstrated that school-aged children with congenital hearing loss had higher levels of behavioral problems and lower adaptive behavior skills compared to NH children. Further, they found that while early identification of hearing loss did improve receptive language scores, it was not associated with lower levels of behavioral problems.¹³ Our study supports these findings and extends them to preschool-aged DHH children by demonstrating higher prevalence of meeting ODD diagnostic criteria and experiencing impairment from ODD symptoms in DHH versus NH children, even after controlling for language impairment.

Other contextual factors such as parent-child relationship quality, parenting behaviors, and family dynamics may contribute to development of ODD in DHH children.³⁸ Previous studies have evaluated the parent-child relationship in the DHH population. Deaf children of deaf parents have been shown to have higher academic achievement, better self-image and more social maturity than deaf children of hearing parents.^{42,43} These outcomes may be related to different communication methods or parenting practices among deaf caregivers of DHH children. In the current study, all respondents were hearing parents/guardians of DHH children with auditory rehabilitation, and indeed, our study showed that a significantly higher number thought that their DHH child had behavioral problems, compared to parents/guardians of NH children.

In the general population, parents of children with ODD are much more likely to seek mental health services, compared to parents of children with other emotional and behavioral disorders.⁴⁴ In contrast, no DHH child in our study had ever received professional mental health services, compared to the 8% of NH children in our sample and the 3–6% of preschool-aged children who would be expected to have accessed mental health services based on prior epidemiological estimates.⁴⁵ We suspect that parents of DHH children with auditory rehabilitation invest a significant amount of time and resources in obtaining hearing healthcare, which may influence their ability or willingness to seek behavioral health resources. Additionally, parents may attribute the disruptive behaviors of DHH children to their hearing loss and communication impairment, with expectations that hearing loss treatment and speech therapy alone will resolve disruptive behaviors. Increasing awareness of disruptive behavior problems in this population is important, because several evidence-based parent/family interventions are available that reduce ODD in NH populations.^{46,47}

With no definitive etiology of behavioral problems in DHH children, behavioral problems in this population are likely multifactorial and influenced by parental impact on children and family dynamics. In general, higher family stress has been negatively associated with health-related quality of life outcomes, including overall health and well-being, in families of DHH children with CI.⁴⁸ However, the levels of parenting stress experienced by parents of DHH children are unclear, with some studies reporting increased levels⁴⁹ and others showing no increase.^{50,51} Consistent with our results, Pipp-Siegel et al. studied 184 hearing mothers of young DHH children using the PSI-SF, finding no differences in stress levels between mothers of DHH versus NH children. They did determine, however, that predictors of

increased parental stress included frequency of hassles, decreased amount of social support, lower annual family income, and children with more delayed language development.⁵¹ Similarly, Sarant and Garrard assessed parenting stress in parents of young DHH children with CI, finding stress levels to be similar to those of a normative population.⁵² In contrast, Quittner et al found higher levels of condition-specific stress—including stress with communicating with their child, educational concerns, and child safety—using the Family Stress Scale in parents of DHH children versus NH children.⁵³ General stress level, however, did not differ between the two groups. Quittner's sample was limited to parents of children with severe to profound hearing loss awaiting cochlear implantation, a narrower population than we included in the current study. Differences in assessment instruments, types of stress measured, and study inclusion criteria likely underlie the inconsistent findings reported in the literature.

Limitations

This study is limited by a modest sample size. In spite of this, significance differences were found in the prevalence and severity of ODD symptoms between NH and DHH groups. The sample size was not large enough to provide adequate power for comparisons between HA and CI groups, and further research is needed in this area. Similarly, several of our findings (e.g., history of behavioral health treatment, prevalence of impairment from ODD symptoms in both sub-threshold and diagnostic categories) did not reach the level of statistical significance, likely due to our limited sample size. It is also possible that several unmeasured variables could have influenced the results; for example, the adequacy of auditory rehabilitation, the degree and type of hearing loss, the etiology of hearing loss, the timing of hearing loss diagnosis, and the timing of hearing loss treatment were not assessed in these children, suggesting additional areas for future research. Although this study did control for language development using the CDI-III, a more extensive and robust evaluation of expressive and receptive language and communication would be informative in future research in this area. Finally, the instruments used in this study to assess behavioral problems and family functioning are well-validated in the NH population, but have not been used frequently (if at all) in the DHH population. These limitations are offset by several key strengths of the study, including our use of a structured clinical diagnostic interview in the assessment of disruptive behaviors and impairment; a heterogeneous sample of DHH children with HA and CI; and a focus on the critical period of early childhood, which is vitally important in both language and behavioral development.

Overall, we observed that the prevalence of meeting ODD diagnostic criteria in preschool-aged DHH children is almost 50%—nearly double the prevalence observed in NH children—despite the delivery of auditory rehabilitation in early childhood. This difference persists after controlling for the effects of language development, suggesting that ODD-type behaviors should be a target for early behavioral intervention among parents/guardians of DHH children with elevated ODD symptoms.

CONCLUSION

Preschool-aged DHH children have significantly higher odds of having disruptive behaviors compared to their NH peers. Compared to the NH population, a higher proportion of parents/guardians of DHH children report concerns about behavior problems. Despite parental concerns, DHH children are at risk for not receiving behavioral health services. Further research into the etiology of disruptive behavior problems in DHH children is warranted, including identification of early interventions to reduce these observed disparities.

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Table 1

Participant characteristics and bivariable associations with normal hearing vs. deaf and hard of hearing children (N = 89)

	Normal Hearing (n = 39)	Hearing Aid (n = 29)	CochlearImplant (n = 21)	<i>p</i> [*]
Child				
Male	19 (49%)	15 (52%)	9 (43%)	0.95
Female	20 (51%)	14 (48%)	12 (57%)	
Age in months (mean ± SD)	49 ± 12	51 ± 12	50 ± 13	0.65
White	32 (82%)	20 (69%)	17 (81%)	0.46
African-American	5 (13%)	4 (14%)	2 (10%)	
Other	2 (5%)	5 (17%)	2 (10%)	
Two-parent household	29 (74%)	21 (72%)	17 (81%)	0.85
Single-parent household	7 (18%)	7 (24%)	3 (14%)	
Other caregiver	3 (8%)	1 (3%)	1 (5%)	
Private Insurance	17 (44%)	13 (45%)	10 (48%)	0.72
Public Insurance	21 (54%)	16 (55%)	8 (38%)	
Vocabulary Percentile, median (IQR)	50 (20, 75)	20 (0, 65)	2.5 (0, 20)	0.002
Sentences Percentile, median (IQR)	50 (20, 99)	20 (0, 55)	5 (0, 55)	0.003
Parent/Guardian				
\$20,000/yr	10 (26%)	6 (21%)	3 (14%)	0.32
\$20,001–\$40,000/yr	12 (32%)	8 (28%)	2 (10%)	
\$40,001–\$60,000/yr	3 (8%)	2 (7%)	5 (24%)	
> \$60,000/yr	13 (34%)	13 (45%)	11 (52%)	
Less than high school	2 (5%)	0	1 (6%)	0.88
High school graduate or GED	9 (24%)	7 (27%)	4 (22%)	
Some college	8 (22%)	8 (31%)	2 (11%)	
College degree	6 (16%)	6 (23%)	4 (22%)	
Graduate school	12 (32%)	5 (19%)	7 (39%)	

Notes. SD = standard deviation. IQR = interquartile range. GED = general equivalency diploma.

* Hearing Aid and Cochlear Implant respondents combined into one group.

Table 2

Multiple logistic regression comparing oppositional defiant disorder diagnoses and impairment between normal hearing children and deaf-of-hearing children, controlling for language percentiles (N = 87).

	Hearing Aid	Cochlear Implant	Normal Hearing	[*] p	aOR [*] (95% CI)
ODD diagnosis in past 3 months	14 (48%)	10 (48%)	9 (23%)	0.02	2.96 (1.11, 7.90)
ODD impairment in past 3 months	12 (43%)	10 (48%)	6 (15%)	<0.01	4.75 (1.58, 14.28)
Sub-threshold ODD in past 3 months	9 (31%)	6 (29%)	22 (56%)	0.01	0.32 (0.13, 0.82)
Sub-threshold ODD impairment in past year	7 (24%)	5 (24%)	14 (37%)	0.19	0.62 (0.23, 1.63)
Any impairment from ODD symptoms	19 (68%)	15 (71%)	20 (53%)	.06	2.51 (0.95, 6.58)

Notes. ODD = oppositional defiant disorder. aOR = adjusted odds ratio (controlling for vocabulary percentiles). CI = confidence interval. Significant findings in **bold**.

^{*} Hearing Aid and Cochlear Implant respondents combined into one group.