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Comparing Parent and Teacher Ratings of Emotional and Behavioural Difficulties in 5-year old Children who are Deaf or Hard-of-Hearing

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Abstract

Children who are deaf or hard of hearing (DHH) are at higher risk of developing mental health problems. This study reports on the parent and teacher ratings of emotional and behavioural difficulties (EBD) in 5-year old DHH children. It explores the similarities and differences between informants, and the risk and protective factors associated with parent and teacher-ratings of EBD. Parents and teachers of 224 DHH children completed questionnaires on children's EBD and functional auditory behaviour. Children completed standardised assessments of non-verbal cognitive and language abilities. On average, parent- and teacher-rated EBD were 0.42 and 0.20 standard deviations higher than typically developing children. Parents reported more behavioural problems (hyperactivity and conduct), whereas teachers reported poorer prosocial behaviour. Inter-rater correlations were generally low to moderate (0.29 to 0.50). Overall, children with additional disabilities, lower non-verbal cognitive ability, and poor functional auditory behaviour were at higher risk of EBD. Language ability was only a significant predictor of teacher-rated EBD for children with hearing aids but not cochlear implants. Differences in informant-ratings emphasize the need for a multi-informant approach to get a global perspective on the psychopathology of DHH children. The findings indicate that parents may need assistance with managing behavioural problems at home, and teachers should facilitate more opportunities to practice prosocial behaviour at school. Intervention efforts should focus on facilitating good functional listening skills, as this may in turn, improve the mental health of young DHH children.

Keywords

Hearing loss; children; mental health; language; emotional behavioural problems; peer relationships

Introduction

Congenital sensorineural hearing loss affects approximately one to two children per 1000 births (Mehra, Eavey, & Keamy, 2009; Morton & Nance, 2006). Childhood hearing loss can have significant adverse effects on all areas of development including language, cognitive, social, emotional and behavioural functioning (Ching et al., 2013). As a result of these potential developmental delays, children who are deaf or hard of hearing (DHH) are at higher risk of developing mental health problems compared to their typically developing peers (Fellinger, Holzinger, Sattel, & Laucht, 2008; Hindley, 2005; Stevenson, Kreppner, Pimperton, Worsfold, & Kennedy, 2015; Van Eldik, 2005). This includes higher rates of emotional disorders (e.g., depression and anxiety) (Theunissen et al., 2012; Theunissen et al., 2011), behavioural problems (e.g., conduct and hyperactivity) (Barker et al., 2009; Stevenson, McCann, Watkin, Worsfold, & Kennedy, 2010) and peer relation problems (Batten, Oakes, & Alexander, 2014; Hoffman, Quittner, & Cejas, 2015; Laugen, Jacobsen, Rieffe, & Wichstrøm, L. 2017; Xie, Potm šil, & Peters, 2014). Prevalence rates of psychosocial difficulties in DHH children have been estimated between 20-50% (Dammeyer, 2010).

Researchers assessing emotional and behavioural difficulties (EBD) in young children have typically relied on parent- and/or teacher-rated questionnaires. A multi-informant approach is particularly important in clinical contexts, to assist clinicians to make decisions about mental health care, such as assigning diagnoses and planning treatment. Some children may only exhibit EBD within some contexts, but not others. As a result, clinicians may fail to identify mental health concerns if they only obtain information from one informant. A multi-informant approach is especially important for diagnosing behavioural disorders (e.g., attention deficit hyperactivity disorder [ADHD] or conduct disorder) as the Diagnostic Statistical Manual (DSM)-5 criteria specifically states that symptoms must be present in two or more settings, for example, the home, school/work, with friends, or in other activities (American Psychiatric Association, 2013). However, inconsistencies between informants often arise, and this has been observed in various clinical and non-clinical populations (Achenbach, McConaughy, & Howell, 1987; De Los Reyes et al., 2015; Kolko & Kazdin, 1993). A recent meta-analysis found only low to moderate cross-informant correlations ($r=.21$ to $.28$) between parents and teachers for assessing child and adolescent mental health (De Los Reyes et al., 2015).

Children may behave differently depending on the context (i.e., school and home), and parents and teachers have different perspectives and motivations for providing ratings (De Los Reyes & Kazdin, 2005). Informant correlation also tends to be higher for externalising (e.g., aggression, hyperactivity) rather than internalising (e.g., depression, anxiety) problems, as externalising problems can be directly observed (Achenbach et al., 1987). Interestingly, Kolko and Kazdin (1993) found that children's self-reports of internalising problems were more similar to teacher's than parent's ratings; however, this has not been found consistently (De Los Reyes et al., 2015). The discrepancy between parents and teachers' reports highlights the need to use multiple informants to obtain a valid assessment of the global emotional and behavioural functioning of young children. Relying on one informant rather than another can lead to different conclusions regarding the prevalence of

EBD, and consequently may impede treatment for those children at risk of psychopathology (De Los Reyes & Kazdin, 2005).

A number of studies have found similar informant discrepancies between parents and teachers' reports of EBD in DHH children (Fellinger et al., 2008; Huber & Kipman, 2011; Mejstad, Heiling, & Svedin, 2009). For example, a population-based study by Fellinger et al. (2008) found that, compared to teachers, parents were more likely to rate DHH children (aged 6-16 years) as having more EBD across multiple domains on the Strengths and Difficulties Questionnaire (SDQ). The SDQ covers areas of difficulties in emotions, behaviour (conduct and hyperactivity), and peer relations; and strengths in prosocial behaviour. Teachers tended to only rate problems in conduct and peer relations; however, both parents and teachers rated significantly more EBD in all domains compared to normative data. Cross-informant correlations between parents and teachers were generally moderate on total difficulties ($r=0.48$), but lower for conduct ($r=0.28$) and prosocial behaviour ($r=0.10$).

This pattern of cross-informant ratings has not been found consistently in all studies. For example, Mejstad, Heiling, & Svedin (2009) found that teachers rated significantly more prosocial behaviour problems than parents in 11-18-year-old DHH children, but there were no differences between raters in emotional or behavioural domains. They found parent-teacher correlations for total SDQ scores were relatively high ($r=0.61$), and overall the DHH group were not showing significantly more EBD than their hearing peers. Studies comparing teachers and parents' reports in DHH children/adolescents with cochlear implants (CIs) have also been mixed, with some finding no differences between informant ratings (e.g., Anmyr, Larsson, Olsson, & Freijd, 2012), and others reporting significantly more teacher-rated peer problems than parent-rated (e.g., Huber & Kipman, 2011). In a study of deaf adolescents who used sign language, Cornes and Brown (2012) found relatively strong correlations between parent and teacher reports on the SDQ ($r=0.76$) but noted that parents rated significantly more EBD than either teachers or the adolescents themselves. However, these latter studies were limited by small sample sizes ($n=22$ to 31). It may also be the case that cross-informant agreements are higher in older children/adolescents compared to younger (Huber et al., 2015), because older children become better at expressing their emotions, and symptoms become more stable. Nonetheless, identifying potential EBD at a younger age is crucial for early intervention.

In a systematic review and meta-analysis, Stevenson et al. (2015) confirmed that DHH children are more likely to show EBD than hearing children, however, the effect may be less marked than earlier studies suggest. They reviewed 12 studies that utilised the SDQ and found that, on average DHH children and adolescents (aged 3-18 years) had EBD scores that were 0.23 standard deviations (SDs) higher than hearing children on parent ratings, and 0.34 SD higher on teacher ratings. The most common problem was in the area of peer relations for both parent and teacher ratings. Across all of the studies reviewed, teachers tended to rate more problems with conduct, whereas parents rated more emotional problems. Reasons for these informant discrepancies were not discussed.

The SDQ studies reviewed by Stevenson et al. (2015) were limited by the high variability in age of children, and age at identification of hearing loss and intervention. The introduction of universal newborn hearing screening in many countries now means that many children have access to early amplification and education efforts. It is not clear, however, how this has impacted on child outcomes, particularly psychosocial development (Moeller, 2007). To address this problem, the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study (Ching, Leigh & Dillon, 2013) has prospectively measured the language, psychosocial and educational outcomes of a large cohort of Australian DHH children since the introduction of universal newborn screening.

Wong et al. (2016; 2017) reported on the parent-rated psychosocial outcomes of 5-year-old DHH children enrolled in the LOCHI study. They found that children were within the range of typically developing peers on all domains of the SDQ and fell on average 0.47 SD below the Australian normative population on the parent-rated SDQ total difficulties score (Wong et al., 2017; Wong et al., 2016). This result was in line with Stevenson et al.'s (2015) review, showing only mild delays on average in the current generation of DHH children. It was suggested that the lower estimate of effect size compared to earlier studies may reflect early detection and confirmation of hearing loss as a result of universal newborn hearing screening programs, and improvements in psychological and educational support for DHH children (Stevenson et al., 2015; Wong et al., 2016). Nonetheless, a high proportion of children in the LOCHI cohort (12%) were two or more SDs below the normative mean on parent-ratings of EBD at 5-years, suggesting that DHH children were still at higher risk of developing psychosocial problems than the general population (Wong et al., 2016).

Wong et al. (2016) also reported on the risks and protective factors of parent-rated global psychosocial outcomes (combining the SDQ and Child Development Inventory Social Skills Scale score) for children in the LOCHI cohort. They found that children with higher non-verbal cognitive ability, no additional disabilities, better language, and higher parent-rated functional auditory behaviour had on average, significantly better psychosocial functioning. In contrast, type of hearing device, severity of hearing loss, and age at intervention (age of first hearing aid [HA] fitting or CI switch-on) were not significantly associated with psychosocial outcomes. However, it is not yet known whether risk and protective factors may differ between parents and teachers' ratings of EBD. Very few studies that have included teacher-reported EBD of DHH children have controlled for potential child, family, or audiological factors that are related to outcomes. Without controlling for potential confounds or baseline differences, it is difficult to draw strong conclusions about the direct and indirect risk and protective factors of EBD in DHH children (Thompson, et al., 2001).

To gain a more comprehensive and global overview of the EBD of 5-year old children with hearing loss at both home and school, this study used a multi-informant approach, reporting on both parent's and teacher's ratings of children enrolled in the LOCHI study. The specific research questions were: 1) Do parent and teacher ratings of EBD in DHH differ from typically developing children; and 2) Are there differences in child, family, and audiological factors that can predict parent- and teacher-rated EBD?

Method

Participants

The data presented here were collected as part of the LOCHI study—a longitudinal study that has prospectively measured the language, psychosocial, and educational outcomes of a large cohort of Australian children with hearing loss. Detailed information about the LOCHI study has been presented previously by Ching, Leigh and Dillon (2013). In brief, families with children born between May 2002 and August 2007 in the Australian States of New South Wales, Victoria, and Queensland who were identified with hearing loss and fitted with amplification before 3 years of age were invited to participate in the study. All children in this study had access to the same hearing service provider (Australian Hearing) before 3 years of age. Written parental consent was obtained for each participant, and ethics was approved for the study from the Australian Hearing Human Research Ethics Committee.

Participants in the current study were 224 children enrolled in the LOCHI study who had completed parent and teacher evaluations of developmental outcomes at 5-years of age ($M = 61.6$ months, $SD = 1.9$; range 58 to 68 months). There were 121 males and 103 females.

Measures

Strengths and Difficulties Questionnaire (SDQ) – parent and teacher ratings—EBD were measured by the SDQ (Goodman, 1997)—a 25-item screening measure designed to identify behavioural and emotional problems in children. The instrument comprises five subscales: conduct problems (e.g., fights with others, well-behaved), hyperactivity (e.g., restless, easily distracted), emotional symptoms (e.g., many worries, often unhappy), peer problems (e.g., picked on or bullied, liked by other children) and prosocial behaviour (e.g., considerate of other people's feelings, shares with other children). Each subscale contains 5 items. Each item is rated on a 3-point response scale from 0= 'not true' to 1= 'somewhat true' and 2= 'certainly true'. Scores from each domain were summed and a 'total difficulties score' was calculated by summing the four deficit-focused subscales (excluding prosocial behaviour). Z-scores were calculated for each domain with higher Z-scores indicating fewer difficulties. The cut-off scores for being 'at risk' of psychopathology were based on Australian normative data for parent-ratings (Kremer et al., 2015) and teacher-ratings (Hayes, 2007) of children aged 5-years. Specifically, scores falling in the bottom 10% of the normative distribution were taken as indicating potential problems of clinical significance. There were 224 completed forms returned for both the parent and teacher SDQs.

Language: Preschool Language Scale- fourth edition (PLS-4)—The PLS-4 (Zimmerman, Steiner, & Pond, 2002) is a standardised language test used to measure language abilities in children aged between birth and 6;11 (years; months). The test contains two subscales of Expressive Communication (EC) and Auditory Comprehension (AC), which are combined to derive a 'Total Language Score'. The EC subscale items for preschool age include naming of common objects, using concepts to describe objects, defining words, and using grammatical constructions. The AC subscale includes items that assess comprehension of vocabulary, concepts, complex sentences, and drawing inferences. Normative data were used to calculate standard scores and age-equivalent scores for the 188

children who completed the PLS-4. Of the remaining 36 children, standard scores could not be computed for 16 who required the PLS-4 to be administered using simultaneous communication methods (i.e., a combination of signed and oral communication). A further 20 children in the study did not complete the PLS-4 for various reasons, which included: insufficient exposure to English (n=4), not wearing their HA on the day of testing (n=1), not being available for testing (n=5), compliance issues (n=2), and inability to cope with the level of testing (n=8).

Functional Auditory Behaviour: The Parents'/Teachers' Evaluation of Aural/Oral Performance of Children (PEACH/TEACH)—The PEACH and TEACH (Ching & Hill, 2007) are measures of DHH children's functional auditory and communicative performance in everyday life as judged by parents/caregivers and teachers. Each test contains 13 questions, two of which address the use of hearing devices. The remaining 11 questions solicit information about the ability to listen and communicate in quiet and in noise, to use the telephone, and to respond to environmental sounds in everyday situations. An overall functional performance score was calculated using the summed ratings provided by caregivers in response to the 11 questions. Higher scores reflect better listening outcomes for all sounds and environments. There were 199 PEACH and 201 TEACH forms completed and returned. Most of the missing data were due to the forms not being returned.

Non-verbal Cognitive Ability: Wechsler Non-verbal Scale of Ability—Non-verbal cognitive ability was assessed using the Wechsler Non-verbal Scale of Ability (WNV; Wechsler, Naglieri, & Petermann, 2006). The WNV is a standardised assessment specifically devised for linguistically diverse populations, including people with hearing loss. The assessment comprises 4 subtests: matrices, coding, object assembly and recognition (for children ages 4;0 – 7;11) which combine to provide a full-scale IQ score. WNV scores were obtained from 186 children. There were 38 children who were unable to complete the WNV test, due to their inability to cope with the demands of the test (e.g., due to visual or physical limitations; n=12), not being available for testing (n=23), or 'other' reasons (n=3).

Procedure

Each child's primary caregiver and teacher completed the questionnaires described above. Teachers included mainstream, itinerant teachers of the deaf, as well as early intervention habilitationists. Parents/caregivers also completed a custom-designed demographic questionnaire that sought information about their child's diagnosed disabilities in addition to hearing loss, communication mode (speech only, sign only, or a combination), location (residential postcode), and the caregivers' own educational experience. Information regarding the gender of the respondent was not available, however, information on educational experience was provided for up to two primary caregivers (i.e. mother and father). Socio-economic status was measured using the reported postcode and the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD; Australian Bureau of Statistics, 2006), which is scored in deciles (1-10), with higher scores indicating greater advantage. Data regarding children's age at first hearing aid fitting, degree of hearing loss (4 frequency average [4FA]), type of hearing device, and age at CI switch-on, were provided by Australian Hearing (the Australian Government agency that provides audiological services

for all Australian children who are residents or citizens). A speech pathologist administered the PLS-4 and a psychologist administered the WNV at a location of convenience such as the child's home, school, or clinical setting.

Data Analysis

All statistical analyses were conducted using SPSS Statistics Package 21. Paired sample t-tests were used to examine any differences between parent- and teacher-rated SDQ subscales. Pearson Product correlation analysis was conducted to test for inter-rater agreement between parents and teachers.

To examine the predictive value of child, family, and intervention-related factors on EBD (while controlling for all other factors), separate multiple regression analyses were conducted with parent- and teacher-rated SDQ combined (total + prosocial) Z-scores as the dependent variables. As previous research has shown differences in predictor variables of EBD between children with HAs and CIs (Wong et al., 2017), analyses were run separately for children with each hearing device. For both groups of children, predictor variables included-verbal cognitive ability (WNV Z-score), presence of additional disabilities (no: yes), age (in months) at hearing intervention (first HA fit or CI switch on), maternal education (<12 years; diploma/certificate; university education), language abilities (PLS-4 total Z-score) and functional communication (PEACH for parent-rated and TEACH for teacher-rated). Children with HAs had the additional predictor of degree of hearing loss (better ear 4FA).

Little MCAR's test was significant for the missing predictor variables ($\chi^2=58.06$, $p<.001$) which indicated that the data were not 'missing completely at random'. Some of the missing data in this cohort may be related to other known characteristics of the participants. Accordingly, significantly more children who had additional disabilities ($\chi^2=7.10$, $p=.008$) and used combined communication mode had missing PLS-4 scores ($\chi^2=41.2$, $p<.001$). However, there were no significant difference for these groups in regard to missing WNV scores. Because removing cases with incomplete data introduces bias and a drop in statistical power, a multiple imputation technique was used to handle missing data for the regression analyses. First, attempts were made to manually impute missing scores for children who were unable to cope with testing due to known reasons relating to ability. Basal scores on the WNV were given to 3 children who were unable to complete the tests due to diagnosed intellectual disabilities. One child was given a basal score on the PLS-4 due to an inability to cope with the material and a corresponding severely impaired score on a parent-rated language ability measure (Child Development Inventory). A multiple imputations method (with 10 imputations) was used for handling the remaining missing data used as predictor variables in the regression analyses. Variables used to impute data included gender, additional disabilities, non-verbal cognitive ability, hearing device, age at first intervention (with current device), degree of hearing loss, maternal education, language abilities, functional communication (PEACH and TEACH), and SDQ combined scores (parent and teacher ratings).

Results

Participant characteristics

Demographic information and outcomes on predictor variables are presented separately for children with HAs and CIs in Table 1. More children wore HAs (65.2%) than CIs (34.8%). There were 8 children with unilateral HAs, 138 with bilateral HAs, 5 with unilateral CI, 45 with bilateral CIs, and 28 with a CI and HA. There were significantly more males in the group of HA children than those with CIs ($\chi^2=5.24$, $p=.016$). Approximately one third (35%) of the children in both device groups had additional disabilities. The most common additional disabilities were developmental disorder ($n=31$), vision impairment ($n=23$), cerebral palsy ($n=19$), and autism spectrum disorder ($n=10$). Degree of hearing loss varied from mild to profound within the group of children with HAs. For these children, the average age of first fit was 9.5 months ($SD=9.7$, range 1-35 months). For children with CIs, the average age of first CI switch-on was 22.2 months ($SD=13.2$, range 5-58 months). It should be noted that as the children in the LOCHI cohort were born between 2002-2007, the age of intervention may not reflect the current situation where HA fitting and CI switch on are now even younger. The majority of children communicated using spoken language only (compared to some combination of spoken and signed communication, including simultaneous communication), however, there was a significant difference between device groups with more children with CIs using a combined communication mode ($\chi^2=7.3$, $p=.006$). Children were generally from areas of less disadvantage with a median IRSAD decile of 8; and 36.6-45% of mothers had some university education.

Non-verbal cognitive ability of the children was in the typical range on average for both children with HAs and CIs. Four children with HAs and 3 with CIs had standard scores below 70 on the WNV (i.e., 2 SDs below the normative population mean), indicating intellectual impairment. In contrast, on average, language ability on the PLS-4 fell approximately 1 SD below the normative mean.

Parent and Teacher-Rated EBD

Table 2 shows the mean Z-scores on the SDQ for parents and teachers, and the proportion of children falling below clinical cut-offs (i.e., in the bottom 10%). On average, DHH children had Z scores that fell within 1 SD of the norm on all subscales for both parent and teacher ratings. Parents rated children as having 0.42 SD more total EBD (total difficulties subscale) compared to norms, whereas teachers rated children as having 0.20 SD more EBD compared to norms. For the 'strength' domain of prosocial behaviour, parent's ratings were 0.24 SD lower than the normative sample, whereas teacher's ratings were 0.74 SD lower. One-way ANOVAs showed no significant differences between children with HAs and CIs on any SDQ subscale, with the exception of teacher-rated prosocial behaviour. Children with CIs were rated as having significantly lower teacher-rated prosocial behaviour ($Z=-0.95$) compared to those with HAs ($Z=-0.62$).

Although on average, DHH children were falling within 1SD of typically developing children, a substantial proportion of children fell below clinical cut-offs on parent-rated hyperactivity (23%), conduct (28%), peer problems (26%), and prosocial behaviour (19%);

and teacher-rated peer problems (19%) and prosocial behaviour (26%). In contrast, parent and teacher ratings of emotional difficulties were very close to the normative sample, as were teacher-rated behaviour difficulties.

Across all the SDQ subscales, parents rated children as having significantly more behavioural difficulties (hyperactivity [$p=.001$] and conduct [$p<.001$]) and total difficulties ($p=.001$) than teachers. In contrast, teachers rated children as having significantly more problems with prosocial behaviour than parents ($p<.001$). As already noted, children with CIs were rated particularly poorly by teachers on prosocial behaviour. In contrast, there were no significant differences between the informant groups on ratings of emotional difficulties or peer problems.

Table 3 shows the cross-informant Pearson product-moment correlations between parent- and teacher-ratings on each SDQ subscale. All subscales were significantly correlated with small to moderate effect sizes ($r=.286$ to $.498$). Cross-informant agreement was lowest for emotional problems ($r=.286$), and highest for peer problems ($r=.415$) and hyperactivity ($r=.498$). The cross-informant correlation for the total SDQ score was moderate ($r=.456$).

Predictors of parent and teacher rated EBD

Multiple regression analyses were conducted to examine the effect of potential risk/protective factors on parent- and teacher-rated EBD while holding all other factors constant for children with HAs (Table 4) and CIs (Table 5). For children with HAs, predictors differed for parent- and teacher-rated EBD. Significant predictors of parent-rated EBD for children with HAs included non-verbal cognitive ability and parent-rated functional auditory behaviour (PEACH scores). Additional disabilities, degree of hearing loss, age of first HA fit, maternal education, and language were not significantly associated. All variables explained 27.3% of the variance in parent-rated EBD. In contrast, significant predictors of teacher-rated EBD for children with HAs included presence of additional disabilities and language ability. All variables explained 30.4% of the variance in teacher-rated EBD.

For children with CIs, significant predictors of parent-rated EBD included the presence of additional disabilities and parent-rated functional auditory behaviour. Non-verbal cognitive ability, degree of hearing loss, age of first CI switch-on, maternal education, and language were not significantly associated. All variables explained 25.2% of the variance in parent-rated EBD. The only significant predictor of teacher-rated EBD for children with CIs was teacher-rated functional auditory behaviour (TEACH). All variables explained 14.2% of the variance in teacher-rated EBD.

Discussion

This study used a multi-informant approach to report on the EBD of a large cohort of 5-year old DHH children in Australia. On average, EBD (SDQ total difficulties score) fell 0.42 and 0.20 SD below the normative mean for parent and teacher ratings respectively. Parents were more likely to rate children as having externalising problems (i.e., hyperactivity and conduct) than teachers; whereas teachers were more likely to rate children as having problems with prosocial behaviour (e.g., considerate of others feelings, shares with others,

volunteers to help others). Similar to previous studies, there were only small to moderate correlations between parent and teacher ratings. They were lowest for emotional problems, and highest for behaviour problems. Some differences were found in the factors associated with parent compared to teacher ratings of EBD for children who use HAs and CIs. For children with HAs, parent-rated EBD was significantly associated with non-verbal cognitive ability and functional auditory behaviour; and teacher-rated EBD was associated with additional disabilities and language ability. For children with CIs, parent-rated EBD was associated with additional disabilities and functional auditory behaviour; and teacher-rated EBD was only associated with functional auditory behaviour.

Similarities and differences in parent and teacher ratings of EBD

The average rating of EBD in this cohort of DHH children, is similar to that found in a meta-analysis of SDQ studies conducted by Stevenson et al. (2015), in which children scored on average within 1 SD of typically developing children. However, compared to the findings of Stevenson et al., the current cohort, on average, showed slightly more problems on parent-rating and fewer problems on teacher-ratings. This difference is likely due to the children in the Stevenson et al. review spanning a much wider age range (3 to 18 years) compared to the current population who were all 5-years-old. Although on average, the children in this study fell in the normal range for EBD, relatively high proportions of children had scores that were below clinical-cut offs (i.e., bottom 10% compared to normative data) on both parent and teacher ratings, indicating they were at risk of psychopathology. For parent ratings these low scores were particularly in the areas of hyperactivity, conduct, and peer problems; and for teacher ratings in the areas of peer problems and prosocial behaviour. There were approximately two to three times more DHH children falling below cut-offs in these areas than expected in a typically developing population, thus indicating that the current cohort of DHH children continue to be at higher risk of EBD.

Parents rated children as having significantly more problems with conduct and hyperactivity than teachers. This finding is consistent with previous studies, and suggests that parents may over-report problems with their child's behaviour (Kolko & Kazdin, 1993). Alternatively, it could be that there are contextual variations in the children's behaviour where they display more difficult behaviour at home compared to school. In hearing children from community and clinical populations, Kolko and Kazdin (1993) found that predictors of parent-teacher discrepancies included low parental acceptance of the child, and level of family control. This indicates there may be specific contextual issues, or variations in strategies used at home compared to school, that may contribute to poorer ratings of child behaviour by parents (De Los Reyes et al., 2015). In the case of DHH children, a number of studies have found that parents experience more stress than parents of hearing children, and that higher parental stress is associated with increased EBD (Hintermair, 2006; Quittner et al., 2010). It has been suggested further that parent stress may impact on a child's behaviour through parenting behaviour (Deater-Deckard, 1998) or expectations (Anthony et al., 2005). Anthony et al. found that stressed parents with high expectations for their child, were more likely to have children with increased externalising behaviour problems. The impact of parental stress and parent-child relationships on child behaviour problems in DHH children may be a fruitful avenue for future research and interventions. Interventions that focus on parent-training for

behavioural management strategies at home may be beneficial for parents who have higher stress levels or rate their child as having significant behavioural issues.

In the current study, teachers rated children as having significantly poorer prosocial behaviour than parents, and this was particularly so for children with CIs. It may be that teachers are able to observe children in a greater number and wider variety of social situations than parents, and that they consequently observe more opportunities for prosocial behaviour towards peers and other adults. Compared to parents, teachers are able to judge the child's behaviour relative to a comparison group of same-age peers (Johnson, Beitchman, & Brownlie, 2010). This potential explanation is consistent with a study in hearing children, which found that teachers were more likely than parents to notice social problems in children with mood disorders (Mesman & Koot, 2000).

Prosocial behaviour is defined as voluntary, intentional behaviour that results in benefits for others (Eisenberg & Miller, 1987), and has been related to empathy, theory of mind, peer acceptance and social adjustment (Crick, 1996; Eisenberg & Miller, 1987; Layous, Nelson, Oberle, Schonert-Reichl, & Lyubomirsky, 2012). Previous research has reported that DHH children show lower levels of empathy and delays in theory of mind compared to hearing children (Netten et al., 2015; Peterson, 2004; Peterson, O'Reilly & Wellman, 2016; Rimmel & Peters, 2009; Woolfe, Want & Siegal 2002). In a study on empathy, Netten et al. found DHH children had specific problems in cognitive empathy but not affective empathy. This result suggests that DHH children might feel what others feel, but understand less about the causes of those feelings, and consequently are less able to respond adaptively to support a person in distress.

The finding that more prosocial difficulties were found in children with CIs stands in contrast to previous studies showing better psychosocial outcomes in that group when compared to children with HAs (Theunissen et al., 2012; Theunissen et al., 2015). However, previous studies have only compared children with similar levels of hearing loss (i.e., severe to profound). In contrast, the current study included a more heterogeneous group of children with HAs who had mild to profound losses. An additional relevant variable of influence here may have been the communication modes used by the children. More children with CIs used a combination of communication modes. This mismatch in communication systems may have created additional difficulties in communicating with hearing peers and teachers in mainstream schools who did not know or use signed communication, thus making it more difficult for children to demonstrate prosocial behaviour in those contexts. Mejstad et al. (2009) similarly found higher teacher-rated prosocial problems in DHH children (with both HAs and CIs). Although reasons for this finding were not explored, the authors did find an association between school type and self-reported prosocial behaviour. Children in schools for the deaf were more likely to report lower prosocial behaviour than children in mainstream schools. The authors posited that children in schools for the deaf may have more severe hearing losses or other disabilities, and there may also be different attitudes towards children in mainstream and special schools. Future studies could also explore differences in EBD between DHH children attending different types schools.

On the other hand, discrepancies between parent and teacher ratings may also be due in part to factors relating to teachers themselves. For example, teachers can differ greatly in regard to their abilities to deal with negative behaviour and social problems (Anthony et al., 2005), and their level of familiarity with a child will also likely influence rating scores (Kolko & Kazdin, 1993). A study by Ines and Sacco (1992) found that familiarity with the student was related to higher correspondence between teacher and self-reported depression in children, which suggests that clinical information should be obtained only from teachers who are at least moderately familiar with the child. Nonetheless, as prosocial behaviour is linked to psychosocial functioning, the fact that teachers rated problems with prosocial behaviour in the current study indicates that education efforts should target the provision of assistance to young DHH children to build up prosocial behaviour skills in the school environment, with a particular focus on children with CIs.

Regarding interventions to promote prosocial behaviour, a meta-analysis of social skill training studies (in hearing children) found group interventions were more effective in promoting prosocial behaviour than changing disruptive behaviour in children with EBD (Quinn, Kavale, Mathur, Rutherford, & Forness, 1999). These interventions focused on promoting specific social skills such as cooperating, social interactions, and social problem solving. However, effect sizes were relatively small (mean effect size of .199). The authors suggested that social skill training could be more effective if they were more targeted to individual students' needs and values, and integrated across environments (i.e., the school curriculum, on the playground, and at home). A more recent study in typically developing pre-school children found a 12-week mindfulness-based prosocial training program (which included bringing awareness/attention to the breath and emotions, working out problems, gratitude and caring for others and the world) significantly increased social competence, prosocial behaviour (e.g., sharing), and emotion regulation compared to a wait-list control (Flook, Goldberg, Pinger, & Davidson, 2015). The authors concluded there was much promise in incorporating mindfulness training for promoting prosocial behaviour in early education for all children (not just those with EBD), but that further research in this area was needed. Overall, social skills and mindfulness-based programs need to be evaluated in DHH children, who may have difficulty with more abstract concepts due to limited language and communication skills.

Both parents and teachers rated a high proportion of children with significant peer problems (19-25.7%). This is consistent with the review by Stevenson et al. (2015) that indicated peer relations was the most common problem area for DHH children. A number of studies to date, have reported social isolation (Nunes, Pretzlik, & Olsson, 2001; Vostanis, Hayes, Feu, & Warren, 1997) and problems with social competence in DHH children (Antia & Kreimeyer, 2003; Batten et al., 2014; Laugen et al., 2017; Xie et al., 2014). A systematic review by Xie et al. (2014) concluded that DHH children face challenges initiating, communicating and maintaining interactions with hearing peers despite early identification and intervention. They suggested that social skill training and co-enrolment (i.e., education with hearing students with both general and special education teachers working together) may improve social competence, acceptance, and the attitudes of hearing students towards DHH students. Interventions in pre-school age children are particularly important to establish good social skills and prevent peer problems in later years; however, further

research on interventions that aim to promote social interactions in DHH children is needed (Martin, Bat-Chava, Lalwani, & Waltzman, 2010).

The highest inter-rater agreement between parent's and teacher's ratings were in the areas of hyperactivity ($r=.498$) and peer problems ($r=.415$), and the lowest was for emotional problems ($r=.286$). This difference is consistent with previous research showing that the greatest inter-rater agreement on measures of this type are for observable and conspicuous behaviours (Achenbach et al., 1987; De Los Reyes et al., 2015; Kolko & Kazdin, 1993). However, the overall low to moderate correlations in the current and previous studies suggest that information obtained from multiple sources is useful in providing a complete view of children's psychosocial functioning. Children's self-reports of their own strengths and difficulties (which can be measured from 11 years on the SDQ) will become an important consideration for measuring emotional difficulties in this cohort in the future; notwithstanding that Kolko and Kazdin (1993), found that children may also "under-report" their own symptoms. Consequently, it might be concluded that collecting and comparing data from parent, teacher, and self-report should remain best practice in obtaining a comprehensive understanding of the child's psychosocial functioning across various contexts.

Risk and protective factors influencing parent and teacher EBD ratings

Differences were found when examining the potential risk and protective factors that influence parent and teacher ratings of EBD. For children with HAs, non-verbal cognitive ability and parent-rated functional auditory behaviour were significantly associated with parent-rated EBD; whereas additional disabilities and language ability were significantly associated with teacher-rated EBD. As reported in our previous research on parent-rated psychosocial outcomes in the LOCHI cohort, additional disabilities, non-verbal cognitive ability, language, and functional auditory behaviour (measured by the PEACH), have consistently been shown to relate to global psychosocial outcomes, with the largest effect size observed for the PEACH (Wong et al., 2017; Wong et al., 2016). The PEACH taps into more functional and practical aspects of listening and communicating in both quiet and noisy environments. This may be relevant for EBD because DHH children typically tend to have more difficulties in challenging listening environments when compared with one-on-one communication (Punch & Hyde, 2011), which is more typical of parent-child interactions. On the other hand, it is possible that teachers might rely more on the child's academic performance and ability to understand/express themselves as a basis for judging their behaviour and social functioning in the school environment, particularly in mainstream schools. However, this is just speculation at this point as it has not been researched.

For children with CIs, functional auditory behaviour was significantly associated with both parent- and teacher-rated EBD. For teacher-ratings, TEACH scores were the only significant factor associated with EBD, suggesting that, particularly for children with CIs, it is not the ability to understand or express language per se, but the ability to functionally listen and communicate well (regardless of modality) in various environments that is needed to reduce the risk of developing EBD. In line with this idea, more children with CIs used a combined communication mode compared to children with HAs. It could be the case that children

using a combined communication mode did not have as developed listening and speech skills; or as previously mentioned, the mismatch in communication between teachers and students makes it more difficult for children to communicate in a mainstream teaching environment. In addition, DHH children may display more behavioural or social difficulties when there is a lot of background noise or distractions. Consistent with this interpretation, a qualitative study in children with CIs found that even children with excellent spoken language development experienced problems in difficult listening environments such as in large groups of people, and had more difficulties understanding subtle social nuances in conversation (Punch & Hyde, 2011). Xie et al. (2014) emphasised the importance of context and situation in influencing social interactions in DHH children (e.g., one-on-one vs. group, or play vs. non-play activities), and that there may be increasing difficulty for DHH children to interact with peers when there is more noise or in larger social situations.

Poorer listening skills may also mean that children miss out on the incidental learning of social and pragmatic language skills. Incidental learning is the process by which information is learned due to passive exposure to events that are seen or heard, but not explicitly taught (Calderon & Greenberg, 2003). DHH children may not overhear spoken conversations where important social information is relayed (e.g., problem solving, praise/discipline directed towards another child, parent/teacher discussions, peer gossiping, etc.), and be less exposed to natural communication interactions. Incidental learning is also thought to be essential in learning abstract social concepts such as emotions, empathy, and that other people may have different beliefs/viewpoints (Netten et al., 2015; Rieffe & Terwogt, 2000). DHH children may be disadvantaged due to their poorer listening skills and limited exposure in overhearing daily conversation (Netten et al., 2015). Consequently, they have fewer opportunities to acquire a range of pragmatic and social cognitive skills such as turn-taking, maintaining topic, asking questions, emotional understanding and theory of mind, which may impact on their socioemotional development (Calderon & Greenberg, 2003; Most, Shina-August, & Meilijson, 2010).

The current findings indicate that parents and teachers may need assistance to improve and facilitate good functional listening and communication skills in a broad range of environments. This could include remediation focused strategies (e.g., improving the ability to listen in noise, detecting subtle social cues, conversational skills, overcoming communication breakdowns); as well as compensatory/environmental modifications (e.g., use of remote microphone systems, Bluetooth assistive listening devices or 2.4 GHz devices; and keeping distractions to a minimum in the classroom).

Consistent with previous literature (Theunissen et al., 2014), no audiological (i.e., severity of hearing loss, age of first HA or CI switch-on) or family factors (i.e., maternal education) were significantly associated with parent or teacher ratings of EBD. It is likely therefore, that these factors may be more directly associated with language development and communication abilities more broadly, and only indirectly related to EBD (Wong et al., 2016).

Limitations

A limitation of this study is the use of an EBD screen rather than a more comprehensive measure such as the Child Behaviour Checklist or psychiatric interview. Nonetheless, the SDQ is a commonly used measure of EBD for research purposes, and has been the most consistently used measure in research on DHH children (Stevenson et al., 2015). It has been shown to have good psychometric properties in both hearing and DHH populations (Nielsen & Dammeyer, 2015). An unavoidable limitation is the missing data from the population-based study, and the use of multiple imputations in the regression analyses. Although this is one of the most commonly used methods in such situations, not all variables were missing at random, introducing possible biases. To address this shortcoming, attempts were made to manually impute PLS-4 and WNV scores if the child was unable to cope with the demands of the test, had shown evidence of poor language on other measures, or had a diagnosed intellectual disability. Only predictor variables were imputed and a large number of imputations (10) were created to reduce sampling variability.

For all of these limitations, however, a significant strength of the LOCHI study lies in its population-based, longitudinal design. This study was novel in that it examined EBD in a large population-based group of young children with HAs and CIs of the same age, and had the statistical power to examine a wide range of factors associated with parent and teacher outcomes separately. We will also be able to investigate whether there are changes in EBD over time, and also, when the children are old enough, whether their self-reported EBD differs from those of their parents and teachers.

The final regression model, including all variables, accounted for 25.2 to 27.3% of the variance in parent-rated EBD, and 14.2 to 30.4% of the variance in teacher-rated EBD, indicating that other unidentified variables are likely contributing directly to outcomes, particularly for teacher-ratings of CI children. As mentioned, other potentially contributing factors shown to be related to EBD that could be explored in future research include: level of parental stress (Quittner et al., 2010), level of family control (Kolko & Kazdin, 1993), parental/family history of EBD, teacher competence/knowledge (Anthony et al., 2005), child's empathy/theory of mind (Netten et al., 2015), type of education/schooling (Nunes et al., 2001; Wauters & Knoors, 2008), and pragmatic language abilities (Most et al., 2010).

Conclusion

In summary, differences were observed between parent and teacher ratings of EBD in 5-year-old DHH children, where parents were more likely to rate behavioural difficulties (hyperactivity and conduct), and teachers more likely to rate poor prosocial behaviour. The low to moderate correlations between parent and teacher ratings indicate that a multi-informant approach is needed to obtain a global perspective on the functioning of DHH children, and that DHH children may show different problems in the home compared to school. On average, children were falling within 1SD of age-norms, although a high proportion of children fell below clinical cut offs, indicating that this population is still at higher risk of developing mental health problems compared to hearing children. The results of the regression analyses indicated that DHH children with low non-verbal cognitive ability, additional disabilities, and poor functional auditory behaviour may be at higher risk of

developing EBD. Functional auditory behaviour was the strongest and most consistent predictor of parent-rated EBD for children with HAs and CIs, and teacher-rated EBD for children with CIs. In contrast, language ability was only significantly related to teacher-rated EBD in children with HAs. The findings suggest that parents may need assistance with managing behavioural problems at home, and that benefits may be gained from teachers trying to facilitate more opportunities for children to practice prosocial behaviour at school. In addition, there might be value in both parents and educators focusing intervention efforts on improving and facilitating good functional listening and communication skills, as this may in turn, have positive impacts on the incidence of EBD in young DHH children.

References

- Achenbach TM, McConaughy SH, Howell CT. 1987; Child/adolescent behavioural and emotional problems: implications of cross-informant correlations for situational specificity. *Psychological bulletin*. 101(2):213. [PubMed: 3562706]
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th. Arlington, VA: American Psychiatric Publishing; 2013.
- Anmyr L, Larsson K, Olsson M, Freijd A. 2012; Strengths and difficulties in children with cochlear implants—comparing self-reports with reports from parents and teachers. *International Journal of Pediatric Otorhinolaryngology*. 76(8):1107–1112. [PubMed: 22613755]
- Anthony LG, Anthony BJ, Glanville DN, Naiman DQ, Waanders C, Shaffer S. 2005; The relationships between parenting stress, parenting behaviour and preschoolers' social competence and behaviour problems in the classroom. *Infant and Child Development*. 14(2):133–154.
- Antia SD, Kreimeyer KH. 2003; Peer interactions of deaf and hard-of-hearing children. *Oxford Handbook of Deaf Studies, Language, and Education*. 1:164–176.
- Barker DH, Quittner AL, Fink NE, Eisenberg LS, Tobey EA, Niparko JK. 2009; Predicting behaviour problems in deaf and hearing children: The influences of language, attention, and parent–child communication. *Development and Psychopathology*. 21(02):373–392. [PubMed: 19338689]
- Batten G, Oakes PM, Alexander T. 2014; Factors associated with social interactions between deaf children and their hearing peers: A systematic literature review. *Journal of Deaf Studies and Deaf Education*. 19(3):285–302. [PubMed: 24222193]
- Calderon, R, Greenberg, M. Social and emotional development of deaf children. In: Marschark, M, editor. *Oxford handbook of deaf studies, language, and education*. Vol. 1. Oxford: Oxford University Press; 2003. 177–189.
- Ching TY, Day J, Seeto M, Dillon H, Marnane V, Street L. 2013; Predicting 3-year outcomes of early-identified children with hearing impairment. *B-ENT*. 99
- Ching TY, Hill M. 2007; The parents' evaluation of aural/oral performance of children (PEACH) scale: Normative data. *Journal of the American Academy of Audiology*. 18(3):220–235. [PubMed: 17479615]
- Ching TY, Leigh G, Dillon H. 2013; Introduction to the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study: Background, design, sample characteristics. *International Journal of Audiology*. 52(S2):S4–S9. [PubMed: 24350694]
- Cornes AJ, Brown PM. 2012; Mental health of Australian deaf adolescents: an investigation using an Auslan version of the Strengths and Difficulties Questionnaire. *Deafness & Education International*. 14(3):161–175.
- Crick NR. 1996; The role of overt aggression, relational aggression, and prosocial behaviour in the prediction of children's future social adjustment. *Child Development*. 67(5):2317–2327. [PubMed: 9022243]
- Dammeyer J. 2010; Psychosocial development in a Danish population of children with cochlear implants and deaf and hard-of-hearing children. *Journal of Deaf Studies and Deaf Education*. 15(1):50–58. [PubMed: 19745003]

- De Los Reyes A, Augenstein TM, Wang M, Thomas SA, Drabick DA, Burgers DE, Rabinowitz J. 2015; The validity of the multi-informant approach to assessing child and adolescent mental health. *Psychological Bulletin*. 141(14):858–900. [PubMed: 25915035]
- De Los Reyes A, Kazdin AE. 2005; Informant discrepancies in the assessment of childhood psychopathology: a critical review, theoretical framework, and recommendations for further study. *Psychological Bulletin*. 131(4):483. [PubMed: 16060799]
- Deater-Deckard K. 1998; Parenting stress and child adjustment: Some old hypotheses and new questions. *Clinical Psychology: Science and Practice*. 5(3):314–332.
- Eisenberg N, Miller PA. 1987; The relation of empathy to prosocial and related behaviours. *Psychological Bulletin*. 101(1):91. [PubMed: 3562705]
- Fellinger J, Holzinger D, Sattel H, Laucht M. 2008; Mental health and quality of life in deaf pupils. *European Child & Adolescent Psychiatry*. 17(7):414–423. [PubMed: 18810312]
- Flook L, Goldberg SB, Pinger L, Davidson RJ. 2015; Promoting prosocial behavior and self-regulatory skills in preschool children through a mindfulness-based kindness curriculum. *Developmental Psychology*. 51(1):44–51. [PubMed: 25383689]
- Hayes L. 2007; Problem behaviours in early primary school children: Australian normative data using the Strengths and Difficulties Questionnaire. *Australian and New Zealand Journal of Psychiatry*. 41(3):231–238. [PubMed: 17464704]
- Hindley PA. 2005; Mental health problems in deaf children. *Current Paediatrics*. 15(2):114–119.
- Hintermair M. 2006; Parental resources, parental stress, and socioemotional development of deaf and hard of hearing children. *Journal of Deaf Studies and Deaf Education*. 11(4):493–513. [PubMed: 16809431]
- Hoffman MF, Quittner AL, Cejas I. 2015; Comparisons of social competence in young children with and without hearing loss: A dynamic systems framework. *Journal of Deaf Studies and Deaf Education*. 20(2):115–124. [PubMed: 25583707]
- Huber M, Kipman U. 2011; The mental health of deaf adolescents with cochlear implants compared to their hearing peers. *International Journal of Audiology*. 50(3):146–154. [PubMed: 21309643]
- Ines TM, Sacco WP. 1992; Factors related to correspondence between teacher ratings of elementary student depression and student self-ratings. *Journal of Consulting and Clinical Psychology*. 60(1):140–142. [PubMed: 1556277]
- Johnson CJ, Beitchman JH, Brownlie E. 2010; Twenty-year follow-up of children with and without speech-language impairments: Family, educational, occupational, and quality of life outcomes. *American Journal of Speech-Language Pathology*. 19(1):51–65. [PubMed: 19644128]
- Kolko DJ, Kazdin AE. 1993; Emotional/behavioural problems in clinic and nonclinic children: correspondence among child, parent and teacher reports. *Journal of Child Psychology and Psychiatry*. 34(6):991–1006. [PubMed: 8408380]
- Kremer P, Silva A, Cleary J, Santoro G, Weston K, Steele E, Waters E. 2015; Normative data for the Strengths and Difficulties Questionnaire for young children in Australia. *Journal of Paediatrics and Child Health*. 51(10):970–975. [PubMed: 25872585]
- Laugen NJ, Jacobsen KH, Rieffe C, Wichstrøm L. 2017; Social skills in preschool children with unilateral and mild bilateral hearing loss. *Deafness & Education International*. 19(2):54–62.
- Layous K, Nelson SK, Oberle E, Schonert-Reichl KA, Lyubomirsky S. 2012; Kindness counts: Prompting prosocial behaviour in preadolescents boosts peer acceptance and well-being. *PloS One*. 7(12):e51380. [PubMed: 23300546]
- Martin D, Bat-Chava Y, Lalwani A, Waltzman SB. 2010; Peer relationships of deaf children with cochlear implants: Predictors of peer entry and peer interaction success. *Journal of Deaf Studies and Deaf Education*. 16(1):108–120. [PubMed: 20805230]
- Mehra S, Eavey RD, Keamy DG. 2009; The epidemiology of hearing impairment in the United States: newborns, children, and adolescents. *Otolaryngology-Head and Neck Surgery*. 140(4):461–472. [PubMed: 19328331]
- Mejstad L, Heiling K, Svedin CG. 2009; Mental health and self-image among deaf and hard of hearing children. *American Annals of the Deaf*. 153(5):504–515. [PubMed: 19350957]

- Mesman J, Koot HM. 2000; Child-reported depression and anxiety in preadolescence: II. Preschool predictors. *Journal of the American Academy of Child & Adolescent Psychiatry*. 39(11):1379–1386. [PubMed: 11068893]
- Moeller MP. 2007; Current state of knowledge: psychosocial development in children with hearing impairment. *Ear and Hearing*. 28(6):729–739. [PubMed: 17982361]
- Morton CC, Nance WE. 2006; Newborn hearing screening—a silent revolution. *New England Journal of Medicine*. 354(20):2151–2164. [PubMed: 16707752]
- Most T, Shina-August E, Meilijson S. 2010; Pragmatic abilities of children with hearing loss using cochlear implants or hearing aids compared to hearing children. *Journal of Deaf Studies and Deaf Education*. 15(4):422–437. [PubMed: 20624757]
- Netten AP, Rieffe C, Theunissen SC, Soede W, Dirks E, Briare JJ, Frijns JH. 2015; Low Empathy in Deaf and Hard of Hearing (Pre) Adolescents Compared to Normal Hearing Controls. *PloS One*. 10(4):e0124102. [PubMed: 25906365]
- Niclasen J, Dammeyer J. 2015; Psychometric Properties of the Strengths and Difficulties Questionnaire and Mental Health Problems Among Children With Hearing Loss. *Journal of Deaf Studies and Deaf Education*. 21(2):129–140. [PubMed: 26714489]
- Nunes T, Pretzlik U, Olsson J. 2001; Deaf children's social relationships in mainstream schools. *Deafness & Education International*. 3(3):123–136.
- Peterson CC. 2004; Theory-of-mind development in oral deaf children with cochlear implants or conventional hearing aids. *Journal of Child Psychology and Psychiatry*. 45(6):1096–1106. [PubMed: 15257666]
- Peterson CC, O'Reilly K, Wellman HM. 2016; Deaf and hearing children's development of theory of mind, peer popularity, and leadership during middle childhood. *Journal of Experimental Child Psychology*.
- Punch R, Hyde M. 2011; Social participation of children and adolescents with cochlear implants: A qualitative analysis of parent, teacher, and child interviews. *Journal of Deaf Studies and Deaf Education*. 16(4):474–493. [PubMed: 21372111]
- Quinn MM, Kavale KA, Mathur SR, Rutherford RB Jr, Forness SR. 1999; A meta-analysis of social skill interventions for students with emotional or behavioral disorders. *Journal of Emotional and Behavioral Disorders*. 7(1):54–64.
- Quittner AL, Barker DH, Cruz I, Snell C, Grimley ME, Botteri M, Team CI. 2010; Parenting stress among parents of deaf and hearing children: Associations with language delays and behaviour problems. *Parenting: Science and Practice*. 10(2):136–155.
- Rieffe C, Terwogt MM. 2000; Deaf children's understanding of emotions: Desires take precedence. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*. 41(5):601–608.
- Rommel E, Peters K. 2009; Theory of mind and language in children with cochlear implants. *Journal of Deaf Studies and Deaf Education*. 14(2):218–236. [PubMed: 18796736]
- Stevenson J, Kreppner J, Pimperton H, Worsfold S, Kennedy C. 2015; Emotional and behavioural difficulties in children and adolescents with hearing impairment: a systematic review and meta-analysis. *European Child & Adolescent Psychiatry*. 24(5):1–20.
- Stevenson J, McCann D, Watkin P, Worsfold S, Kennedy C. 2010; The relationship between language development and behaviour problems in children with hearing loss. *Journal of Child Psychology and Psychiatry*. 51(1):77–83. [PubMed: 19686333]
- Theunissen S, Rieffe C, Kouwenberg M, De Raeve L, Soede W, Briare JJ, Frijns JH. 2012; Anxiety in children with hearing aids or cochlear implants compared to normally hearing controls. *The Laryngoscope*. 122(3):654–659. [PubMed: 22252674]
- Theunissen S, Rieffe C, Kouwenberg M, Soede W, Briare JJ, Frijns JH. 2011; Depression in hearing-impaired children. *International Journal of Pediatric Otorhinolaryngology*. 75(10):1313–1317. [PubMed: 21862140]
- Theunissen S, Rieffe C, Netten AP, Briare JJ, Soede W, Schoones JW, Frijns JH. 2014; Psychopathology and its risk and protective factors in hearing-impaired children and adolescents: a systematic review. *JAMA Pediatrics*. 168(2):170–177. [PubMed: 24296921]
- Thompson DC, McPhillips H, Davis RL, Lieu TA, Homer CJ, Helfand M. 2001; Universal newborn hearing screening: summary of evidence. *JAMA*. 286(16):2000–2010. [PubMed: 11667937]

- Van Eldik T. 2005; Mental health problems of Dutch youth with hearing loss as shown on the Youth Self Report. *American Annals of the Deaf*. 150(1):11–16. [PubMed: 15969220]
- Vostanis P, Hayes M, Feu M, Warren J. 1997; Detection of behavioural and emotional problems in deaf children and adolescents: comparison of two rating scales. *Child: Care, Health and Development*. 23(3):233–246.
- Wauters LN, Knoors H. 2008; Social integration of deaf children in inclusive settings. *Journal of Deaf Studies and Deaf Education*. 13(1):21–36. [PubMed: 17573356]
- Wechsler, D, Naglieri, JA, Petermann, F. Wechsler nonverbal scale of ability: WNV. PsychCorp; 2006.
- Wong CL, Ching TY, Cupples L, Button L, Leigh G, Marnane V, Martin L. 2017; Psychosocial Development in 5-Year-Old Children With Hearing Loss Using Hearing Aids or Cochlear Implants. *Trends in Hearing*. 21:1–19. DOI: 10.1177/2331216517710373
- Wong CL, Ching TY, Leigh G, Cupples L, Button L, Marnane V, Martin L. 2016; Psychosocial Development of 5-year-old Children with Hearing Loss: Risks and protective factors. *International Journal of Audiology*. doi: 10.1080/14992027.2016.1211764
- Woolfe T, Want SC, Siegal M. 2002; Signposts to development: Theory of mind in deaf children. *Child development*. 73(3):768–778. [PubMed: 12038550]
- Xie YH, Potm šil M, Peters B. 2014; Children who are deaf or hard of hearing in inclusive educational settings: A literature review on interactions with peers. *Journal of Deaf Studies and Deaf Education*. 19(4):423–437. [PubMed: 25052819]

Table 1

Demographic characteristics and predictor variable outcomes for children with Hearing Aids (HAs) and Cochlear Implants (CIs) (N=224)

Child characteristics		HAs (n=146)	CIs (n=78)
Gender	Male	87 (59.6%)	34 (43.6%) *
	Female	59 (40.4%)	44 (56.4%)
Additional disabilities	Absent	93 (64.1%)	50 (66.7%)
	Present	52 (35.9%)	33.3%
	Not reported	1	3
Severity of hearing loss (based on better ear 4FA)	Mild (20-40 dBHL)	36 (24.7%)	-
	Moderate (41-60 dBHL)	76 (52.1%)	1 (1.3%)
	Severe (61-80 dBHL)	28 (19.2%)	8 (10.3%)
	Profound (>80 dBHL)	6 (4.1%)	69 (88.5%)
Age at first hearing aid fitting (months)	Mean (SD)	9.5 (9.7)	6.8 (6.9)
	Median	5.0	3.5
	Range	1-35	0-34
Age at first cochlear implant switch-on (months)	Mean (SD)	N/A	22.2 (13.2)
	Median		20.3
	Range		5-58.9
Maternal education	School	40 (28.8%)	23 (32.4%)
	Diploma or certificate	36 (25.9%)	22 (31.0%)
	University	63 (45.3%)	26 (36.6%)
	Not reported	7	7
Socio-economic status (IRSAD Decile)	Mean	7.0 (2.6)	7.3 (2.6)
	Median	8	8
	Range	1-10	1-10
Communication mode	Aural/oral only	120 (83.3%)	52 (67.5%)
	Oral and sign	24 (16.7%)	25 (32.5%) *
	Not reported	2	1
Nonverbal cognitive ability (WNV scaled score) (n=186)	Mean (SD)	103.20 (15.5)	100.27 (16.0)
	Range	60-132	30-136
Language ability (PLS-4 Total SS)	Mean (SD)	85.74 (19.3)	80.54 (21.2)
	Range	50-124	50-134
Parent-rated Functional Auditory behaviour (PEACH Total%)	Mean (SD)	77.2 (16.0)	78.0 (19.1)
	Range	13.6-100	2.3-100
	Mean (SD)	74.1 (18.9)	70.53 (20.5)
Teacher-rated Functional Auditory behaviour (TEACH Total%)	Range	16.7-100	13.9 -100

Note: 4FA= four frequency average; IRSAD = Index of Relative Socio-Economic Advantage and Disadvantage; WNV = Wechsler Non-Verbal Test; PLS = Preschool language test; PEACH = Parents' Evaluation of Aural/Oral Performance of Children; TEACH = Teachers' Evaluation of Aural/Oral Performance of Children;

* significant difference between CI and HA (Chi-square)

Table 2

Mean parent and teacher raw and Z-scores (SDs) for SDQ domains, and proportions falling below clinical cut offs

	Parent			Teacher			Diff*
	Mean raw score (SD)	Mean Z-score (SD)	% below clinical cut-off	Mean raw score (SD)	Mean Z-score (SD)	% below clinical cut-off	
Emotion	1.36 (1.5)	-.01 (.96)	14.2%	1.46 (1.7)	.01 (.81)	13.3%	n.s
Hyperactivity	1.61 (1.5)	-.51 (1.2)	23%	1.08 (1.4)	-.25 (.97)	6.2%	.001
Conduct	3.88 (2.6)	-.33 (1.1)	28.3%	3.74 (2.9)	-.03 (.81)	12.8%	<.001
Peer	1.53 (1.8)	-.22 (1.2)	25.7%	1.82 (1.9)	-.27 (1.1)	19%	n.s
Prosocial	7.81 (2.2)	-.24 (1.2)	19%	6.19 (2.6)	-.74 (1.1)	26.1%	<.001
Total	8.38 (5.0)	-.42 (1.1)	11.9%	8.09 (5.6)	-.20 (.89)	10.2%	.001

* based on paired sample t-tests. Clinical cut offs based on Kremer et al., (2015) for parent and Hayes (2007) for teacher SDQ ratings.

Cross-informant Pearson product correlations between parent and teacher-ratings on the SDQ

Table 3

		TEACHER SDQ				
		Emotion	Hyperactivity	Conduct	Peer	Prosocial
PARENT	Emotion	.286**	.046	.111	.141*	.131
SDQ	Hyperactivity		.498**	.275**	.160*	.268**
	Conduct			.357**	.152-	.215**
	Peer				.415**	.355**
	Prosocial					.403**
	Total					.266**
						.456**

Note:

*

p<.05,

**

p<.001

Table 4

Regressions on parent and teacher SDQ (combined) scores for children with Hearing Aids

	Parent SDQ				Teacher SDQ			
	B	95%CI	p		B	95%CI	p	
Disabilities	-.170	-.481 .141	.283		-.380	-.663 -.097	.009**	
Non-verbal cog	.206	.052 .359	.009**		.096	-.049 .240	.193	
Degree of HL	.004	-.005 .013	.403		-.002	-.010 .007	.692	
Age HA fit	.001	-.013 .015	.881		.002	-.011 .015	.792	
Maternal ed	.086	-.092 .264	.345		.157	-.006 .320	.059	
Language	.115	-.019 .250	.092		.185	.051 .318	.007**	
Functional Beh	.014	.004 .023	.004**		.005	-.003 .012	.220	
r ²	.273				.304			

Note: Disabilities= additional disabilities (No [reference]: Yes); Degree of HL = Better ear 4 frequency average; Age HA fit = age at first hearing aid fitting (months); Maternal ed = maternal education (high school; diploma; university); Language = Pre-school Language Scale 4 Total Z-score; Functional Beh = PEACH for parents or TEACH for teachers.

* p<.05,

** p<.001

Table 5

Regressions on parent and teacher SDQ (combined) scores for children with Cochlear Implants

	Parent SDQ				Teacher SDQ			
	B	95%CI		p	B	95%CI		p
Disabilities	-.557	-1.023	-.092	.019 [*]	-.120	-.571	.331	.601
Non-verbal cog	.090	-.127	.306	.417	-.010	-.235	.215	.931
Age CI	.005	-.009	.020	.469	.008	-.006	.022	.256
Maternal ed	.071	-.178	.321	.576	.059	-.177	.296	.622
Language	-.103	-.276	.070	.241	.096	-.080	.271	.283
Functional Beh	.019	.007	.031	.001 ^{**}	.012	.001	.023	.039 [*]
* r^2	.252				.142			

Note: Disabilities= additional disabilities (No [reference]: Yes); Age CI = age at CI switch on (months); Maternal ed = maternal education (high school: diploma: university); Language = Pre-school Language Scale 4 Total Z-score; Functional Beh = PEACH for parents or TEACH for teachers.

*
p<.05,

**
p<.001