EMPIRICAL MANUSCRIPT

Predictors of Psychosocial Outcomes in Hard of Hearing Preschool Children

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Abstract

Children with hearing loss are at risk for developing psychosocial problems. Children with mild to severe hearing loss are less frequently subject to research, in particular in preschool, and we therefore know less about the risk in this particular group. To address this, we compared psychosocial functioning in thirty-five 4–5-year olds with hearing aids to that of 180 typically hearing children. Parent ratings of psychosocial functioning and social skills, as well as scores of receptive vocabulary, were obtained. Children with hearing loss evidenced more psychosocial problems than hearing agemates. Female gender and early detection of hearing loss predicted better psychosocial functioning among children with hearing loss, whereas vocabulary and degree of hearing loss did not. Early intervention addressing psychosocial functioning is warranted for children with all degrees of hearing loss, including mild and moderate. Gender differences should be investigated in future research.

Children who are deaf and hard of hearing (DHH) are at risk for psychosocial problems (Fellinger, Holzinger, Sattel, & Laucht, 2008; Moeller, 2007). Identifying the prevalence of psychosocial problems and their potential causes are vital to prevent and ameliorate these. Research has often addressed children with cochlear implants (Hogan, Shipley, Strazdins, Purcell, & Baker, 2011), but we know comparatively less about the psychosocial development of hard of hearing (HH) children; that is, children with mild to severe hearing loss (25–89 dB) who often use spoken language as their main language and who benefit from hearing aids rather than cochlear implants. By many, this group has been described as "historically underserved" (Holte et al., 2012, p. 163). This lack of knowledge even concerns basic information such as gender differences in psychosocial problems, as outcomes about this particular group are rarely reported separately in DHH research.

Psychosocial adjustment includes emotional, social, and behavioral aspects. Development within these areas is associated with one's mental health, which is defined by WHO as "a state of well-being in which every individual realizes his or her own potential" (WHO, 2014). There is a substantial continuity in psychosocial difficulties from preschool years to middle childhood and adolescence (Luby, Gaffrey, Tillman, April, & Belden, 2014), thus emphasizing the importance of early intervention in this area. Even so, most research has been directed towards middle childhood and adolescence. It is therefore especially important to study preschoolers to provide a knowledge base to build early interventions upon. Specifically, there is a considerable lack of knowledge about (a) the prevalence of psychosocial problems and (b) its relation to degree of hearing loss, gender, and other potential risk and protective factors in HH preschool children. The overarching aim of this study is therefore to provide such information.

Degree of Hearing Loss

The majority of the DHH population has mild to moderate hearing loss. The share varies due to different samples and definitions, but numbers between 55% and 70% are reported (Caluraud et al., 2015; Russ et al., 2003; Wake, Poulakis, Hughes, Carey-Sargeant,

& Rickards, 2005). Although some aspects of deafness are applicable regardless of degree, for example, the inability to follow a conversation in noisy surroundings, there are important differences between milder and more profound hearing loss. HH children have to some degree access to language very early in life; in contrast, children with profound loss have no access to language until cochlear implantation or hearing aid fitting, unless their parents are familiar with sign language. On the other hand, HH children may be at risk for not receiving timely intervention. Firstly, they may be diagnosed later than deaf children, as the hearing loss is not as easily observable. Secondly, intervention can be delayed as parents may be less aware of the need for such if the hearing loss is mild or moderate (Walker et al., 2014). Thus, different degrees of hearing loss may affect psychosocial development through different mechanisms.

Psychosocial Problems in HH Children

Several studies have documented increased prevalence of psychosocial problems in DHH children. However, as demonstrated in a recent review (Stevenson, Kreppner, Pimperton, Worsfold, & Kennedy, 2015), very few studies include preschool children. Though language problems tend to be more severe in children with profound hearing loss than in HH children (Fitzpatrick, Crawford, Ni, & Durieux-Smith, 2011), the association between degree of hearing loss and psychosocial problems is less clear. Whereas one study reports little relationship between degree of hearing loss and prevalence of diagnosable mental health problems (Fellinger, Holzinger, Sattel, Laucht, & Goldberg, 2009), another study suggests that higher degree of hearing loss predicted psychosocial adjustment problems in elementary, secondary, and high school students (Polat, 2003). To complicate further, HH children may even suffer more than those with profound hearing loss; in a study by Wake, Hughes, Collins, and Poulakis (2004), parents of 7- to 8-year-old children with milder hearing loss reported lower health-related quality of life for their children, as compared to parents of children with more severe losses. Thus, there is no clear lesson to be learned from studies of DHH children regarding the psychosocial adjustment in HH children. Heterogeneity regarding age range and degree of hearing loss may explain some of the inconsistencies in previous research (Moeller, 2007). In the present study, we therefore included only HH children in a narrow age range.

Psychosocial Problems in Preschool Age

Studies demonstrate lower social competence and more behavior problems in deaf or cochlear implanted preschool children, compared to children with typical hearing (TH) (Barker et al., 2009; Hoffman, Quittner, & Cejas, 2015; Wiefferink, Rieffe, Ketelaar, & Frijns, 2012). Although older research suggests similar difficulties for HH children (Prior, Glazner, Sanson, & Debelle, 1988), newer research on infants and toddlers has been inconclusive. To illustrate, Stika et al. (2015) recently found that early identified HH children displayed social competence scores comparable to TH peers at the age of 12–18 months. In contrast, Topol, Girard, St. Pierre, Tucker, and Vohr (2011) found more symptoms of withdrawal and internalizing problems in children aged 18–24 months. Notably, the symptoms were more prevalent among children with mild or unilateral hearing loss compared to those with moderate to profound hearing loss, which the authors suggested could be related to lacking amplification in the mild/unilateral hearing loss group. However, a study on preschoolers with hearing loss ranging from mild to profound found social skills to be within the normal range, and

that degree of hearing loss did not predict outcomes (Leigh et al., 2015). In sum, it seems that although many HH children may have social skills comparable to TH children, other areas may still be problematic. There is a need for a closer description of the different areas of development that may be at risk.

Gender Differences

Several studies of the general population have documented gender differences in the prevalence and clinical manifestations of mental health problems (Luby et al., 2009; Tanidir et al., 2015; Zahn-Waxler, Shirtcliff, & Marceau, 2008). Girls and boys show differences in their social development from an early age; boys seem to have less impulse control and be more confronting and aggressive, both physically and verbally, especially during preschool years (Zahn-Waxler et al., 2008). Preschool girls, on the other hand, tend to be more cooperative and exhibit more prosocial behavior. As the presence of a hearing loss affects the child's interaction with their social environment, and this interaction differs between boys and girls, it is reasonable to ask if and how gender differences interact with the effects of the hearing loss.

Very few studies have investigated gender differences in psychosocial outcomes for DHH children. To our knowledge, no differences between genders have been documented in school-age children and adolescents (Hintermair, 2007; Van Eldik, 2005; Van Eldik, Treffers, Veerman, & Verhulst, 2004). As for preschool children, one study reports a slight gender difference in 3-year-old DHH children; girls performed better than boys on social and self-help skills, as reported by parents (Leigh et al., 2015).

Age at Detection

The importance of early detection and early intervention with regard to language development is well documented for children with severe and profound hearing loss, with special attention to children who receive a cochlear implant (Geers & Nicholas, 2013; Yoshinaga-Itano, 2003). However, the relationship between psychosocial development and early intervention is still unclear; Stevenson et al. (2011) did not find any relationship between behavior problems at age 5–12 years and age at detection, whereas Korver et al. (2010) found a relationship between early detection and several developmental outcomes, including social development and quality of life, in 3–5 year olds.

When a profound hearing loss is diagnosed, decisions need to be made regarding interventions like cochlear implantation, sign language programs, and auditory-verbal therapy. However, for HH children, intervention needs may not be as obvious. For example, parents and local service providers may doubt the diagnosis, as they observe that the baby responds to loud sounds. This could cause a delay of service provision, even when the hearing loss is detected early through universal newborn hearing screening (Holte et al., 2012; Walker et al., 2014).

Given the potential effect of early intervention for HH children, and the lack of knowledge concerning the extent and predictors of psychosocial problems on which to base such interventions, we collected data from children with hearing loss ranging from unilateral/mild to severe. The majority had mild or moderate hearing loss. We asked (a) whether HH 4-year olds are at greater risk for psychosocial problems and poor social competence compared to TH children, (b) whether gender differences in psychosocial adjustment and social competence are different in HH children compared to TH children, and (c) to what extent receptive vocabulary, age at detection, and degree of hearing loss predict psychosocial problems among HH preschool children.

Method

Participants

All audiology departments in Norway were asked to assist in the work of family recruitment. Of all 21 departments that serve children, 19 agreed to participate. Two special education providers were also recruiting participants. In all, 79 letters of invitation were distributed to families all over Norway, and 36 families accepted the invitation. Inclusion criteria were: age 4–5 years at the time of assessment, use of hearing aid in one or both ears, spoken Norwegian being one of the languages used by the child and at least one parent, no cochlear implantations, and no additional diagnoses. One child was excluded from the study due to insufficient spoken language.

Of the 35 HH children who were included, 7 reported genetic reasons and 2 reported birth complications as the cause of hearing loss. The majority did not know the cause of hearing loss. The families lived throughout Norway, 17 lived in rural areas and 18 in or near cities. Six children preferred sign supported Norwegian and the remaining preferred spoken Norwegian. Further details about participants are described in Table 1. We have no data on the families who did not reply.

The control (TH) group was drawn from an existing community sample, reported in Wichstrom et al. (2012). These children had previously been assessed with all the instruments used in this study. From the original sample of 1,250, 180 were drawn from the community sample to act as a control group. Because the original sample was screen stratified according to psychosocial problems, we drew comparatively more children from the strata with no or low psychosocial problems and fewer children high on psychosocial problems. The proportion drawn from each sample was factored by the inverse of the initial drawing probability when the larger community sample was created (see figure 1 in Wichstrom et al., 2012). Using a random number generator when drawing within each stratum, the effect was henceforth that our control group formed a representative sample of TH children. None of the 180 TH children had parent-reported hearing loss. There were no significant differences between the HH and TH group regarding age, gender, mothers' education, or prematurity. A larger proportion of HH children had a history of neonatal intensive care unit (NICU) stay (25.0% vs. 7.8%, Fisher's exact *p* = .022; see Table 1). None of the children had any additional disabilities as reported by parents.

Procedure

The families of the HH children were seen at home, in the child's daycare or in the facilities of a local service provider, by a clinical psychologist experienced in working with children with hearing loss. In 9 cases, both parents were present, only fathers in 2 cases, and only mothers in the remaining 24 cases. Parents filled out a questionnaire concerning the child's psychosocial functioning, social competence as well as on demographic and health information while the child's receptive vocabulary was assessed by the psychologist. Care was taken to minimize visual and auditory noise during the assessment. Signing was used to support communication with some of the children; however, the language assessment was conducted in spoken Norwegian only, without sign support. The TH children were examined at the University. The study was approved by the Regional Committee for Medical and Health Research Ethics.

Measures

The Strengths and Difficulties Questionnaire (SDQ; Goodman, Ford, Simmons, Gatward, & Meltzer, 2000) is a screening tool for psychosocial adjustment, including four subscales for difficulties (emotional problems, peer problems, conduct problems, and hyperactivity/inattention) and one subscale for strengths (prosocial behavior). The 25 items are rated 0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*. The scores of the four difficulties subscales are also added for a total difficulties score, with a range of 0–20. The SDQ also proves to be an excellent screening instrument for psychiatric disorders in preschoolers (Sveen, Berg-Nielsen, Lydersen, & Wichstrøm, 2013).

Internal consistency for the total problems scale, reported in Cronbach's α coefficients, range from .79 to .83 both in TH and DHH samples (Goodman, 2001; Hintermair, 2007). In this study, as can be seen in Table 2, internal consistency was fairly low for some subscales.

The Social Skills Rating System (SSRS; Gresham & Elliott, 1990) provides a parent-reported assessment of a range of social skills. The 39 items are examples of social behaviors, like ability to make friends or to follow household rules, and are rated by parents on a 4-point frequency scale (how often does the behavior occur) and a 3-point importance scale (how important is the behavior for the child's development). In addition to the total score, four subscales are available: Cooperation, assertion, responsibility, and prosocial behavior.

The Peabody Picture Vocabulary Test, 3rd version (PPVT-III; L. M. Dunn & D. M. Dunn, 1997) is a measure of the child's receptive vocabulary. The child is presented with four drawings and is requested to point to the drawing corresponding to the target word (e.g., pointing to the drawing of a bus, when the test administrator says "bus"). The whole test consists of 10 blocks with 12 items in each, and in the case of 8 wrong answers in one block, the testing is terminated.

Age at detection, measured in months, was obtained through parents' reports. Age at first hearing aid fitting was also reported

Table 1. Demographic profile of participants

	TH (*n* = 180)	HH (*n* = 35)
Age, mean (SD) months	55.0 (3.4)	56.7 (6.2)
Boys	55.0 (3.3)	58.5 (6.3)
Girls	55.0 (3.5)	55.1 (5.9)
Male gender, no (%)	94 (52.2)	16 (45.7)
Missing	3 (1.7)	
Gestation age	39.4 (2.9)	39.5 (2.7)
NICU stay, no (%)	14 (7.8)*	9 (25.7)*
Missing	39 (21.7)	
Maternal education >12 years, no (%)	104 (75.9)	28 (80.0)
Missing	43 (23.9)	
Degree of hearing loss, no (%)		
Unilateral[a]		4 (11.4)
Mild (26–40 dB)		10 (28.6)
Moderate (41–55 dB)		15 (42.9)
Moderately severe (56–70 dB)		4 (11.4)
Severe (71–90 dB)		2 (5.6)
Age at detection, months (SD)		15.8 (15.8)
Age at amplification, months (SD)		22.8 (17.4)

Note. HH = hard of hearing; NICU = neonatal intensive care unit; TH = typical hearing.

[a]Degree of unilateral hearing loss ranged from mild to profound.

*p < .05.

Table 2. Psychometric properties, means, and intergroup differences

Variable	Range	α	TH	HH	t	p	P_{bh}	95% CI	g
Strengths and difficulties									
Emotion	0–10	.67	1.42 (1.59)	2.31 (2.11)	2.76	.006	.014	0.09, 0.54	0.53
Hyperactivity	0–10	.79	2.46 (2.00)	4.26 (2.53)	4.03	.000	.000	0.24, 0.68	0.86
Conduct	0–10	.44	1.03 (1.07)	1.49 (1.34)	1.96	.051	.077	−0.00, .038	0.41
Peer	0–10	.55	0.82 (1.28)	1.52 (1.65)	2.86	.005	.014	0.10, 0.51	0.52
Prosocial	0–10	.56	8.38 (1.43)	8.14 (1.67)	−0.99	.323	.352	−0.09, 0.03	0.16
Total problems	0–40	.80	5.72 (4.06)	9.58 (5.97)	3.90	.000	.000	0.23, 0.70	0.87
Social skills									
Cooperation	0–22.5	.70	11.32 (2.27)	11.20 (3.15)	0.25	.804	.804	−1.07, 0.83	0.05
Assertion	0–22.5	.75	13.59 (2.67)	12.73 (3.31)	−1.59	.113	.151	−1.93, 0.21	0.30
Responsibility	0–22.5	.67	11.00 (2.59)	9.42 (3.19)	−3.01	.003	.012	−2.61, −0.54	0.58
Self-control	0–22.5	.83	13.57 (2.96)	12.94 (3.05)	−1.10	.272	.326	−1.76, 0.50	0.21
Total score	0–90	.82	49.58 (8.40)	46.15 (10.51)	−1.99	.048	.077	−6.84, 0.28	0.38
Vocabulary	0–120	.92	63.59 (19.85)	54.09 (22.32)	−2.45	.016	.032	−17.18, −1.83	0.47

Note. SDs are in parentheses. CI = confidence interval; HH = hard of hearing; TH = typical hearing. g = Hedge's g; P_{bh} = p values corrected for multiple comparisons, by false discovery rate.

and included in preliminary analyses; however, as age at detection and age at first hearing aid fitting are interdependent and indeed were highly correlated, $r = .88$, $p < .01$, only age at detection is reported here.

Degree of hearing loss was reported by parents for each ear separately, using the categories normal (<25 dB), mild (26–40 dB), moderate (41–55 dB), moderately severe (56–70 dB), severe (71–90 dB), and profound (>90 dB). In some cases where the parents were not sure of their child's degree of hearing loss, they contacted the audiology department for clarification. Hearing loss in best ear was used in the analyses.

A measure of risk factors was constructed as a sum of three variables; Whether or not the child had been admitted to a NICU, whether or not the child had been premature (born in gestation week 36 or earlier), and whether the mother had 12 years or less of education. This resulted in a scale ranging from 0 to 3.

Statistical Analyses

All statistical analyses were performed using the computer software IBM SPSS Statistics, version 21. The data set was examined for normality, outliers, and influential cases. By indication of skewness and kurtosis, data were transformed into natural logarithms for the SDQ scores as well as age at detection. However, for presentation purposes, means and *SD* are reported from nontransformed data.

Differences in psychosocial outcomes between the HH and TH group, as well as gender differences within each group, were tested using independent samples t tests. In order to compensate for multiple comparisons, we corrected p values with false discovery rate as described by Benjamini and Hochberg (1995; 2000). Due to the small sample size, Hedge's g was used to estimate effect size, which was used along with t tests for interpretation. To analyze multivariate associations with SDQ total problems score, a multiple regression analysis was conducted, including group, gender, vocabulary, social skills, and risk factors as covariates. To test whether any gender differences between the HH and TH groups were significantly stronger in one of the groups, a series of linear regressions were conducted for all subscales of SDQ and SSRS, including age, group, gender, and the group*gender product as independent variables. To address the question of potential predictors of psychosocial development in HH children, a hierarchical regression analysis was performed

on the HH group with SDQ total problems score as the dependent variable. Based on previous research, we included age at detection, degree of hearing loss, vocabulary, and risk factors as independent variables. We also included gender, based on the findings in the present study. As the number of predictors was rather large for the small sample size, adjusted R^2 was used in the interpretation of the results, as recommended by Austin and Steyerberg (2015).

Results

Prevalence of Psychosocial Problems

Table 2 presents means, intergroup differences, and psychometric properties for the TH and HH groups. Corrected p values are marked P_{bh}. As portrayed in the Table 2, independent samples t tests and Hedge's g estimates revealed that HH children evidenced more emotional, hyperactivity, and peer problems than TH children. The difference in hyperactivity was most pronounced—HH children scoring about 1 *SD* above TH children. The higher problem scores among HH children were also reflected in a higher total score on the SDQ. In a multiple linear regression analysis controlling for gender, vocabulary, social skills, and risk factors, the presence of hearing loss still remained a significant predictor of psychosocial problems, $B = .35$, $\beta = .23$, $p = .002$, 95% confidence interval (CI): 0.13, 0.57. As for social skills subscales, the responsibility scale was the only one reaching significance. The receptive vocabulary score of HH children was about half a *SD* below that of TH children.

Gender Differences

As presented in Table 3, there were no gender differences for any of the measures in the TH group. For the HH group, the difference between boys and girls was significant for SDQ hyperactivity and total problems. Regression analyses controlling for age revealed a significant interaction effect between group and gender regarding SDQ total problems score, $B = .61$, $\beta = .26$, $p = .012$, 95% CI: 0.14–1.08, as well as the hyperactivity subscale, $B = .58$, $\beta = .26$, $p = .014$, 95% CI: 0.12–1.05, confirming that the gender difference was significantly stronger in the HH group than in the TH group. The gender difference in the HH group remained significant when controlling for confounding factors, as presented in Table 4.

Table 3. Gender differences in psychosocial problems, social skills, and language

	TH					HH				
Variable	Boys	Girls	p	P_{bh}	g	Boys	Girls	p	P_{bh}	g
Strengths and difficulties										
Emotion	1.54 (1.72)	1.27 (1.41)	.375	.996	0.17	3.00 (2.61)	1.74 (1.41)	.175	.334	0.60
Hyperactivity	2.52 (2.19)	2.35 (1.78)	.996	.996	0.08	5.56 (2.00)	3.16 (2.43)	.002	.024	1.04
Conduct	1.14 (1.12)	0.89 (0.99)	.095	.996	0.23	1.88 (1.36)	1.16 (1.26)	.079	.237	0.54
Peer	0.69 (1.09)	0.88 (1.37)	.322	.996	0.15	1.88 (1.71)	1.22 (1.58)	.195	.334	0.39
Prosocial	8.26 (1.42)	8.53 (1.42)	.230	.996	0.19	8.19 (1.87)	8.11 (1.52)	.981	.981	0.05
Total problems	5.89 (4.45)	5.39 (3.37)	.843	.996	0.13	12.31 (5.79)	7.28 (5.22)	.006	.036	0.90
Social skills										
Cooperation	11.25 (2.10)	11.38 (2.43)	.764	.996	0.06	11.08 (3.28)	11.31 (3.12)	.837	.913	0.07
Assertion	13.67 (2.78)	13.51 (2.58)	.743	.996	0.06	13.45 (3.90)	12.13 (2.68)	.242	.363	0.39
Responsibility	11.08 (2.50)	10.92 (2.69)	.728	.996	0.06	10.22 (3.21)	8.74 (3.09)	.176	.334	0.46
Self-control	13.54 (2.98)	13.60 (2.97)	.910	.996	0.02	12.48 (3.46)	13.33 (2.70)	.423	.564	0.27
Total score	49.54 (8.33)	49.62 (8.53)	.960	.996	0.01	47.22 (11.48)	45.18 (9.80)	.579	.695	0.19
Vocabulary	64.33 (18.90)	62.88 (20.84)	.679	.996	.07	61.88 (16.15)	47.53 (24.99)	.057	.228	0.66

Note. SDs are in parentheses. HH = hard of hearing; TH = typical hearing. g = Hedge's g; P_{bh} = p values corrected for multiple comparisons, by false discovery rate.

Table 4. Hierarchical linear regression analyses predicting SDQ total problems scores in hard of hearing children ($n = 35$)

	Step 1		Step 2		Step 3		
Variable	β	p	β	p	β	p	95% CI
Age at detection	.59	.001	.49	.003	.49	.003	0.07, 0.32
Degree of HL	.07	.671	−.01	.923	−.02	.889	−0.18, 0.21
Gender			−.43	.008	−.44	.008	−0.97, −0.16
Vocabulary			−.26	.079	−.26	.084	−0.02, 0.00
Risk factors					−.09	.528	−0.33, 0.17
R^2		.33		.50		.51	
ΔR^2		.33		.17		.01	
Adjusted R^2		.28		.42		.41	
ΔF		7.05		4.56		0.41	
$p\Delta F$		.003		.020		.528	

Note. CI = confidence interval; HL = hearing loss; SDQ = Strengths and Difficulties Questionnaire. Risk factors = prematurity, intensive care unit stay, low maternal education.

Predictors of Psychosocial Problems

To detect possible predictors of psychosocial problems among HH children, a hierarchical regression analysis was conducted in the HH group with the SDQ total problems score as the dependent variable. As can be seen in Table 4, Step 2 in the regression including four variables revealed that young age at detection and female gender predicted better outcomes, whereas degree of hearing loss and vocabulary did not. Including risk factors in Step 3 did not change the model significantly. Adjusted R^2 in Step 2 and 3 indicate rather large effect sizes (Cohen, 1992).

Discussion

Due to the lack of research on which to base early interventions among HH children with hearing aids, we raised three issues when comparing the psychosocial functioning of HH preschoolers with hearing aids to that of TH peers.

Are HH Preschool Children at Risk for Psychosocial Difficulties?

The HH preschoolers in our study evidenced considerably more psychosocial problems than TH children—a difference that remained significant even after controlling for a range of covariates. Such a difference is in line with the robust finding from adolescent and adult populations that hearing loss of any degree is associated with more psychosocial and mental health problems (Fellinger, Holzinger, & Pollard, 2012; Hintermair, 2007). Our study adds two important findings: Firstly, psychosocial difficulties seem to appear as early as in preschool age, which has important implications for early intervention planning. Secondly, the finding that psychosocial problems are apparent even after controlling for receptive vocabulary suggests that although language plays an important role in psychosocial functioning (Stevenson, McCann, Watkin, Worsfold, & Kennedy, 2010), additional mechanisms significantly affect development in HH children. This finding is supported by Netten et al. (2015) who found communication abilities, but not vocabulary or syntax skills, to be related to psychosocial functioning in preschool children with hearing loss. Thus, psychosocial development should be addressed also in the children who perform well on traditional language measures.

Compared to SDQ scores, the difference between HH and TH children was less pronounced for social skills. Our findings contrast those of Hoffman et al. (2015), who found a difference in social competence between preschool children with and without hearing loss. However, whereas their sample consisted of children with profound hearing loss, our study includes mild to severe degrees of hearing loss, with the majority in the mild/

moderate categories. Similar to our study, Antia, Jones, Luckner, Kreimeyer, and Reed (2011) included school-age children with all degrees of hearing loss and found social skills in DHH children to be comparable to those of TH children. However, importantly, the authors note that even with adequate social skills, one may lack close relationships; thus, skills and well-being must be considered separately, as demonstrated in our study by the discrepant findings in psychosocial functioning and social skills.

Is There a Gender Difference?

Parents of HH boys report significantly more problems compared to HH girls. Although in contrast to the majority of previous research (Dammeyer, 2010; Polat, 2003; Van Eldik, 2005), our finding seems robust, as it remains even after controlling for a variety of possibly confounding factors. Moreover, the HH group differed significantly from the TH group, which did not exhibit the same gender pattern. One main difference between previous studies and the present is that our study concerns younger children. Possibly, gender differences may be more pronounced in early childhood. From our study, it is not possible to pinpoint the exact mechanisms behind these early gender differences, but some hypotheses may be proposed. Boys in the HH group were on average 3 months older than girls and could exhibit more problems than girls because of an older age. However, this possible explanation was not borne out because when age was entered into the regression analysis, the results remained the same.

Rutter, Caspi, and Moffitt (2003) suggested that boys are more vulnerable to early-onset diagnoses, like attention-deficit/hyperactivity disorder and conduct disorder, whereas girls are more vulnerable to disorders that normally appear later, such as anxiety and mood disorders. Possibly, the effect of hearing loss is more evident in boys early on because it manifests in disorders with an early debut, whereas the effect of hearing loss become evident among girls at a later stage in development, that is, the preadolescent and adolescent years, when the prevalence of anxiety and depression increases. Hence, such a gender difference in the effect of hearing loss might weaken or vanish at later stages.

Another possibility, following the logic of transactional theories of development (Sameroff, 2009), is that the social surroundings react to boys and girls differently, meaning that boys and girls may experience different social environments even when being in the same family or same day care facility. For example, although boys and girls may not differ in the prevalence of shyness, boys seem to be met with more negative reactions when acting shyly than girls do (Doey, Coplan, & Kingsbury, 2014). Thus, boys could be met with less understanding for their hearing-related difficulties as compared with girls, whose withdrawal behavior may be more accepted, resulting in a more emotionally supportive environment.

In the same vein, boys and girls may receive different amounts of support from service providers (Walker et al., 2014). Preschoolers with behavioral disorders more often receive professional help than preschoolers with emotional disorders (Wichstrom, Belsky, Jozefiak, Sourander, & Berg-Nielsen, 2014). Behavioral problems are the typical problems among HH boys. Moreover, boys are more prone to receive help than girls over and above their more often occurring behavioral problems. However, for DHH children, language development is a main concern, and interventions are most often targeted towards minimizing language delay. Hence, psychosocial difficulties in preschool children are likely to be attributed to language difficulties. If psychosocial difficulties prompt language interventions, this could

explain why boys in our study exhibit psychosocial problems but perform fairly well regarding receptive vocabulary.

Predictors of Psychosocial Problems in the HH Group

In the HH group, age at detection was a significant predictor of psychosocial outcomes; earlier diagnosis of hearing loss predicted fewer psychosocial problems. It is well appreciated that early detection—leading to early intervention—is a major predictor of language outcomes (Ching et al., 2013). The same relationship seems to apply to psychosocial development, regardless of degree of hearing loss. Our findings support the findings of Korver et al. (2010) who found that early detection had a positive effect on a range of developmental outcomes for all degrees of hearing loss but stand in contrast to Stevenson et al. (2011) who reported an effect of early detection on language development, but not on the degree of behavior problems. However, the latter study did not address differences concerning the very first months of life, as early detection was defined to be before the age of 9 months. In sum, it is possible that hearing loss detection in the first months of life has an impact on psychosocial development.

Regarding children with profound hearing loss, it is easy to see the importance of early detection both for language and psychosocial development. Strongly reduced access to sound is likely to affect parent–child interaction unless parents are familiar with sign language. However, for HH children, the advantage of early detection is not as obvious.

Babies spend a lot of their time awake close to their caregivers, and usually in quiet surroundings; these are good listening conditions, thus reducing the adverse effect of the hearing loss. Moreover, parent–child interaction includes to a large degree visual and physical elements like movement, gaze, and facial expression, as well as easily audible sound patterns. Under such conditions, one could assume that the early parent–child interaction would not be much different if the child has a mild or moderate hearing loss compared to TH, and that early detection would not be as crucial for these as for children with profound hearing loss; however, our findings suggest the contrary. Possibly, there are confounding factors accounting for this effect, not yet investigated. For example, subtle auditory cues such as sighing and mumbling hold information about emotional states but may be inaccessible for HH children. This could lead to a different reaction pattern, which again could affect the parent–child interaction despite the child's access to clearer sounds such as speech. Alternatively, the auditory environment is not as favorable for babies as one could assume. In addition, the effect of early detection could also be the effect of the family meeting a professional and receiving guidance in parent–child communication, meaning that the effect could also have been seen in TH children if they had received the same kind of support. Further research is warranted in this field.

In the HH group, degree of hearing loss did not predict psychosocial outcomes. The findings fit well with previous research on older children and adolescents, pointing to the same degree of difficulties regardless of degree of hearing loss (Dammeyer, 2010; Fellinger et al., 2008). In other words, even a mild to severe hearing loss is a risk factor for psychosocial difficulties and adverse mental health, and our findings suggest that this risk is considerable even in preschool age.

The relationship between receptive vocabulary and psychosocial outcomes was not significant in our study. This contrasts for example the findings reported by Stevenson et al. (2010), who report that language ability predicts behavioral problems. However, a related study reports that early age at detection predicted better

language ability, but not better psychosocial outcomes (Stevenson et al., 2011); despite the association between language and behavior, language is not sufficient to remove the risk of psychosocial difficulties. Our study seems to fit well with this conclusion.

Even though comparable in severity, psychosocial difficulties in HH children may be qualitatively different from what is reported for children with profound hearing loss. Whereas profound hearing loss causes an obvious disadvantage of accessing less auditory information, HH children may experience other difficulties, in terms of service access (Holte et al., 2012), or expectations from their surroundings. If their language progresses satisfactorily, their psychosocial needs could be underestimated. Parents and teachers may expect similar behavior as from hearing peers, whereas deaf children more readily are compared with other deaf children. HH individuals risk falling between the deaf community and the hearing community, thus being in a marginalized position (Fellinger et al., 2008).

Limitations

This study has several limitations. The group of HH children (N = 35) was relatively small, and we may have been unable to detect some differences between HH and TH children. The regression analysis presented in Table 4 includes a large number of predictors, considering the small sample size, causing a risk of overfitting of the model. However, in linear regression as opposed to logistic regression, very few subjects per variable are necessary to achieve accurate estimation of regression coefficients, and with minimal bias in adjusted R^2 (Austin and Steyerberg, 2015). Thus, we are confident that our results are reliable, even though a larger sample would provide more detailed information on intragroup differences.

We do not have any knowledge of the families who did not reply to the invitation, thus we do not know the representability of the sample. We did not obtain data on the amount or type of follow-up the families received, and further research is needed to explore if there are any differences in interventions in relation to gender and degree of hearing loss.

Another limitation is the fact that information regarding level of hearing loss was derived from the parents instead of the child's medical records. However, the fact that our findings coincide with other studies that indeed derived the degree of hearing loss from medical files suggests that the parents were relatively good in providing this kind of information about their child.

Internal consistency for the SDQ subscales are fairly low, conduct problems subscale as low as α = .44. The levels are quite similar to the levels reported by Hintermair (2007) in his discussion of psychometric properties of SDQ in a DHH sample; he presents levels of Cronbach's α for the conduct problems subscale ranging from .46 to .65. Likewise, in TH populations, internal consistency levels for conduct and peer problems subscales are reported to be lower than for the other subscales (.57 and .63; Goodman, 2001). Nevertheless, the findings related to the subscales of the SDQ must be interpreted with this fact in mind; there is a possibility of HH children having more behavioral problems than TH children which we were not able to detect due to a combination of moderate statistical power and low reliability.

Conclusion

Our results show that preschool HH children are at risk for psychosocial problems. This must be taken into consideration in early intervention planning. Boys and girls may react to risk factors in different ways; HH boys seem to have higher psychosocial

difficulties, whereas HH girls show a slight tendency towards having more severe language delays at the age of 4.

Early detection of the hearing loss predicts better psychosocial outcomes, whereas degree of hearing loss does not affect outcomes. Screening and early intervention services must therefore be aware of the importance of early intervention even for milder hearing losses, and the importance of taking psychosocial development into account alongside with intervention targeted towards language development.

Conflicts of Interest

No conflicts of interest were reported.

References

Antia, S. D., Jones, P., Luckner, J., Kreimeyer, K. H., & Reed, S. (2011). Social outcomes of students who are deaf and hard of hearing in general education classrooms. *Exceptional Children*, 77, 489. doi:10.1177/001440291107700407

Austin, P. C., & Steyerberg, E. W. (2015). The number of subjects per variable required in linear regression analyses. *Journal of Clinical Epidemiology, 68*, 627–636. doi:10.1016/j.jclinepi.2014.12.014

Barker, D. H., Quittner, A. L., Fink, N. E., Eisenberg, L. S., Tobey, E. A., Niparko, J. K., & Team, C. D. I. (2009). Predicting behavior problems in deaf and hearing children: The influences of language, attention, and parent-child communication. *Development and Psychopathology*, 21, 373–392. doi:10.1017/S0954579409000212

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate – a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society Series B (Methodological)*, 57, 289–300. doi:10.2307/2346101

Benjamini, Y., & Hochberg, Y. (2000). On the adaptive control of the false discovery fate in multiple testing with independent statistics. *Journal of Educational and Behavioral Statistics*, 25, 60–83. doi:10.2307/1165312

Caluraud, S., Marcolla-Bouchetemblé, A., de Barros, A., Moreau-Lenoir, F., de Sevin, E., Rerolle, S., … Lerosey, Y. (2015). Newborn hearing screening: Analysis and outcomes after 100,000 births in Upper-Normandy French region. *International Journal of Pediatric Otorhinolaryngology*, 79, 829–833. doi:10.1016/j.ijporl.2015.03.012

Ching, T. Y., Dillon, H., Marnane, V., Hou, S., Day, J., Seeto, M., … Yeh, A. (2013). Outcomes of early- and late-identified children at 3 years of age: Findings from a prospective population-based study. *Ear and Hearing*, 34, 535–552. doi:10.1097/AUD.0b013e3182857718

Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155–159. doi:10.1037/0033-2909.112.1.155

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, 50–58. doi:10.1093/deafed/enp024

Doey, L., Coplan, R. J., & Kingsbury, M. (2014). Bashful boys and coy girls: A review of gender differences in childhood shyness. *Sex Roles*, 70, 255–266. doi:10.1007/s11199-013-0317-9

Dunn, L. M., & Dunn, D. M. (1997). *Peabody picture vocabulary test – third edition*. Circle Pines, MN: American Guidance Service.

Fellinger, J., Holzinger, D., & Pollard, R. (2012). Mental health of deaf people. *The Lancet*, 379, 1037–1044. doi:10.1016/S0140-6736(11)61143-4

Fellinger, J., Holzinger, D., Sattel, H., & Laucht, M. (2008). Mental health and quality of life in deaf pupils. *European Child & Adolescent Psychiatry*, 17, 414–423. doi:10.1007/s00787-008-0683-y

Fellinger, J., Holzinger, D., Sattel, H., Laucht, M., & Goldberg, D. (2009). Correlates of mental health disorders among children with hearing impairments. *Developmental Medicine and Child Neurology*, 51, 635–641. doi:10.1111/j.1469-8749.2008.03218.x

Fitzpatrick, E. M., Crawford, L., Ni, A., & Durieux-Smith, A. (2011). A descriptive analysis of language and speech skills in 4- to 5-yr-old children with hearing loss. *Ear and Hearing*, 32, 605–616. doi:10.1097/AUD.0b013e31821348ae

Geers, A. E., & Nicholas, J. G. (2013). Enduring advantages of early cochlear implantation for spoken language development. *Journal of Speech, Language, and Hearing Research: JSLHR*, 56, 643–655. doi:10.1044/1092-4388(2012/11-0347)

Goodman, R. (2001). Psychometric properties of the Strengths and Difficulties Questionnaire. *Journal of the American Academy of Child and Adolescent Psychiatry*, 40, 1337–1345. doi:10.1097/00004583-200111000-00015

Goodman, R., Ford, T., Simmons, H., Gatward, R., & Meltzer, H. (2000). Using the Strengths and Difficulties Questionnaire (SDQ) to screen for child psychiatric disorders in a community sample. *The British Journal of Psychiatry*, 177, 534–539. doi:10.1192/bjp.177.6.534

Gresham, F. M., & Elliott, S. N. (1990). *Social Skills Rating System*. Circle Pines, MN: American Guidance Service.

Hintermair, M. (2007). Prevalence of socioemotional problems in deaf and hard of hearing children in Germany. *American Annals of the Deaf*, 152, 320–330. doi:10.1353/aad.2007.0028

Hoffman, M. F., Quittner, A. L., & 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, 115–124. doi:10.1093/deafed/enu040

Hogan, A., Shipley, M., Strazdins, L., Purcell, A., & Baker, E. (2011). Communication and behavioural disorders among children with hearing loss increases risk of mental health disorders. *Australian and New Zealand Journal of Public Health*, 35, 377–383. doi:10.1111/j.1753-6405.2011.00744.x

Holte, L., Walker, E., Oleson, J., Spratford, M., Moeller, M. P., Roush, P., … Tomblin, J. B. (2012). Factors influencing follow-up to newborn hearing screening for infants who are hard of hearing. *American Journal of Audiology*, 21, 163–174. doi:10.1044/1059-0889(2012/12-0016)

Korver, A. M. H., Konings, S., Dekker, F. W., Beers, M., Wever, C. C., Frijns, J. H. M., … Grp, D. C. S. (2010). Newborn hearing screening vs later hearing screening and developmental outcomes in children with permanent childhood hearing impairment. *Journal of the American Medical Association*, 304, 1701–1708. doi:10.1001/jama.2010.1501

Leigh, G., Ching, T. Y., Crowe, K., Cupples, L., Marnane, V., & Seeto, M. (2015). Factors affecting psychosocial and motor development in 3-year-old children who are deaf or hard of hearing. *Journal of Deaf Studies and Deaf Education*, 20, 331–342. doi:10.1093/deafed/env028

Luby, J. L., Essex, M. J., Armstrong, J. M., Klein, M. H., Zahn-Waxler, C., Sullivan, J. P., & Goldsmith, H. H. (2009). Gender differences in emotional reactivity of depressed and at-risk preschoolers: Implications for gender specific manifestations of preschool depression. *Journal of Clinical Child and Adolescent Psychology*, 38, 525–537. doi:10.1080/15374410902976312

Luby, J. L., Gaffrey, M. S., Tillman, R., April, L. M., & Belden, A. C. (2014). Trajectories of preschool disorders to full DSM depression at school age and early adolescence: Continuity of preschool depression. *The American Journal of Psychiatry*, 171, 768–776. doi:10.1176/appi.ajp.2014.13091198

Moeller, M. P. (2007). Current state of knowledge: Psychosocial development in children with hearing impairment. *Ear and Hearing*, 28, 729–739. doi:10.1097/aud.0b013e318157f033

Netten, A. P., Rieffe, C., Theunissen, S. C., Soede, W., Dirks, E., Korver, A. M. H., … Group, D. C. S. (2015). Early identification: Language skills and social functioning in deaf and hard of hearing preschool children. *International Journal of Pediatric Otorhinolaryngology*, 79, 2221–6. doi:10.1016/j.ijporl.2015.10.008

Polat, F. (2003). Factors affecting psychosocial adjustment of deaf students. *Journal of Deaf Studies and Deaf Education*, 8, 325–339. doi:10.1093/deafed/eng018

Prior, M. R., Glazner, J., Sanson, A., & Debelle, G. (1988). Temperament and behavioral adjustment in hearing-impaired children. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 29, 209–216. doi:10.1111/j.1469-7610.1988.tb00705.x

Russ, S. A., Poulakis, Z., Barker, A., Wake, M., Rickards, F., Saunders, K., & Oberklaid, F. (2003). Epidemiology of congenital hearing loss in Victoria, Australia. *International Journal of Audiology*, 42, 385–390. doi:10.3109/14992020309080047

Rutter, M., Caspi, A., & Moffitt, T. E. (2003). Using sex differences in psychopathology to study causal mechanisms: Unifying issues and research strategies. *Journal of Child Psychology and Psychiatry*, 44, 1092–1115. doi:10.1111/1469-7610.00194

Sameroff, A. (2009). The transactional model. In A. Sameroff (Ed.), *The transactional model of development: How children and contexts shape each other* (1 Ed., pp. 3–21). Washington, DC: American Psychological Association.

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, 477–496. doi:10.1007/s00787-015-0697-1

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, 77–83. doi:10.1111/j.1469-7610.2009.02124.x

Stevenson, J., McCann, D. C., Law, C. M., Mullee, M., Petrou, S., Worsfold, S., … Kennedy, C. R. (2011). The effect of early confirmation of hearing loss on the behaviour in middle childhood of children with bilateral hearing impairment. *Developmental Medicine and Child Neurology*, 53, 269–274. doi:10.1111/j.1469-8749.2010.03839.x

Stika, C. J., Eisenberg, L. S., Johnson, K. C., Henning, S. C., Colson, B. G., Ganguly, D. H., & DesJardin, J. L. (2015). Developmental outcomes of early-identified children who are hard of hearing at 12 to 18 months of age. *Early Human Development*, 91, 47–55. doi:10.1016/j.earlhumdev.2014.11.005

Sveen, T. H., Berg-Nielsen, T. S., Lydersen, S., & Wichstrøm, L. (2013). Detecting psychiatric disorders in preschoolers: Screening with the Strengths and Difficulties Questionnaire. *Journal of the American Academy of Child and Adolescent Psychiatry*, 52, 728–736. doi:10.1016/j.jaac.2013.04.010

Tanidir, C., Adaletli, H., Gunes, H., Kilicoglu, A. G., Mutlu, C., Bahali, M. K., … Uneri, O. S. (2015). Impact of gender, age at onset, and lifetime tic disorders on the clinical presentation and comorbidity pattern of obsessive-compulsive disorder in children and adolescents. *Journal of Child and Adolescent Psychopharmacology*, 25, 425–431. doi:10.1089/cap.2014.0120

Topol, D., Girard, N., St. Pierre, L., Tucker, R., & Vohr, B. (2011). The effects of maternal stress and child language ability on behavioral outcomes of children with congenital hearing loss at 18-24 months. *Early Human Development*, 87, 807–811. doi:10.1016/j.earlhumdev.2011.06.006

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, 11–16. doi:10.1353/aad.2005.0024

Van Eldik, T., Treffers, P. D. A., Veerman, J. W., & Verhulst, F. C. (2004). Mental health problems of deaf Dutch children as indicated by parents' responses to the child behavior check-list. *American Annals of the Deaf*, 148, 390–395. doi:10.1353/aad.2004.0002

Wake, M., Hughes, E. K., Collins, C. M., & Poulakis, Z. (2004). Parent-reported health-related quality of life in children with congenital hearing loss: A population study. *Ambulatory Pediatrics*, 4, 411–417. doi:10.1367/a03-191r.1

Wake, M., Poulakis, Z., Hughes, E. K., Carey-Sargeant, C., & Rickards, F. W. (2005). Hearing impairment: A population study of age at diagnosis, severity, and language outcomes at 7-8 years. *Archives of Disease in Childhood*, 90, 238–244. doi:10.1136/adc.2003.039354

Walker, E. A., Holte, L., Spratford, M., Oleson, J., Welhaven, A., & Harrison, M. (2014). Timeliness of service delivery for children with later-identified mild-to-severe hearing loss. *American Journal of Audiology*, 23, 116–128. doi:10.1044/1059-0889(2013/13-0031)

WHO. (2014, August). Mental health: A state of well-being. Retrieved January 23, 2016, from http://www.who.int/features/factfiles/mental_health/en/

Wichstrom, L., Belsky, J., Jozefiak, T., Sourander, A., & Berg-Nielsen, T. S. (2014). Predicting service use for mental health problems among young children. *Pediatrics*, 133, 1054–1060. doi:10.1542/peds.2013-3184

Wichstrom, L., Berg-Nielsen, T. S., Angold, A., Egger, H. L., Solheim, E., & Sveen, T. H. (2012). Prevalence of psychiatric disorders in preschoolers. *Journal of Child Psychology and Psychiatry*, 53, 695–705. doi:10.1111/j.1469-7610.2011.02514.x

Wiefferink, C. H., Rieffe, C., Ketelaar, L., & Frijns, J. H. (2012). Predicting social functioning in children with a cochlear implant and in normal-hearing children: The role of emotion regulation. *International Journal of Pediatric Otorhinolaryngology*, 76, 883–889. doi:10.1016/j.ijporl.2012.02.065

Yoshinaga-Itano, C. (2003). From screening to early identification and intervention: Discovering predictors to successful outcomes for children with significant hearing loss. *Journal of Deaf Studies and Deaf Education*, 8, 11–30. doi:10.1093/deafed/8.1.11

Zahn-Waxler, C., Shirtcliff, E. A., & Marceau, K. (2008). Disorders of childhood and adolescence: Gender and psychopathology. *Annual Review of Clinical Psychology*, 4, 275–303. doi:10.1146/annurev.clinpsy.3.022806.091358