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Depression in hearing-impaired children

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ABSTRACT

Objective: The purpose of this study was to examine the levels of depressive symptoms and the unique contribution of two aspects of emotion regulation (coping and mood states) to the development of depression in hearing-impaired children and a control group.

Methods: In order to compare the groups, self-report questionnaires concerning symptoms of depression, coping strategies, and mood states were used. The study group consisted of 27 children with cochlear implants, 56 children with conventional hearing aids, and 117 normally hearing children.

Results: Hearing-impaired children reliably reported more symptoms of depression than their normally hearing peers. Degree of hearing loss, socioeconomic status, gender, and age were unrelated to the level of depressive symptoms. But attending mainstream schools or using exclusively speech for communication were related to fewer depressive symptoms. The associations with depressive symptoms differed between the groups. For hearing-impaired children, the cognitive aspects (coping) and the affective aspects (mood states) of emotional functioning contributed separately to the prediction of depressive symptoms. For normally hearing children an integration of cognitive and affective aspects was detected: adequate coping skills prevented the development of negative mood states and in turn depressive symptoms.

Conclusions: Hearing-impaired children reported more depressive symptoms than normally hearing children. Prevention and treatment of depression in hearing-impaired children could focus on the use of coping strategies adequately, because these strategies have a direct relation with the level of depression.

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1. Introduction

Most research on hearing impairment in children focuses on speech and language development, because these children are hearing-impaired (HI) or deaf in a sound-dominated world. However, HI children are exceedingly vulnerable to poor psychosocial development. For many of them, communication problems make social and emotional learning rather difficult [1,2]. This might be one of the factors underlying the fact that HI children have more depressive symptoms than normally hearing (NH) children [3–5]. In NH children, problems in the domain of emotion regulation are frequently identified as contributors to the development of depressive symptoms, but a comprehensive understanding of factors influencing depressive symptoms in HI children has so far been lacking. In this study we examined the

extent to which the antecedents of depression that are common in NH children also apply to HI children.

1.1. Pediatric depression and hearing loss

According to the DSM-IV criteria, depressive disorders are mental illnesses characterized by a profound and persistent feeling of sadness or despair and anhedonia. Although the risk of major depressive disorder in childhood is relatively small, it substantially increases with adolescence [6]. Estimates of the point prevalence of depression range from 0.4% to 2.5% for children, and from 0.4% to 8.3% for adolescents [7], yet note that pediatric depression is often underdiagnosed and subsequently undertreated in children [8,9]. The few studies that investigated the level of depression in HI children show coherent results: HI children show higher prevalences of depression than NH children when reported by parents or caregivers [3,4] or by the children themselves [5]. In contrast, the one study that specifically examined the influence of cochlear implants on symptoms of depression found no differences between children with a CI and a NH control group [10].

Abbreviations: HI, hearing-impaired; NH, normally hearing; CI, cochlear implant.

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1.2. Pediatric depression and emotion regulation

The current literature identifies problems in adaptive emotion regulation, or more specifically coping, as one of the key factors in the development of depression [11,12]. 'Coping' refers to controlling and possibly reducing the impact of a negative emotion-evoking event. Even in infancy, children show the capacity to decrease the impact or intensity of their emotions. At first children tend to avoid the stressful stimulus. Somewhat later in life they can distract themselves in case of distressing stimuli. Thus when children grow older, their coping strategies become more sophisticated [13]. A next step in development involves confronting the negative event. Instead of seeking distraction, children make progressively more efforts to manage and resolve problems [13,14]. A frequent use of these kinds of approaching strategies is related to less depression. On the other hand, when older children keep using avoidant coping strategies they are more susceptible to various mental health problems.

However, it could be argued that the frequently found association between coping strategies and depression is not necessarily a direct one, but is mediated by children's dysregulated affective states. It is well-known that a lack of adaptive coping strategies causes longer-lasting or more intense negative affective states [15]. These negative moods such as anger, fear, and sadness, in turn, might contribute to the development of depressive symptoms.

1.3. This study

Despite high prevalence in hearing children, not much is known as yet about the level of depression and its development in a special group who might even be more vulnerable in this respect: HI children. For this study we chose the age range of 9–15 years, because over this period children are increasingly able to reproduce and reflect on their own internal states and emotions [16]. The aim of this study was three-fold. First, we wanted to compare the prevalence of depressive symptoms in HI and NH children. The second purpose was to compare how various coping strategies were related to symptoms of depression in HI children and NH children. Third, we wanted to analyse the extent to which these coping strategies were associated with symptoms of depression over and

above negative mood states in both groups separately. Given the very small body of literature on which to base predictions, no specific hypotheses could be formulated in this respect.

2. Methods

2.1. Participants

In total 200 children participated in this study. Children living in the Netherlands or in the Dutch speaking part of Belgium were included. The exclusion criterion was having any other medical or developmental disability, like mental retardation or speech motor problems.

The inclusion criteria for the HI group were (i) having significant hearing losses of at least 40 dB in the best ear, (ii) that were detected pre- or perilingually. The 83 HI children were recruited from Speech and Hearing centers, hospitals, primary and secondary schools (specials schools for the deaf and mainstream schools) and via specific magazines and websites for HI people. In order to reach the complete spectrum of HI children and to reduce any possible selection bias, we approached as many as possible different organizations and schools. All HI children were born into hearing families, except for one child, whose parents both were deaf. The children were in schools that promoted the development of auditory and oral skills, with or without the use of signs. The 27 HI children who received a CI were implanted between 11 months old and 10 years and 8 months old ($M = 4;00$, $SD = 2;07$). The 117 controls were recruited at primary and secondary mainstream schools. Table 1 shows descriptive statistics. No significant age or gender differences were found between the HI and control group or between the HI samples (children who received CIs versus conventional hearing aids). There were very little missing data in the sample: 100% of the demographic and medical characteristics were collected. Only the information about degree of hearing loss and age at implantation were incomplete (14% and 18.5% unknown, respectively).

2.2. Procedure

The Medical Ethics Committee of the Leiden University Medical Center granted permission for the study. Parental consent was

Table 1
Characteristics and demographic profile of participants.

	Total sample		HI sample	
	HI (<i>n</i> = 83)	Controls (<i>n</i> = 117)	CI (<i>n</i> = 27)	Hearing aid (<i>n</i> = 56)
Age mean in years (<i>SD</i>)	11;11 (1;08)	11;08 (1;03)	11;08 (1;09)	12;03 (1;08)
Age range (in months)	100–192	114–176	100–192	110–188
Sex – <i>n</i> (%)				
Male	41 (49%)	54 (46%)	14 (52%)	27 (48%)
Female	42 (51%)	63 (54%)	13 (48%)	29 (52%)
Degree of hearing loss ^a – <i>n</i> (%)				
Moderate (40–60 dB)	20 (24%)		0 (0%)	20 (36%)
Severe (61–90 dB)	23 (28%)		4 (15%)	19 (34%)
Profound (>90 dB)	28 (34%)		17 (63%)	11 (20%)
Unknown	12 (14%)		6 (22%)	6 (10%)
Preferred mode of communication – <i>n</i> (%)				
Oral language only	58 (70%)		18 (67%)	40 (71%)
Combination of oral and sign language	23 (28%)		9 (33%)	14 (25%)
Sign language only	2 (2%)		0 (0%)	2 (4%)
Type of education – <i>n</i> (%)				
Regular education	52 (63%)		16 (59%)	36 (64%)
Special education	31 (37%)		11 (41%)	20 (36%)

^a Note: Degree of hearing loss was calculated by averaging unaided hearing thresholds at 500, 1000, and 2000 Hz (this information was obtained from medical records).

obtained for all children. Since children are the better informants of their own internal processes [17], we used self-reports instead of other-reports (parents, teachers). All children were assured that their responses would be processed anonymously. Instructions were provided clearly, in an appropriate communicative way to ensure children's understanding. According to the preferred mode of communication, HI children could choose between two versions: a written version or a version in which each item was presented in written text and sign language simultaneously.

3. Materials

The *Child Depression Inventory* (CDI) is for children between 6 and 17 years old [18]. This questionnaire is an instrument containing 26 multiple choice items about a specific category of signs and symptoms associated with depression (for example: "I think that somebody loves me"). Each item consists of a self-evaluation sentence with a score in the direction of severity of the symptom. The item is scored from 1 (symptom absent) to 3 (symptom is always or most of the time present). The original version consists of three sentences per item. We converted these sentences to one sentence with three short answers, to shorten the reading time for HI children (i.e., "I do not like myself; I like myself a bit; I like myself" became "I like myself" with the options: "no; a bit; yes"). In a pilot study with 100 NH children, high correlations were found between the original version and our version, $r = .75$, $p < .001$. The original CDI version had 27 items, but the one item about suicide was deleted in order to not burden the children. The internal consistency of our version was good (Table 2).

To assess the different mechanisms of coping in a problematic peer situation, a modified version of the Self-Report *Coping Scale* was used, consisting of 32 items [19]. The Coping Scale contains two specific types of approach strategies: (a) Problem Solving (example of item: "I do something to change the situation"), (b) Social Support Seeking ("I ask someone in my family for advice") and four types of avoidance strategies: (c) Externalizing ("I yell or shout to let off steam"), (d) Internalizing ("I worry about it"), (e) Distraction ("I find lots of other things to think about"), (f) Trivializing ("I ignore the problem"). The children were asked how much they would use the strategy. The item scored from 1 (*almost never*) to 5 (*almost always*). One item of the Distraction strategy was changed because it involved 'reading a book' in case of a problem. HI children often have speech and language delays, so we supposed that reading is not one of their favorite activities. We

changed this item into 'playing with the computer'. The questionnaire had a good internal consistency (Table 2).

The *Mood* questionnaire is a self-report, containing 12 items [20]. In total three mood scales were used: Anger, Sadness, and Fear. Each item concerns a type of mood. Children were asked if they felt that way in the last 4 weeks. The item can be scored from 1 (*never*) to 3 (*often*). Because of the simple and short sentences, no linguistic adjustments were made. Just as the preceding two self-reports, good internal consistency was found (Table 2).

3.1. Statistical analyses

In order to make a comparison of the prevalence of depressive symptoms between the HI and NH groups and the subsamples of the HI group (i.e., degree of hearing loss, preferred mode of communication, type of education, and type of device) *t*-tests and analysis of variance (ANOVA) were carried out. The relations between the emotional functioning variables and depressive symptoms were established by means of Pearson's correlations and regression analyses. Depressive Symptoms was the dependent variable and aspects of emotional functioning were the independent variables. The program *Statistical Packages for the Social Sciences* version 17.0 was used.

4. Results

4.1. Prevalence of depression

HI children reported significantly more depressive symptoms than NH controls, $t(198) = -2.04$, $p = .043$. For all scales of the Mood and Coping questionnaires no significant differences were found (Table 2). A one-way between subjects ANOVA was conducted to compare the effect of Degree of hearing loss on depression. No significant differences were found between participants with moderate, severe, or profound hearing losses, $F(2, 68) = 1.62$, $p = .206$. However, children who make use of oral language as their preferred mode of communication reported fewer depressive symptoms than children using sign language or a combination of sign and oral language, $t(81) = 2.01$, $p = .048$. Additionally, children attending mainstream schools reported fewer depressive symptoms than children attending special schools for the deaf, $t(81) = -2.76$, $p = .007$. Finally, no significant differences were found between children with CI or conventional hearing aids, $t(81) = -.25$, $p = .800$ (Table 3).

Table 2
Psychometric properties and mean scores of CDI, Coping and Worry questionnaires.

	No. of items	Cronbach's Alpha		Mean scores (SD)	
		HI	Controls	HI	Controls
Depression	26	.75	.74	1.38 (.21)*	1.32 (.19)*
Coping					
Problem Solving	7	.77	.78	2.24 (.42)	2.28 (.44)
Social Support	5	.74	.79	2.04 (.47)	1.95 (.55)
Externalizing	5	.57	.70	1.24 (.28)	1.21 (.31)
Internalizing	5	.76	.55	1.71 (.49)	1.66 (.39)
Distraction	5	.71	.72	2.07 (.48)	2.16 (.47)
Trivializing	7	.81	.76	1.69 (.46)	1.58 (.41)
Mood states					
Anger	4	.80	.79	1.41 (.39)	1.42 (.44)
Sadness	4	.81	.82	1.38 (.44)	1.41 (.46)
Fear	4	.69	.73	1.29 (.37)	1.32 (.45)

* $p < .05$.

Table 3
Means of Depressive Symptom in HI children.

	n	M (SD)
Degree of hearing loss ^a		
Moderate	20	1.33 (.22)
Severe	23	1.35 (.18)
Profound	28	1.43 (.23)
Preferred mode of communication		
Oral language only	58	1.35 (.20)*
Oral and sign language or sign only	25	1.45 (.22)*
Type of education		
Regular education	52	1.33 (.19)**
Special education	31	1.46 (.21)**
Type of device		
Hearing aid	56	1.39 (.20)
Cochlear implant	27	1.38 (.22)

^a Note: Degree of hearing loss was calculated by averaging unaided hearing thresholds at 500, 1000, and 2000 Hz.

* $p < .05$.

** $p < .01$.

Table 4
Correlations between Depressive Symptoms, Coping and Mood.

	Depression		Anger		Sadness		Fear	
	HI	Controls	HI	Controls	HI	Controls	HI	Controls
Coping								
Problem Solving	-.33**	-.18*	-.09	-.15	-.08	-.05	-.24**	-.05
Social Support	-.16	-.13	.09	-.19*	.16	.11	-.01	.02
Externalizing	.35***	.16*	.22*	.37***	.21*	-.05	.10	.08
Internalizing	.40***	.39***	-.06	.02	.26**	.41***	.30***	.37***
Distraction	-.06	-.13	-.05	-.04	-.01	-.10	-.07	-.15
Trivializing	.06	-.15	-.10	.10	-.10	-.18*	-.12	-.10
Mood states								
Anger	.34***	.31***						
Sadness	.48***	.54***						
Fear	.37***	.44***						

* $p < .05$.

** $p < .01$.

*** $p < .001$.

4.2. Relations between Coping strategies, Mood states, and Depressive Symptoms

For both groups, high correlations in the expected direction were found between Depression and the Problem Solving, Externalizing and Internalizing scales of the Coping questionnaire. Seeking Social Support, Seeking Distraction, and Trivializing did not correlate with Depression in both groups. As expected, all negative Mood states were positively correlated with Depression in both groups. Age, Sex, Socioeconomic status (measured by net income per year, job, and highest education of both parents), Degree of hearing loss, and Type of device were not correlated with depression in both groups and were therefore omitted from the results presented here (Table 4).

4.3. Emotional Functioning predicting Depressive Symptoms

The outcomes of the hierarchical regression analyses with two steps (Table 5), adding one new variable in each step, showed that

Table 5
Hierarchical regression analyses for Coping and Mood scales on Depression in HI children and Controls.

Variable	HI			Controls		
	R^2_{adj}	B	p	R^2_{adj}	B	p
Model 1	.36***			.20***		
Coping						
Problem Solving		-.31	.00		-.19	.05
Social Support		-.08	.44		-.09	.36
Externalizing		.27	.01		.08	.35
Internalizing		.45	.00		.41	.00
Distraction		-.20	.06		-.10	.29
Trivializing		.27	.01		-.09	.37
Model 2	.50***			.38***		
Coping						
Problem Solving		-.22	.02		-.11	.21
Social Support		-.19	.05		-.12	.16
Externalizing		.17	.06		.06	.48
Internalizing		.44	.00		.21	.02
Distraction		-.19	.05		-.04	.60
Trivializing		.28	.00		-.08	.35
Mood states						
Anger		.20	.04		.16	.06
Sadness		.30	.00		.35	.00
Fear		-.05	.60		.11	.26

*** $p < .001$.

almost all scales of the Coping questionnaire (except Social Support) in step one made a significant contribution to the prediction of Depressive Symptoms in the HI group, although Distraction showed a trend. In the control group, only the Problem Solving and the Internalizing scale of the Coping questionnaire contributed significantly. When adding Mood to the prediction of Depressive Symptoms in step two, a significant increase in the amount of explained variance occurred. The Model demonstrated that Sadness and Anger were contributive to the prediction of Depressive Symptoms in both groups, although Anger showed a trend in the NH population. In the HI group, again almost all scales of the Coping questionnaire were contributive, with the Externalizing scale showing a trend. Additionally, the Distraction and the Social Support scale became significant in the prediction of Depressive Symptoms in the HI group. This outcome suggests that coping strategies fail to prevent HI children from developing negative mood states. In fact, these cognitions seem to contribute directly to the prediction of depression, over and above negative mood states. In the control group, the Internalizing scale remained contributive, but Problem Solving lost its contribution. So for NH children, adequate coping skills help to prevent the development of negative mood states and in turn depressive symptoms.

Finally, all regression analyses were also carried out with the variables Age, Sex, Socioeconomic status, Type of device, and Degree of hearing loss added to the model, but these variables did not make a significant contribution and were therefore omitted from the results.

5. Discussion

The aim of this study was to examine the prevalence of depression in HI children and the extent to which the two different aspects of emotion regulation were associated with depression in HI children as compared to a NH control group. HI children reported significantly more symptoms of depression than their NH peers. This outcome is in line with earlier studies [3–5]. It is presumed that the higher prevalence of depression in HI children may stem from communicative barriers within a hearing world, different etiologies of hearing loss, and experiences related to stigma and discrimination [21]. In addition, regardless of sophisticated signal processing technologies and improvement in speech and oral language development, HI children still experience difficulties in adverse listening situations, such as speech-in-noise and reverberation [22]. Moreover, gender and age proved unrelated to prevalence. This outcome strongly supports the results described by Nolen-Hoeksema and Girgus, who claimed

that no difference in the level of depression between sexes exists until the age of 15 years old in NH children [23]. In contrast to this study on NH children, age did matter in studies concerning HI children; older participants reported more depressive symptoms [3,5]. The fact that this increase was not seen in our sample could be due to the difference in age of the samples used. In these studies the HI children were 6–18 years old; in our samples 9–15. Finally, socioeconomic status did not have an impact on depression. These findings were consistent with others [4].

The prevalence of depression in children who attend mainstream schools or use oral speech exclusively is lower than the prevalence of HI children who attend special schools for the deaf, or use a signing or combined (sign supported) mode of communication. These variables will be interdependent, because special schools usually use signs to supplement spoken communication. A large body of literature shows better psychological well-being in HI children attending mainstream schools and/or using oral communication [5,24–26]. Possibly, HI children attending special schools or using sign language have less contact with peers in the hearing society and feel more isolated. Alternatively, these HI children might have been raised more protectively and thus have developed slightly different coping capacities than their NH peers. Additionally, HI children with language delays or mental health problems are more likely to be referred to special schools for the deaf. All possible explanations remain speculative.

The finding that the degree of hearing loss was unrelated to the level of depressive symptoms is in line with earlier findings [3–5]. Moreover, CI recipients and HI children with hearing aids reported similar levels of depression. However, this outcome should be interpreted with caution, because CI children were compared to children with hearing losses, situated on a continuum from mild to profound, whereas the majority of CI children were profoundly HI. Additionally, our sample mainly comprised late-implanted HI children, whereas early implants have been associated with better speech and language development [27]. Evidently, more research to monitor depression in children with CI will be important for guiding professionals' and parents' decisions regarding the implant. Therefore, future studies could include and analyse more participants with profound hearing losses with conventional hearing aids and with CIs.

This study is based on cross-sectional data, which rules out drawing conclusions about causal relationships. We can only assume certain cause and effect directions derived from a theoretical framework. A longitudinal study should validate our assumptions concerning causality. Secondly, it should be noted that many more variables concerning emotional functioning could be relevant for the development of depression. For example, self-esteem, social qualities, and anxiety could be contributive in this respect.

On the basis of our results, intervention programs for HI children could focus on the use of adequate coping strategies, because these strategies appear to have a direct relationship with the level of depression. Hopefully these findings will help to implement better prevention, counseling, and treatment trajectories for depression in HI children in the future, because this vulnerable group of children is more prone to developing depression than NH children.

Conflicts of interest

None declared.

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