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Emotion Understanding in Preschool Children with Mild-to-Severe Hearing Loss

Nina J. Laugen[1], Karl H. Jacobsen[2], Carolien Rieffe[3,4], and Lars Wichstrøm[2]

[1]Statped & Norwegian University of Science and Technology, [2]Norwegian University of Science and Technology, [3]Leiden University, and [4]Dutch Foundation for the Deaf or Hard of Hearing Child

Correspondence should be sent to Nina J. Laugen, Department of Psychology, NTNU, 7491 Trondheim, Norway (e-mail: nina.jakhelln.laugen@ntnu.no).

Abstract

Deaf and hard of hearing school-aged children are at risk for delayed development of emotion understanding; however, little is known about this during the preschool years. We compared the level of emotion understanding in a group of 35 4–5-year-old children who use hearing aids to that of 130 children with typical hearing. Moreover, we investigated the parents' perception of their child's level of emotion understanding. Children were assessed with the Test of Emotion Comprehension. Parents were presented with the same test and asked to guess what their child answered on each item. The results showed that children with hearing loss performed at the same level as typically hearing children, despite having lower vocabulary scores. Parents of children with hearing loss were more accurate in their estimations of their child's competence, and higher accuracy was associated with better emotion understanding. These findings may have implications for early intervention planning.

Emotion understanding refers to knowledge about the nature of one's own and others' emotions, as well as their causes and regulation processes (Pons, Harris, & De Rosnay, 2004). Such knowledge allows us to understand social processes and is thus an important prerequisite for psychosocial and cognitive development (Denham et al., 2012; Rieffe & De Rooij, 2012; Rosnay, Harris, & Pons, 2008). Some research indicates that children who are deaf or hard of hearing (DHH) have delays in emotion understanding, such as emotion attribution from situational cues (Gray, Hosie, Russell, Scott, & Hunter, 2007) and understanding causes of emotions (Rieffe, Terwogt, & Smit, 2003), whereas findings are more mixed regarding emotion recognition (Ketelaar, Rieffe, Wiefferink, & Frijns, 2013; Wiefferink, Rieffe, Ketelaar, De Raeve, & Frijns, 2013).

Recently, there has been increased interest regarding children with mild-to-severe hearing loss (25–89 dB) who use hearing aids (HA) rather than cochlear implants (CI) and who often use spoken language as their main mode of communication. For example, the Outcomes of Children with Hearing Loss project (Moeller & Tomblin, 2015) has provided increased knowledge concerning language and audiological outcomes in this group of children. However, little is known about the development of emotion understanding before the age of 6. Therefore, the first aim of our study was to investigate the development of emotion understanding in a group of preschool children who use HA and have unaided hearing loss ranging from mild to severe, compared to that of typically hearing (TH) children.

The association between language development and emotion understanding is well known (Harris, De Rosnay, & Pons, 2005), and DHH children's language difficulties have been suggested to contribute to their delayed emotion understanding (Dyck, Farrugia, Shochet, & Holmes-Brown, 2004). However, less attention has been paid to the role of parents. Because parents' estimations of their child's ability have been found to affect emotion understanding in TH children (Kårstad, Wichstrøm, Reinfjell, Belsky, & Berg-Nielsen, 2015), the second aim of our study was to investigate how parents of children with HA estimate their children's level of emotion understanding compared to parents of TH children.

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Emotion Understanding

As part of the wider concept of emotion competence (Saarni, Campos, Camras, & Witherington, 2006), emotion understanding refers to knowledge about the nature of emotions, as well as their causes and regulation processes (Pons et al., 2004). Emotion understanding is quite different from emotion experience. For example, a child could *experience* a complex emotion such as guilt as young as preschool age but not be able to *understand* the underlying processes related to norms and morals until school age (Harris, 2008).

Emotion understanding develops gradually throughout childhood. Pons et al. (2004) suggest three developmental phases. Around the age of 5, most children are able to identify emotion expressions, situational causes of emotions and reminders that may activate emotions. Around the age of 7, the subjective role of desires and beliefs is acknowledged, as well as the difference between expressed and felt emotions. In the third phase, around 9–11 years, an understanding of more complex processes emerges, such as the possibility of experiencing conflicting emotions, cognitive regulation of emotion and how different perspectives can trigger different emotions.

Emotion Understanding in Children with Hearing Loss

As emotion understanding requires an understanding of mental processes in others, theory of mind development is also involved. Emotion understanding and theory of mind are closely associated, although empirical research suggests that they should be considered separately (Cutting & Dunn, 1999). A large body of evidence has shown that DHH children are at risk for delayed development of theory of mind (Peterson, 2009), which may affect emotion understanding development as well. In fact, DHH research does suggest a delay in the development of emotion understanding. For example, in a study of children and adolescents between 6 and 18 years of age, children with mild-to-profound hearing loss showed a delay in their understanding of the relationship between emotions and their causes compared to TH children (Dyck et al., 2004). However, when the DHH children were compared to a group of TH children matched for verbal ability, the difference disappeared, suggesting that the delay in emotion understanding was related to their delayed language development. In two other studies, deaf children aged 6–12 years performed comparably to TH children on emotion attribution, but the deaf children had a less mature understanding of the causes of emotions and less sophisticated strategies for communicating anger (Rieffe & Terwogt, 2000, 2006). Language level was not considered in these two studies, but the authors suggest that the difficulties in explaining causes of emotions could be related to communication problems and less participation in conversations with mental state content.

Several studies have reported that the aspects of emotion understanding that are developed early, such as emotion recognition, are comparable in DHH and TH children (Hopyan-Misakyan, Gordon, Dennis, & Papsin, 2009; Netten et al., 2015; Rieffe, 2012). However, many of these studies include school-age children. Because emotion recognition is normally acquired at a younger age, a possible delay may not have been detected because the DHH children could have caught up with the TH children by the time of the assessment. Potentially delayed development of emotion recognition is more likely to be present at ages 4–5, when children are normally in the process of acquiring these skills.

Relatively few studies have addressed emotion understanding in preschool children, but some suggest a delay in emotion recognition in preschool children with CI (Wiefferink et al., 2013), as well as more difficulties perceiving emotions through facial expressions or prosodic cues in preschool children with moderate-to-profound hearing loss (Most & Michaelis, 2012). In contrast, a study of Israeli kindergarteners did not report differences in emotion understanding between TH children, children with CI and deaf children of deaf parents (Ziv, Most, & Cohen, 2013). Additionally, in a sample of children with CI, the parent-reported ability of their child to read others' emotions was at the same level as that reported by parents of TH children (Ketelaar et al., 2013).

In summary, the heterogeneity of these studies in terms of participants and results indicates a need for further research to clarify who might be at risk for emotion understanding difficulties at the preschool age. For example, few attempts have been made to investigate whether the degree of hearing loss affects emotion understanding. One study reported that children with profound hearing loss had more difficulties than children with mild-to-severe hearing loss (Most & Michaelis, 2012), and the importance of language also suggests that children with milder hearing loss may not have as large of a disadvantage in their emotion understanding development (Dyck et al., 2004). However, DHH children's lower performance on nonverbal tasks (Wiefferink et al., 2013) suggests that DHH children may be at risk even if they have good language outcomes.

Parents' Estimation Accuracy

Literature on development in TH children provides sound theoretical and empirical support for the importance of parents' contribution to their children's emotional and cognitive development (Sameroff, 2009; Sroufe, 1995). In typically developing children, studies suggest that maternal input, specifically the amount of mental state references in their conversations with their child, predicts the child's later emotion understanding (De Rosnay, Pons, Harris, & Morrell, 2004; Taumoepeau & Ruffman, 2006, 2008). In their conversations, mothers also typically adjust their mental state talk according to their child's development, introducing more complexity as the child grows (Taumoepeau & Ruffman, 2006). These observations fit well with the notion of the zone of proximal development (ZPD), which is a term introduced by Vygotsky (1962) and later adopted by Valsiner (1997). The ZPD is defined as the gap between the child's level of knowledge and the level that the child can understand with support from an adult. By adjusting the complexity of interaction to fit the child's ZPD, the adult supports the child's development. To adjust their level of conversation, parents depend on their own appraisal of their child's developmental level. Thus, parents who are more aware of their child's level of understanding may be more likely to adjust their contributions to fit the child's ZPD. Accordingly, children with parents who accurately estimate their child's level of emotion understanding advance more in their emotion understanding than children with less accurate parents (Kårstad et al., 2015).

In the case of DHH children, several studies suggest that parent–child interactions in dyads with DHH children differ from the interaction patterns observed in dyads with TH children (Gale & Schick, 2009; Lam & Kitamura, 2010). Specifically, parents of DHH children have been reported to include less mental state talk in their conversation with their children (Morgan et al., 2014). Given some DHH children's language delays and these differences in the parent–child interaction, it is appropriate to investigate whether parents' accuracy in appraising their DHH child's competence differs from that of parents of TH children. It is possible that due to the discrepancy between some DHH children's language level and chronological age, parents'

estimations of their DHH children could be less accurate than those of parents of TH children. Alternatively, an increased concern for their child's development could also contribute to an increased awareness and accuracy in parents' estimations of DHH children. Regardless, knowledge about the accuracy of parents with DHH children in estimating their child's emotion understanding may prove to be important if interventions to increase emotion understanding are considered. To our knowledge, our study is the first to investigate these issues.

The Present Study

The aim of the present study is twofold. First, we investigated whether the level of emotion understanding in a sample of 35 preschool children with mild-to-severe hearing loss, fitted with HA, was lower than that in a group of TH children drawn from a representative community sample. Because language is known to be an important predictor of emotion understanding in TH children (Harris et al., 2005; Pons, Lawson, Harris, & De Rosnay, 2003) and DHH children are at risk for language delays (Tuller & Delage, 2014), we included vocabulary in our analysis as a control variable to be able to separate the contributions of hearing loss and vocabulary. Second, we examined whether parents of children with HA have different perceptions of their child's level of emotion understanding compared to parents of TH children. In line with findings in the TH group (Kårstad et al., 2015), we predicted that increased accuracy of parents' estimations would be associated with increased level of emotion understanding in both groups.

Method

Participants

Data from the children with HA were collected as part of a larger study on psychosocial development in children with hearing loss (Laugen, Jacobsen, Rieffe, & Wichstrøm, 2016). Families were recruited via letters of invitation that were distributed from 19 audiology departments and 2 special education providers. The inclusion criteria were as follows: age 4–5 years at the time of the assessment, use of HA in one or both ears, the child and at least one parent speak Norwegian, no CI, and no known additional diagnoses. In total, 79 letters of invitation were distributed. Of the 79 families, 36 agreed to participate. One child was excluded due to language difficulties. We do not have any information about the 43 families who did not accept the invitation; thus, the possibility of a selection bias is present. However, the final sample of 35 children did not differ significantly from the TH group regarding parents' education and work situation. The families were evenly distributed throughout Norway. None of the children had any additional diagnoses, such as intellectual disabilities or autism, as reported by the parents.

Seven families reported genetic reasons and two reported birth complications as the cause of the hearing loss. The majority did not know the cause of the hearing loss. All children spoke Norwegian, but six of them preferred to use signs to support their spoken Norwegian. Two of these six children used sign language in addition to speaking Norwegian, but sign language was not their preferred language according to parent reports.

The group of TH children was drawn from an existing community sample that was collected for a larger study. The recruitment procedure is described in Wichstrøm et al. (2012). Although the size of the original community sample would allow for a matched samples design, this approach was not chosen due to the limited number of variables available in our data set and thus the possibility of unobserved confounding factors (Arceneaux, Gerber, & Green, 2006, 2010). Rather, the group was drawn from the community sample using a random number generator. Because the original sample of 1,250 had an overrepresentation of children with psychosocial problems, we drew more children who had low or no psychosocial problems and fewer who had many psychosocial problems using the inverse of the drawing probability that was used when creating the original sample. Thus, our group of 180 TH children formed a sample that was representative of the TH population. Of these 180 children, data on emotion understanding were available for 130. These were included in our study. Findings concerning emotion understanding and parents' estimations in this longitudinal cohort study have been published elsewhere (Kårstad, Kvello, Wichstrøm, & Berg-Nielsen, 2013; Kårstad et al., 2015). Demographic information of all participants is described in Table 1. There were no significant differences between the HA and TH groups regarding age, gender, parents' education or prematurity. A larger proportion of children with HA had a history of NICU stay ($p = .024$), and children with HA had significantly lower vocabulary scores ($p = .016$).

Instruments

The Test of Emotion Comprehension (TEC; Pons et al., 2004) assesses nine components of emotion understanding that are divided into three developmental phases: (a) the external phase, characterized by the understanding of expressions of emotions and situational causes; (b) the mentalistic phase, where the child understands the distinction between expressed and felt emotions, as well as the influence of desires and beliefs on emotions, and (c) the reflective phase, referring to the acknowledgment of conflicting emotions and the influence of norms and morals. The components and phases are described in Table 2. The test consists of a book with drawings, and the protagonist's face is left blank. The drawing is accompanied by a short story that is read aloud by the experimenter, and the child is asked to

Table 1 Demographic profile of participants

	TH ($n = 130$)	HA ($n = 35$)
Age, mean (*SD*) months	55.1 (3.4)	56.7 (6.2)
Boys	55.3 (3.4)	58.5 (6.3)
Girls	55.0 (3.5)	55.1 (5.9)
Male gender, no (%)	63 (48.5)	16 (45.7)
Gestation age, mean (*SD*) weeks	39.4 (2.9)	39.5 (2.7)
NICU stay, no (%)	13 (10.0)*	9 (25.7)*
Parents' education		
Both parents > 12 years, no (%)	71 (54.6)	18 (51.4)
One parent >12 years, no (%)	38 (29.2)	13 (37.1)
Vocabulary	63.6 (19.9)*	54.1 (22.3)*
Degree of hearing loss (unaided), 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)

*$p < .05$.
[a]Unilateral losses range from mild to profound.
Note. TH = typically hearing children; HA = children with hearing aids; NICU = neonatal intensive care unit.

Table 2 Overview of the components of emotion understanding measured by the TEC

Phase	Component	Description	Example item
External	Recognition	Recognize emotions from external cues (e.g., facial expression)	"Can you point at the angry face?" (Component: Recognition)
	External cause	How external causes affect emotions	
	Reminder	How memory of past events affects emotions	
Mental	Desire	How people's emotions depend on what they want or prefer	"The rabbit eats a carrot. It doesn't see the fox hiding behind the bushes. How do you think the rabbit feels?" (Component: Belief)
	Belief	How people's emotions depend on what they think or know	
	Hiding	The possible discrepancy between expressed and felt emotion	
Reflective	Regulation	Strategies for emotion regulation	"The boy is sad because his rabbit died. What can he do to stop being sad?" (Component: Regulation)
	Mixed	The possibility of experiencing multiple emotions concurrently	
	Morality	How morals affect emotions	

attribute an emotion to the story protagonist. The child is asked to choose between four drawings of facial expressions, each representing one of five emotions: "happy," "sad," "angry," "afraid," or "just all right." The items are scored as correct or not correct. Due to the dichotomous nature of the item responses, Cronbach's alpha was not suitable for the reliability analysis. Rather, Armor's theta was used as a measure of internal consistency. High levels were achieved both for the children ($\theta = 0.81$) and for the parents' estimation ($\theta = 0.95$). Previous studies have reported high test–retest reliability (0.83 with a 3-month delay; Pons, Harris, & Doudin, 2002) and good concurrent validity (see Pons et al., 2014 for a review). The TEC has been translated to a wide range of languages and was also used previously with DHH children in an Italian study (Mancini et al., 2016).

For vocabulary, we used the Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997). In this test, the child is presented with four drawings per item and is asked to point to the drawing corresponding to the target word pronounced by the experimenter. The PPVT-III consists of 10 blocks with 12 items in each, and the test is terminated if 8 wrong answers are given in one block. Cronbach's alpha in our sample was 0.96. The PPVT-III has been subject to a range of validation studies, yielding moderate-to-high correlations with other vocabulary measures and measures of verbal ability, and it is considered suitable for DHH individuals (Williams & Wang, 1997).

Demographic data were obtained through parent reports. Parents' education was measured by an 11-point scale, where 1 = not completed elementary school and 11 = PhD. The mean of both parents' education was used in the analysis. If only one parent's education was reported, then that parent's level of education was used. Age at detection refers to the age of the child when the parents were informed about the hearing loss. Degree of hearing loss was measured on a 6-point scale using the categories of normal (<25 dB), mild (26–40 dB), moderate (41–55 dB), moderately severe (56–70 dB), severe (71–90), and profound (>90 dB). The parents provided reports for each ear separately, and hearing level in the best ear was used in the analysis.

Procedure

The children with HA were visited at home, daycare, or a local service provider, based on the family's preferences, by a clinical psychologist experienced in working with deaf children. The parents filled out a questionnaire regarding demographic and audiological information while the psychologist tested the child's vocabulary and emotion comprehension level. When necessary, measures were taken prior to the assessment to ensure good auditory and optical conditions, such as turning off the dishwasher or turning on lights.

When the TEC was administered, the parent was in another room. Spoken Norwegian was mainly used in the assessment and was supported by signs as required. The psychologist's facial expression was kept neutral to avoid giving away additional emotion cues, which could have made the tasks easier. When the PPVT-III was conducted, no sign support was provided. To measure the parent's ability to estimate their child's emotion comprehension, the TEC was administered to the parent while the child was in another room. The parents were instructed to provide the answer they thought their child had provided.

The TH children were examined at NTNU, the Norwegian University of Science and Technology. The study was approved by the Regional Committee for Medical and Health Research Ethics Mid Norway.

Statistical Analysis

The data were inspected for normality and outliers. Values of skewness and kurtosis were acceptable for the PPVT-III and TEC in both the TH and HA groups, with z values ranging from 0.55 to 1.65 (skewness) and from 0.10 to 1.20 (kurtosis). We used independent sample t tests to investigate the differences between the TH and HA groups in terms of emotion comprehension, parent ratings, and parent–child discrepancy. To control for random significance that may result from multiple t tests, the statistics were corrected using the false discovery rate, as described by Benjamini and Hochberg (1995, 2000). Due to unequal sample sizes, Welch's unpooled t test was used for all comparisons, as recommended by Zimmerman (2004). Due to the small sample size of the HA group, Hedge's g was used to calculate the effect size. Because of the correlation between the presence of hearing loss and vocabulary difficulties, we performed two linear regression analyses to control for vocabulary scores on children's TEC outcomes and parental accuracy outcomes.

Parent–child discrepancy was defined as the difference between the child's score and the parent's estimation, converted into absolute values. This score was calculated for each of the three phases, as well as for the total score. If the parent's estimation of the child's level was identical to the child's actual

level, they received a discrepancy score of 0. Higher scores indicate higher discrepancy, which implies lower accuracy. For clarity, the findings will be discussed in terms of accuracy rather than discrepancy.

Results

Emotion Understanding in Children with HA and TH Children

Means and intergroup differences for the children and parents, as well as discrepancy scores, are displayed in Table 3. Overall emotion understanding scores in children with HA did not differ from the scores of TH children, as both groups attained a total mean score close to three out of nine correct components. Better vocabulary and higher parental accuracy were both associated with emotion understanding. When vocabulary and parental accuracy were controlled for, the difference between the groups remained non-significant (Table 4).

Parent's Estimation of their Child's Emotion Understanding

The parent's estimation of their child's performance on the TEC and their estimation discrepancy are presented in Table 3. Parents in both groups overestimated their child's emotion competence. The children's scores were approximately 3, whereas the parents' estimations were close to 5 in the HA group and above 6 in the TH group. Effect sizes were medium to high. The discrepancy between the parent and child scores was significantly lower in the HA group than in the TH group (Table 3), indicating that parents of children with HA were better at estimating their child's performance level than parents of TH children. Table 5 shows that parental accuracy is associated with both the child's TEC score and the vocabulary score. However, even when these covariates are controlled for, the group difference remains.

Discussion

In the present study, we examined whether mild-to-severe hearing loss in children with HA affects emotion understanding in preschool children and whether parents of these children assess their child's level of emotion understanding differently than parents of TH children. We therefore compared the level of emotion understanding among 4-year-old children with HA to that of TH 4-year-old children drawn from a representative community sample. We found that the level of emotion understanding did not differ between the groups but that parents of children with HA had greater accuracy in estimating their child's emotion understanding than parents of TH children.

Emotion Understanding in Children with HA and TH Children

In our study, both children with HA and TH children reached a mean score close to 3 out of 9 points. Because the TEC was developed to assess emotion understanding in children between 3 and 11 years of age, we expected that the majority of the items would be too difficult for both the TH and HA groups. Our scores fit well with the level found in a representative British sample of 20 children with a mean age of 4.8 (Pons et al., 2003) and with the Norwegian norms based on 926 children with a mean age of 4.4 years (Kårstad et al., 2015).

The finding that children with HA perform comparably to TH children on emotion understanding is similar to the studies of Ketelaar et al. (2013) and Ziv et al. (2013), but it contrasts the findings of Wiefferink et al. (2013), who reported that preschool children with CI have more difficulties with emotion discrimination, identification, and attribution compared to TH children. Our study includes children with HA and considerably milder unaided hearing loss than participants in the study by Wiefferink et al. (2013). It is possible that the children's better access to sound, especially in the early years, could contribute to an enhanced understanding of emotions.

At the preschool age, emotion recognition is one of the main emotion competences to be learned. Whereas our study did not find any difference between the TH and HA group, Most and Michaelis (2012) found that 4–7-year-old children with moderate-to-profound hearing loss were outperformed by TH children when presented with tasks of emotion perception using visual and auditory nonverbal cues. However, while their study focused more specifically on perceptual processes, our study included

Table 3 Psychometric properties and mean scores on the TEC

		Mean scores (*SD*)					
	Range	TH (n = 130)	HA (n = 35)	T	p	P_{bh}	Hedge's g
Emotion comprehension: child							
External	0–3	1.63 (1.00)	1.71 (0.93)	−0.46	.640	.706	0.084
Mental	0–3	0.85 (0.77)	0.91 (0.87)	0.387	.719	.719	−0.075
Reflective	0–3	0.60 (0.69)	0.36 (0.55)	−2.13	.037	.088	0.360
Total score	0–9	3.08 (1.50)	2.94 (1.53)	−0.47	.647	.706	0.092
Emotion comprehension: parent							
External	0–3	2.54 (0.65)	2.20 (0.68)	−2.73	.010	.030	0.515
Mental	0–3	2.27 (0.71)	1.89 (1.02)	−2.08	.044	.088	0.482
Reflective	0–3	1.64 (0.89)	1.09 (0.89)	−3.26	.002	.012	0.617
Total score	0–9	6.45 (1.52)	5.17 (1.84)	3.77	.000	.000	0.801
Parent–child discrepancy							
External	0–3	0.89 (1.11)	0.49 (1.17)	1.89	.074	.123	0.359
Mental	0–3	1.42 (0.92)	1.0 (1.28)	1.78	.082	.123	0.413
Reflective	0–3	1.04 (1.11)	0.70 (1.10)	1.58	.119	.159	0.308
Total score	0–9	3.35 (1.78)	2.23 (2.18)	3.13	.008	.030	0.594

Note. TH = typically hearing children; HA = children with hearing aids. P_{bh} = p values corrected for multiple comparisons, by false discovery rate.

Table 4 Predictors of emotion comprehension

Variable	B	β	p	95% CI
Group	−0.28	−0.08	.075	[−0.70, 0.13]
Vocabulary	0.03	0.46	.000	[0.03, 0.04]
Discrepancy	−0.41	−0.53	.000	[−0.50, −0.32]
Model fit	Adjusted $R^2 = 0.53$			

Note. CI = confidence interval. Group = dummy variable for typically hearing children (0) or children with hearing aids (1).

Table 5 Predictors of parental accuracy

Variable	B	β	p	95% CI
Group	−1.05	−0.23	.000	[−1.63, −0.47]
Vocabulary	0.02	0.22	.003	[0.01, 0.03]
Child's TEC score	−0.87	−0.67	.000	[−1.05, −0.69]
Model fit	Adjusted $R^2 = 0.39$			

Note. CI = confidence interval. Group = dummy variable for typically hearing children (0) or children with hearing aids (1). TEC = Test of Emotion Comprehension.

additional aspects of emotion understanding, such as understanding the relationship between situational context and emotions. The children in our study may have benefited from additional information in the verbal instructions and short stories provided, which may have contributed to the age-appropriate performance in our study.

In line with the literature on TH children, our study confirms the importance of vocabulary development as a predictor of emotion understanding (De Rosnay & Harris, 2002). However, although children with HA performed significantly lower on the vocabulary measure, they still performed similar to TH children on emotion understanding. It must be noted that only a small part of the children's language abilities were measured (spoken language vocabulary). Although the majority of the HA group used spoken language only, two of the children also used sign language and some used signs as support for their spoken Norwegian. Thus, their total language ability could be different from what is reflected in the PPVT-III score. Additionally, the age-appropriate level of emotion understanding that we found could be due to the nature of emotion understanding in the preschool age, which primarily focuses on emotion recognition. Unlike the aspects of emotion understanding that develop later, emotion recognition may be less dependent on language, as visual and contextual cues are likely to assist in the recognition of emotion expressions. It is possible that language may have a greater impact on emotion understanding in later childhood, when the acquisition of less visible aspects of emotion understanding is relevant, such as hidden emotions and the impact of one's beliefs versus desires.

Parents' Estimation of their Child's Emotion Understanding

In both groups, parents clearly overestimated their child's emotion understanding ability. On average, parents of TH children estimated that their child would score 6.5 out of 9 points, which is the expected score of TH 8–9 year olds, whereas parents of children with HA estimated an average score of 5.2, which is expected for TH 6–7 year olds (Pons et al., 2003). Parents' tendency to overestimate their child's abilities has been demonstrated within other areas of development, such as level of intelligence (Chamorro-Premuzic, Arteche, Furnham, & Trickot, 2009).

For the TH group, the parents' overestimation of their child's abilities was not unexpected, as this was reported in the larger study from which our TH group was drawn (Kårstad et al., 2013). It is interesting that parents of children with HA think that their children perform at a lower level than parents of TH children, even though this is not the case. As a result, parents of children with HA present more accurate estimates of their child's emotion understanding than parents in the TH group. It is possible that parents of children with HA are more aware of their child's competence because they are more concerned about their child's development, or it could be the result of more feedback about their child's competence in the context of family-centered interventions related to the child's hearing loss. These parents may also have estimated their children's emotion understanding as lower than the estimation of parents of TH children because of their children's language delays, as suggested by the significant contribution of vocabulary scores to parental accuracy. However, even when controlling for vocabulary scores, parents of children with HA remained significantly more accurate than parents of TH children.

Underestimating a child's level of understanding could be a disadvantage for the child, as parents would refrain from introducing new concepts and perspectives. In contrast, overestimation of the child's abilities could promote the child's development if the parent thereby addresses the child at a slightly higher level than their current level of understanding, or in other words, within the ZPD. However, if the discrepancy between the parent's estimation and the child's actual level is too high, the parent's initiatives in interactions with the child risk falling outside the ZPD and will be too difficult for the child to understand.

As predicted, better parental accuracy was associated with higher emotion understanding scores for children in both groups. Thus, in the HA group, the parents' increased accuracy compared to the TH group may have increased their child's emotion understanding, making up for their disadvantage in vocabulary development. It is possible that the increased accuracy of parents of children with HA, which caused them to be within the ZPD more often, could partly explain why children with HA were at the same level as TH children in emotion understanding, despite their significantly lower vocabulary scores.

The role of parental accuracy and its relevance for adjustment according to the child's ZPD is likely to change as the child grows older. While parents are the primary interaction partners of preschool children and thus have a vital role in the child's social and cognitive development, the peer group gradually becomes more important as the child reaches school age. Because peers normally cannot be expected to be equally aware of the child's developmental level or special communication needs due to their hearing loss, children with HA may not benefit from the adaptations of their parents to the same degree as when they are younger. Hence, a disparity between children with HA and TH children in emotion understanding may emerge in middle childhood, as indicated by Dyck et al. (2004) and Rieffe (2012).

Because our study is cross-sectional, we cannot infer any causal relationships between the parents' accuracy and the child's emotion understanding. However, our findings fit well with the findings of Kårstad et al. (2015), who reported that parents' accuracy at estimating the child's emotion understanding at age 4 predicted the child's emotion understanding level at age 6. If future research confirms the same relationship in children with HA, this has important implications for the services

provided to these children and their families. The families' ability to perceive their child's developmental level is an important area for intervention that deserves a more explicit focus to detect families who may need assistance in this respect.

Although the limitations of representability, as discussed below, must be kept in mind, we believe that our findings are likely to be representative for the population of children with HA in Norway. Caution is needed when generalizing the results to populations in other countries, as emotion comprehension and the parents' awareness thereof are likely to differ between cultures (Molina, Bulgarelli, Henning, & Aschersleben, 2014).

Future research is needed to assess whether children with CI and their parents follow the same pattern as the children with HA in our study. Although children with CI and HA are similar in many respects, there are also important differences, for example, regarding early auditory experience and service provision. This may lead to a different development of emotion understanding.

Limitations

As mentioned, our study is cross-sectional, and we are thus unable to provide any causal explanations for the relationship between children's emotion understanding and their parents' estimation accuracy. Moreover, our findings need to be interpreted with caution because the HA group only consisted of 35 children. Nonetheless, we achieved satisfactory effect sizes for the total scores.

Some aspects about the study design must also be noted. We do not know whether our sample of children with HA is a representative one because we do not have any information about the non-respondents. As participation in the study included a home visit, families with additional social problems may have been reluctant to participate. However, our HA group did not differ significantly from the TH group on relevant measures such as parent education and work situation.

Two of the children used sign language as well as spoken Norwegian, and parents reported that the preferred language was spoken Norwegian supported by signs. Because this information was collected from parent reports, there is a possibility that the children could actually prefer sign language, but the parents' lack of sign language skills obscured this preference in everyday life. Moreover, we did not assess these children's sign language skills or the sign vocabulary in the children who used signs to support spoken language. Thus, it must be considered that our measure of receptive vocabulary in spoken Norwegian represents just a small part of language development, and future research should address sign language or signing skills as well to obtain a fuller picture of language abilities.

None of the children included in the study had any known additional diagnoses, but some difficulties may not yet have been diagnosed. For example, autism spectrum disorders are often diagnosed later in DHH children compared to TH children (Szarkowski, Flynn, & Clark, 2014). Our results must be interpreted with the possibility of undiagnosed difficulties in mind.

The TEC has been used in the DHH population in only one other study of which we are aware (Mancini et al., 2016), and there is little knowledge about the appropriateness of using this test with DHH children. The TEC has a high verbal loading, as the child is required to listen to a short story or description before providing an answer. Furthermore, because the testing was performed in the families' homes, the auditory conditions could have varied, although measures were taken to prevent this. Thus, the children with HA may have had more difficulties than TH children in understanding the task and may have perceived the task to be more energy consuming. However, as the HA children scored quite similar to TH children, we believe that these challenges did not significantly affect the scores.

Conclusion

The emotion understanding of children with HA and TH children did not differ at age 4. Although parents of children with HA overestimate their child's emotion understanding, their estimations were more accurate than parents of TH children. This increased accuracy is likely to benefit the development of emotion understanding in children with HA. Future research should explore the potential benefits of interventions aimed at increasing the accuracy of less proficient parents.

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Conflicts of Interest

The authors have no conflicts of interest to report.

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