Psychosocial functioning in toddlers with moderate hearing loss : the importance of caregivers

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CHAPTER 4

Are you there for me? Joint Engagement and Emotional Availability in Parent-Child Interactions for Toddlers with Moderate Hearing Loss

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ABSTRACT

Objectives
This study examined joint engagement and emotional availability of parent-child interactions for toddlers with moderate hearing loss (MHL) compared with toddlers with normal hearing (NH) and in relation to children's language abilities.

Design
The participants in this study were 25 children with MHL (40-60 dB hearing loss) and 26 children with NH (mean age 33.3 months). The children and their parents were filmed during a 10-minute free play session in their homes. The duration of joint engagement and success rate of initiations were coded next to the level of emotional availability reflected by the Emotional Availability Scales. Receptive and expressive language tests were administered to the children to examine their language ability.

Results
Groups differed in joint engagement: children with MHL and their parents were less successful in establishing joint engagement and had briefer episodes of joint engagement than children with NH and their parents. No differences between groups were found for emotional availability measures. Both joint engagement and emotional availability measures were positively related to children's language ability.

Conclusions
Children with MHL and their parents are emotional available to each other. However, they have more difficulties in establishing joint engagement with each other and have briefer episodes of joint engagement compared with children with NH and their parents. The parent-child interactions of children with better language abilities are characterized with higher levels of emotional availability and longer episodes of joint engagement. The results imply that interactions of children with MHL and their parents are an important target for family-centered early intervention programs.

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INTRODUCTION

Early parent-child interactions have a long-term impact on children's linguistic, social-emotional, and cognitive development (Dunn et al. 1991; Quittner et al. 2013; Kok et al. 2015; Fay-Stammbach et al. 2016). Parents who are available for their children by providing warmth, positive affect, and encouragement support their children's development (Emde, 2000). This parental availability might be particularly necessary for children with hearing loss (HL), since these children are more at risk for difficulties in their language and social-emotional development than their hearing peers (Stevenson et al. 2015). Most children with HL have hearing parents who have little or no experience with HL (Mitchell & Karchmer, 2004). Consequently, the interactions between children with HL and their parents may be hampered by their parents' lack of experience with HL. When the parents and their children have a different hearing status, parents need to adapt their communication style to attain successful interactions.

Recent studies indicate that parent-child interactions of children with HL are less positive than those of hearing children (Barker et al. 2009; Quittner et al. 2013; Ambrose et al. 2015; Depowski et al. 2015). Interactions are briefer, have more conversational breakdowns and parents are less sensitive and responsive to their children's communicative acts (Barker et al.; Cejas et al., 2014; Depowski et al.; Lederberg et al., 1990; Quittner et al.). Since most of these studies are restricted to children with profound HL, it is unclear if this is also true of parent-child interactions in which the child has a moderate loss (MHL). In the present study we compared toddlers with MHL (here defined as 40-60 dB HL) with toddlers with no hearing loss (NH). We examined joint engagement and emotional availability in the parent-child interactions in relation to children's language ability.

Parent-child interaction in children with MHL

The "mismatch" in hearing states between hearing parents and children with HL can have a negative effect on parents' intuitive interaction skills. Hearing mothers of children with HL tend to engage in more directive and controlling interactions with their children than mothers who share the same hearing status with their children (Meadow-Orlans & Steinberg, 1993; Vaccari & Marschark, 1997; Pressman et al. 1999; Ambrose et al. 2015). Moreover, parent-child interactions between hearing parents and children with HL are briefer and more often interrupted (Lederberg & Mobley, 1990; Meadow-Orlans & Steinberg, 1993; Barker et al. 2009; Depowski et al. 2015). Several studies have reported lower levels of maternal affect, sensitivity, verbal responsiveness, and engagement in parents of children with HL, compared with parents of NH children (Macturk et al, 1993; Meadow-Orlans & Steinberg, 1993; Nittrouer, 2010; Quittner et al. 2013; Cejas et al. 2014). Other studies however failed to confirm differences between these two populations (Lederberg & Mobley; Pressman et al. 1998).

Most of the abovementioned studies included children with profound HL (with or without cochlear implants) or groups of children with a range of HL. A clear picture of the parent-

child interactions of children with MHL is lacking. Children with MHL have better auditory opportunities than children with profound HL, which could in turn have a positive effect on the interactions with their parents. Most children with MHL use spoken language with their parents and they wear hearing aids that can enable them to hear speech relatively well. When children with MHL are in close proximity to their parents in an acoustically friendly environment, and they are wearing their hearing aids, they are likely to have good or sufficient access to social information. However, their ability to clearly hear their parents' voices is impaired in more noisy environments, despite the use of their hearing aids (Moeller & Tomblin, 2015). Under these circumstances children with MHL have restricted access to their parents' speech, which has the potential to negatively affect the parent-child interactions. The inconsistent reactions of children with MHL to their parents' speech, dependent on the environment, may cause parents to feel insecure about their parenting role (Kurtzer-White & Luterman, 2003). These feelings of insecurity can hamper parents in interacting intuitively with their children.

Although, to the best of our knowledge, there are no studies that specifically examine parent-child interactions in dyads of parents and children with MHL, we know of three publications that focus on the quantity and quality of parental linguistic to children with mild to severe HL (25-75 dB HL) (VanDam et al., 2012; Ambrose et al. 2014; Ambrose et al. 2015). These three publications are part of the Outcomes of Children with Hearing Loss (OCHL) study – a multicenter, longitudinal project investigating the outcomes of children who are hard-of-hearing (for a description see Tomblin et al., 2015a). This is one of the first study that follow children with mild to severe HL longitudinally in their development. In two of their publications, the authors describe the use of automated vocal analysis of full-day recordings in the home environment. In particular, conversational turns between parent and child and the amount of words parents exposed their child to were examined. The recordings showed no differences on the number of conversational turns nor the amount of words parents exposed children with mild to severe HL to in comparison with NH children. The number of conversational turns was positively related to children's language abilities.

In the third publication the authors analyzed video recordings of semi-structured conversational interactions of 156 children with mild to severe HL and 59 children with NH aged approximately 18 months and/or 3 years old. The results showed no differences on the number of utterances parents exposed their children with HL to in comparison with NH children. However, parents of the children with mild to severe HL exposed their three year-old children to a less diverse vocabulary and their vocalizations were shorter. This type of more simple language exposure was related to lower language ability. In addition, longitudinal analysis of the data of 28 children with mild to severe HL in this study indicated that more directive language when the child was 18 months old was related to lower language ability at the age of three (Ambrose et al. 2015). Taken together, the results of these studies imply that parents of children with mild to severe HL expose

their children to language that is less rich than the language parents of children with NH use. Furthermore, the exposure to more different kind of words, longer utterances, and more conversational turns is related to better language abilities.

Joint engagement

Children benefit the most of their parents' linguistic input during moments of joint engagement. Joint engagement refers to episodes during which interest in objects or events are shared between child and social partner (e.g. parent) (Bakeman & Adamson, 1984). However, children with mild to profound HL and their parents have been found to be less successful in establishing and maintaining joint engagement episodes than children with NH and their parents (Lederberg, et al., 1990; Nowakowski et al., 2009; Nittrouer, 2010). Moreover, these children with HL frequently failed to respond to their parents' initiations (Lederberg et al.) and vice versa (Nittrouer). These difficulties in starting and maintaining joint engagement result in briefer episodes of joint engagement. Several studies confirmed that children with severe to profound HL indeed had briefer episodes of joint engagement with their (hearing) parents than their hearing peers (Barker et al., 2009; Cejas et al. 2014; Lederberg et al.; Prezbindowski et al., 1998).

Language is an important factor in the initiation and duration of joint engagement. Within the group of children with severe to profound HL those with better language abilities had longer episodes of joint engagement than their peers with lower language abilities (Cejas et al., 2014). Possibly, conversational breakdowns increase when children have lower language abilities resulting in briefer episodes of joint engagement. Briefer episodes, in turn, may limit the potential exposure to parental linguistic input. Joint engagement is therefore an important aspect of parent-child interaction that needs to be explored in children with MHL.

Emotional availability

A healthy parent-child interaction includes not just the mutual physical presence of parent and child, but also their emotional availability. The concept of 'emotional availability' or sometimes labeled as 'sensitivity' is used to reflect the quality of the emotional connection between parents and their children (Emde, 2000; Emde & Easterbrooks, 1985). Children signal their affective states and needs to their parents to let them know how they are feeling, to communicate that their parents are needed and appreciated, and that they enjoy interacting with them. Parents display their emotions to affirm their children's signals, reciprocate their affection, and extend social interaction (Bornstein et al. 2010). Emotional availability entails the emotional expression and understanding of both partners in the interaction, resulting in the emotional accessibility of one to the other (Biringen & Robinson, 1991). Several studies with hearing children showed that emotional availability is positively linked to children's attachment (Easterbrooks et al. 2000; Ziv et al. 2000), cognitive development (Bernier at al., 2010; Kok et al. 2013), and social-emotional development (Moreno et al. 2008). In fact, emotional availability is seen as the foundation underlying healthy development in children (Bornstein et al. 2010).

A recent study by Quittner et al. (2013) found a lower level of emotional availability in parent-child interactions between parents and 188 deaf children with a cochlear implant (CI) (five months - 8.5 years old) compared with children with NH. Moreover, maternal emotional availability was a significant predictor of language ability four years after implantation (Quittner et al. 2013). In similar vein, emotional availability at the age of two was predictive of language ability in children with mild to profound HL at the age of three, even when controlled for initial language level, maternal education, and severity of their HL (Pressman et al. 1999).

Although there are no studies on emotional availability in a well-defined group of children with MHL, some studies included a few number children with MHL (4 or 5 per study) in combination with children with more severe HL (Meadow and Steinberg, 1993; Pressman et al. 1998). The results of these studies are however inconsistent, with one study reporting lower levels of emotional availability in children with HL relative to children with NH (Meadow & Steinberg) and the other study reporting no differences between children with and without HL (Pressman et al.). Further research is needed to determine the impact of emotional availability in parent-child interactions on the (language and social-emotional) development of children with MHL.

Present study

In the present study joint engagement and emotional availability in parent-child interactions for children with and without MHL were investigated. The duration of joint engagement and the success rate of initiations were examined. In line with findings in children with severe and profound HL, we expected briefer periods of joint engagement and a lower success rate of initiations for toddlers with MHL and their parents compared with toddlers with NH (Lederberg & Mobley, 1990; Barker et al. 2009; Cejas et al. 2014; Prezbindowski et al., 1998).

To be emotional available as a parent, parents should be sensitive to their children's signals, follow these signals and respond to them appropriately. Children are emotional available to their parents when they respond to their initiatives with affect and pleasure and engage parents in their interactions. Of interest in the current study is exploring whether it is more difficult to achieve high levels of emotional availability in parent-child interaction when a child has MHL. In the present study, the emotional availability in the interactions of toddlers with MHL and their parents were explored and compared with those of toddlers with NH and their parents. Based on research in deaf children with CI (Quittner et al. 2013), we expected lower levels of emotional availability in the interactions of toddlers with MHL compared with toddlers with NH. Given previous studies have demonstrated a link between the duration of joint engagement, emotional availability, and language ability (Pressman, et al. 1999; Van Dam et al. 2012; Quittner et al. 2013; Ambrose et al. 2014; Ambrose et al. 2015) we also expected this relationship in toddlers with MHL.

METHOD

Participants

This study is part of a larger study of the psychosocial functioning of toddlers with MHL and their families (Dirks et al., 2016; Dirks et al., 2017). A total of 51 children between 29 and 45 months of age (mean age 33.3 months) participated in this study. A group of 25 children with MHL was compared to a group of 26 children with NH. Characteristics of the samples are reported in Table 1. Age, gender, and maternal education level did not differ between the groups. The children with MHL were recruited by two family-centered early intervention centers in the Netherlands. The children with NH were recruited via a well-baby clinic. The children with NH were included in the study when they had passed the neonatal hearing screening and had no known medical or developmental disabilities. Children with MHL were included in the study when they were diagnosed with congenital moderate hearing losses (40-60 dB HL) in the better ear (residual hearing was calculated by averaging unaided hearing thresholds at 500, 1,000 and 2,000 Hz) and they had no other medical or developmental disability such as mental retardation, visual impairment or speech-motor problems. A total of five children with MHL had a father with HL (one deaf father and 4 hard-of-hearing fathers) and one child had a hard-of-hearing mother. None of the children had more than one parent with hearing loss. In the NH group no parents had HL. All children with MHL wore hearing aids and received care by an audiologist. Furthermore, all children with MHL participated in a family-centered early intervention program for children with HL.

Table 1. Demographic profile of participants

	MHL (n = 25)		NH (n = 26)	
	Mean (SD)	Range	Mean (SD)	Range
Age, months	33.1 (4.3)	29-42	33.6 (5.3)	30-45
Gender, No. (%)				
Male	8 (32%)		10 (38%)	
Female	17 (68%)		16 (62%)	
Maternal educational level,[1]	3.0 (0.9)	1-4	3.2 (0.9)	2-4
Degree of hearing loss (dB),	52.4 (5.6)	40-60	NA	
Age at start family intervention in months	8.9 (7.9)	1-24	NA	
Age at amplification hearing aid in months	8.7 (8.4)	1-33	NA	

Abbreviations: MHL Moderate Hearing Loss, NH Normal hearing, SD Standard deviation, NA Not Available
[1] (1=no/primary education, 2 = lower general secondary education, 3= higher general education, 4 = college / university).

Procedure

Families were visited at home by one of the two members of the research team. The children and their parents engaged in a 10-minute free-play session with standardized toys. The toys were selected in order to be age-appropriate and included building blocks,

a puzzle, and a tea set. Parents were asked to play with their child the way they usually do. All interactions were videotaped. Of the MHL population, 23 mothers (one mother with HL) and two fathers (one father with MHL) participated in de the free-play session; in the NH population 25 mothers and one father participated.

Parents were asked to fill in a questionnaire about their family's background. Additional information, such as degree of hearing loss and age at amplification, was obtained from medical records. Speech and language therapists assessed the language ability of the children with MHL as part of the assessment protocol of the early intervention program. The members of the research team assessed the language abilities of the children with NH. The study was carried out in accordance with the standards set by the Declaration of Helsinki and informed consent was obtained for all children.

Measures

Language ability

Receptive language ability was assessed with the Reynell Developmental Language Scales - Dutch Version (Schaerlaekens, Zink, & Van Ommeslaeghe, 1993). Expressive language ability was assessed with the Sentence Development Scale of the Schlichting Expressive Language Test (Schlichting, van Eldik, & Lutje Spelberg, 1995). Both language tests were developed and standardized for children between two and five years of age and have been widely used for children with and without HL. Raw scores are converted to age equivalents and language standard scores. The standard scores are normally distributed scores, with a mean score of 100 and a standard deviation of 15. These tests are a standard part of the assessment protocol used in intervention programs of organizations in the Netherlands that participated in this study. The receptive language scores of three children (2 MHL and 1 NH) and the expressive language scores of five children (4 MHL and 1 NH) were missing.

Joint engagement

A coding procedure developed by Lederberg (1984) was used to analyze the duration of each joint engagement (in milliseconds) within the interaction. An initiative behavior came after a period of no engagement and included one or more of the following: verbal initiation, eye gaze, laughing, smiling, pointing or reaching for an object, tapping a toy or moving it into the visual field of the partner (Lederberg & Mobley 1990). This behavior was then deemed as 'successful' if the partner responded within 3 seconds from the end of the behavior (for example: responding verbally, taking an offered toy, following a verbal instruction or laughing with the initiator). The engagement finished when either the parent or child stopped responding to the other (disengaged) for a period of 5 seconds. In line with other studies on linguistic or communicative aspects of parent-child interactions in children with HL the interactions were coded for a 5-minute interval (from 1:00 to 6:00) (Ambrose et al., 2015; Cruz et al., 2013; Loots et al., 2005). The number of initiations resulting into an episode of joint engagement was count to calculate the proportion of successful initiations by both parents and children. The mean time of each joint engagement was calculated next to the total duration of joint engagement within

the 5-minute interval. The total duration of joint engagement was calculated by summing the duration of each engagement.

The first author and a research assistant coded the play sessions. Five videos of another study were scored together to practice with the coding system. Thirteen videos of the current study (20%) were scored independently to calculate the interrater reliability. Interrater reliability was assessed using a two-way mixed, absolute agreement, single-measures intraclass correlation (ICC; McGraw & Wong 1996) to assess the degree that coders agreed in their ratings of interaction duration. The resulting ICC was in the excellent range (ICC = 0. 91), indicating a high degree of agreement between the two coders.
Two children with MHL walked out off camera during the recording and therefore five continuous minutes throughout the total recording were lacking for these children. The videos of these two children were thus not suitable for this part of the parent-child interaction analysis.

Emotional availability
The Emotional Availability Scales (EAS), Fourth Edition (Biringen, 2008) were used to assess dyadic emotional availability. In the present study, five dimensions of the EAS were used; three of them related to parental behavior and two related to child behavior. All were rated on a 1-7 response scale. The scales are linear, with a higher score reflecting a higher quality. Numerous studies showed the EAS to have good psychometric properties (e.g., Biringen & Easterbrooks 2012; Easterbrooks, 2005).

The three parent dimensions used in the present study were *sensitivity*, *structuring*, and *non-intrusiveness*, and the two child dimensions were *responsiveness* to the parent and *involvement* of the parent. *Sensitivity* refers to the parent's ability to create a generally positive, genuine, and affective climate. A highly sensitive parent is emotionally connected to the child and is able to correctly read and respond to the child's signals. *Structuring* refers to the degree of which the parent is able to adequately support the child's learning with respect for the child's autonomy. A parent scoring high on structuring is able to guide and scaffold the child's activities without overpowering the interaction. *Non-intrusiveness* refers to the parent's tendency to follows the child's lead. A parent high on non-intrusiveness is available for the child without being intruding, interfering or overprotective. *Child Responsiveness* is reflected by the child's eagerness and willingness to respond to the parent's suggestions or demands. A highly responsive child expresses clear signs of pleasure in the interaction and reacts positively to the parent. *Child Involvement* refers to the ability of the child to engage the parent in the interaction. A child high on involvement is available to positively involve the parent in an activity or play, for example by looking, pointing or talking.

The free play sessions were coded by two raters (the first author and a child psychologist) who had completed a training program conducted by Zeynep Biringen and achieved interrater reliability with Biringen ($r > .80$). The two raters coded 20 percent of the video

sessions independently. The intra-class reliability coefficients revealed highly satisfactory levels for all scales (r = .92 - .96).

Statistical analyses

Independent t-tests were used to test for differences between groups in demographics, language ability and joint engagement measures. Effect size was estimated with Cohen's *d.* Holm's sequential Bonferroni method was used to control for Type 1 error at the .05 level across comparisons. Multivariate Analyses of Variance (MANOVAs) were used to test for differences between the MHL and NH samples in the emotional availability in the interaction. Effect size was estimated with partial eta square. Correlations between the measures were calculated by Pearson's Correlations. These correlations were compared between the two groups using Fisher's *r*-to-*z* transformations to be able to show significant differences between the strength of the correlations.

RESULTS

Language ability

There were differences in language ability between the two groups of children. Children with MHL had poorer receptive and expressive language abilities than the NH children, $t(46) = -4.54$, $p < 0.001$, $d = 1.31$, and $t(44) = -4.32$, $p < 0.001$, $d = 1.25$ respectively (see Table 2).

Joint engagement

Differences between groups were found for the total duration of joint engagement, $t(47) = -2.42$, $p = 0.030$, $d = .66$, and the mean time of each episode of joint engagement $t(47) = -2.69$, $p = 0.010$, $d = .79$, with a briefer episode of joint engagement found for the MHL group (see Table 2). The success rate of both parent and child initiations differed between groups, respectively $t(45) = -2.71$, $p = 0.010$, $d = .82$, and $t(39) = -2.31$, $p = 0.027$, $d = .71$. Both parents and children within the MHL group were less successful in establishing joint engagement than the parents and children in the NH group. The results remained the same when the interactions of the two parents with HL in the MHL group were excluded from the analysis.

Emotional availability

A 2 (Group: MHL and NH) x 5 (Emotional availability scales) Multivariate Analysis of Variance (MANOVA) was conducted to test for differences in the quality of interaction. The MANOVA produced no main effect for group, $F(5, 45) = 0.81$, $p = 0.549$, $\eta_p^2 = .09$. The parent-child interactions of children with MHL did not differ from their hearing peers in regard to sensitivity, structuring, non-intrusiveness, responsiveness, and involvement (see Table 2). These results did not change when the interactions of the two parents with HL in the MHL group were excluded from the analyses.

Table 2. Emotional availability, duration of joint engagement and success rate of initiations by group

	MHL			NH		
	n	Mean (SD)	Range	n	Mean (SD)	Range
Emotional availability						
Child Scales						
Responsiveness	25	5.5 (1.1)	3.0-6.5	26	5.8 (0.7)	4.0-6.5
Involvement	25	5.6 (1.1)	3.0-6.5	26	5.8 (0.7)	4.0-6.5
Parent Scales						
Sensitivity	25	5.6 (0.9)	3.5-7.0	26	5.7 (0.7)	4.5-6.5
Non-Intrusiveness	25	5.6 (0.9)	3.0-6.5	26	5.9 (0.5)	5.0-6.5
Structuring	25	5.6 (1.1)	3.0-7.0	26	5.9 (0.7)	4.0-6.5
Joint engagement						
Total duration of JE (sec.)*	23	200 (64)	50-288	26	241 (61)	43-300
Mean duration of JE (sec.)*	23	43 (31)	7-144	26	98 (93)	8-300
Parent success rate JE*	23	0.63 (.24)	0.11-1.00	26	0.83 (.25)	0.20-1.00
Child success rate JE*	23	0.82 (.28)	0.00-1.00	26	0.97 (.11)	0.50-1.00
Language ability						
Receptive language***	23	93.3 (16.6)	55-121	25	111.6 (10.3)	90-134
Expressive language***	21	94.1 (15.9)	65-117	25	110.9 (10.3)	95-135

Abbreviations: MHL Moderate Hearing Loss, NH Normal hearing, SD Standard deviation, JE Joint Engagement
*$p < 0.05$, ***$p < 0.001$

Table 3. Correlations age, degree of HL, emotional availability, and duration of communicative engagement with language ability

	Receptive language	Expressive language
Age	.05	-.04
Degree HL[a]	-.11	-.31
C- Responsiveness	.44**	.29*
C- Involvement	.39**	.32*
P-Sensitivity	.45***	.29*
P-Non-Intrusiveness	.36*	.22
P-Structuring	.47***	.35*
Total duration JE (sec)	.45**	.33*
Mean time JE (sec)	.39**	.29

Abbreviation: JE Joint Engagement
[a] only available for the children with MHL. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Associations between parent-child interaction and child's language ability

As we found no significant differences in the strength of the correlations between the two groups, we collapsed the data of both groups. Pearson's correlation coefficients between age, degree of HL, emotional availability, and joint engagement duration with language ability are presented in Table 3. No significant associations between degree of

HL and age were found with language ability. All emotional availability subscales were positively related to children's receptive and expressive language ability with the exception of non-intrusiveness that was unrelated to expressive language. Total and mean duration of joint engagement were related to receptive language ability. Further, total duration of joint engagement was also related to expressive language ability. In figure 1 and 2 the relation between total duration of joint engagement and language ability is presented. Furthermore, the emotional availability subscales were positively related to the total duration of joint engagement duration (Table 4) and the subscales structuring and non-intrusiveness were positively related to mean duration of joint engagement.

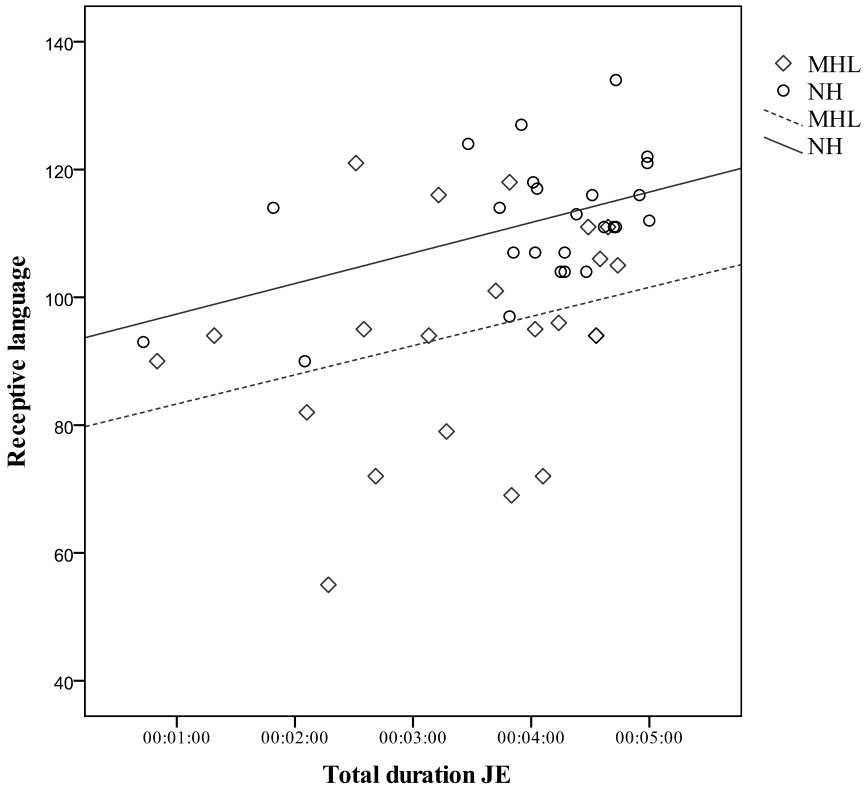

Figure 1. This figure shows the relation between the duration of joint engagement (JE) and receptive language standard scores by group

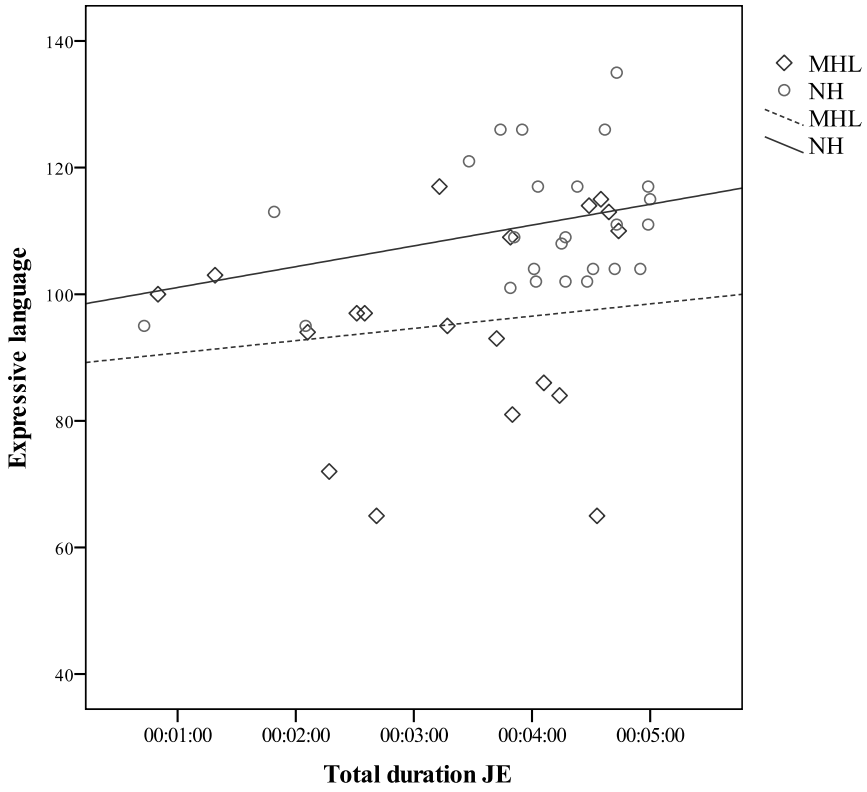

Figure 2. This figure shows the relation between the duration of joint engagement (JE) and expressive language standard scores by group

Table 4. Correlations emotional availability and duration of joint engagement

	Total duration JE	Mean time of JE
C- Responsiveness	.47***	.21
C- Involvement	.47***	.30*
P-Sensitivity	.31*	.18
P-Non-Intrusiveness	.46***	.25
P-Structuring	.54***	.30*

Abbreviation: JE Joint Engagement. * $p < 0.05$, *** $p < 0.00$

DISCUSSION

Parent-child interactions are crucially important for a child's development (Bornstein et al., 2010). Children with a disability, such as hearing loss, may need to rely even more strongly on a positive and supporting relationship with their caregivers (Pressman et al., 1999). To the best of our knowledge, this study is the first to examine joint engagement and emotional availability of parent-child interactions in a special group that has received little attention in the research literature. The outcomes of the current study revealed that children with MHL and their parents were less successful in establishing joint engagement compared with children with NH and their parents. Also, they had briefer episodes of joint engagement. No differences between groups were found for the levels of emotional availability. Children with better language abilities had interactions with longer episodes of joint engagement and higher levels of emotional availability.

In line with the results of studies on children with more severe HL (Gale & Schick, 2009; Cejas et al., 2014; Prezbindowski et al., 2015), the children with MHL in our study also engaged in briefer episodes of joint engagement with their parents than the children with NH. One reason for these briefer episodes might be the lower language abilities of children with MHL compared to children with NH. In our study children with lower language abilities had briefer episodes of joint engagement. This confirms similar results in children with severe to profound HL (Cejas et al., 2014). Language is an important factor in keeping interactions going. Understanding what the other is saying is necessary for responding adequately. When social partners fail to understand each other well, communication breakdowns lay ahead, resulting in briefer episodes of joint engagement.

Children with NH and their parents can use spoken language for an ongoing interaction even without making eye contact. Spoken language is less accessible in noisy environments for children with MHL. Therefore, they need to divide their visual attention between their parent and their toys during play to maintain joint engagement. Because the children in our sample were quite young, they might have been less experienced in using both auditory and visual information simultaneously.

Another explanation for the briefer episodes of joint engagement might be the lower success rate of establishing joint engagement in the MHL group. The skills needed to establish joint engagement are probably also needed to maintain joint engagement. Possibly, children with MHL were less skilled in directing a parent's attention or their parents were less responsive to their initiations and vice versa. The results were in line with Nittrouer (2010) who reported that parents of children with moderate to profound HL were less verbally responsive to their children's initiations. Also, in comparison with deaf parents, hearing parents of children with HL used less visual-tactile engagement strategies than deaf parents during interactions (Loots et al., 2005). Loots et al. suggested that hearing parents of children with HL should learn visual-tactile engagement strategies in order to better facilitate communicative exchange with their children.

The findings of the current study have implications for how children with MHL engage in social interactions and, by doing so, enhance their language skills. When interactions between parents and children are briefer, parents have less opportunity to expand their children's vocabulary. Furthermore, briefer interactions might also provide fewer opportunities to exchange social information.

The findings of the analyses regarding the levels of emotional availability in the parent-child interactions were positive. The interactions of children with and without MHL did not differ on any of the emotional availability measures. Parents of toddlers with MHL were sensitive to their children's signals and needs and they responded accurately with affect and pleasure to them, comparable to the interactions of parents of NH children. Furthermore, parents of both groups of toddlers structured their child's play, and they tended to follow their child's lead. The children with MHL were responsive to their parents; they showed pleasure and eagerness in the interactions. Further, they involved their parents in a comfortable, affectively positive manner into their play, just like their NH peers.

The emotional availability outcomes seem to contrast those concerning joint engagement. While both measures reflected interaction aspects such as responsive behavior and initiation skills, note that one is a more a qualitative measure and the other more quantitative. Although the proportion of successful initiations is lower in the MHL group and the episodes are briefer, children and their parents engage with pleasure and affect when they have episodes of joint engagement. Qualitative aspects of parent-child interaction such as affect, respect for child's autonomy, and having fun together did not seem to be negatively affected in children with MHL. Emotional availability measures were related to the duration of joint engagement. Parent-child interactions with higher levels of emotional availability had longer episodes of joint engagement.

The outcomes of our study contrast with findings of studies with CI children. Quittner and colleagues (2013) for example reported the children with CI attained lower levels of emotional availability in parent-child interactions when compared to hearing children. Attaining optimal emotional availability may be easier for children with MHL than CI children. Since most deaf children receive a CI around their first birthday, they have more limited auditory access during the first months of life than MHL children. Infants with MHL will respond more often to their parent's voices and sounds than profoundly deaf children, which may impact the early interactions with their parents. Indeed, the sample of Quittner et al. included deaf children who received a CI between five months and five years of age.

Alternatively, the setting in which the video-recordings were made might have been different in the two studies. In the present study, video-recordings of the parent and child playing were made at home, while in the Quittner et al. (2013) study the recordings were made at the CI center. Parents might feel more confident in their home environment and

consequently may have interacted more naturally. CI children undergo an intensive rehabilitation period with frequent visits to CI centers. These visits might be stressful for parents and this may impact the interaction during the video-recordings. Future research could further examine the differences in outcomes between the two studies and test the possible explanations suggested here.

Children's language abilities were positively related to both the duration of joint engagement and levels of emotional availability, conform to studies in other groups of children with HL (Van Dam et al. 2012; Quittner et al. 2013; Cejas et al. 2014; Ambrose et al. 2015). Higher levels of emotional availability were related to better receptive and expressive language skills. Furthermore, children who engaged in longer episodes of joint engagement with their parents had better language skills than children who engaged in briefer interactions. Since children with MHL are at risk for language difficulties (Tomblin et al. 2015b), parent-child interactions are a critical target for family-centered early intervention programs.

In the current study we focused on a well-defined group of children with MHL. This group of children has only recently become the focus of research (e.g. Ambrose et al. 2015; McCreery et al., 2015; Stika et al. 2013; Netten et al. 2015, 2016; Tomblin et al., 2015b; Laugen et al. 2016a, 2016b; Walker et al. 2015). For example, in the OCHL study (Tomblin et al., 2015), the language outcomes of infants and preschool-age with mild-to-severe HL were longitudinally examined. The results of Tomblin et al. indicated that these children are at risk of language difficulties, a finding in line with our results and other studies on this population (Koehlinger et al. 2013; Netten et al. 2015; Hammer & Coene, 2016). The findings of the current study revealed more insight in the association between MHL children's language ability and the interaction with their parents.

In addition to language difficulties, social-emotional delays and/or difficulties have been reported in studies on children with MHL (Dirks et al. 2017, Laugen et al. 2016; Netten et al. 2017). For example, 30-month-old toddlers with MHL lagged behind their hearing peers in joint attention and intention understanding (Dirks et al.). In an older group of MHL children (3 to 5 year olds), difficulties with theory of mind reasoning (Netten et al.) and more psychosocial problems (Laugen et al.) were reported. More longitudinal research into this group of children is needed to find out whether the children with MHL catch up with their NH peers. Furthermore, the relation between parent-child interaction and the social-emotional development of children with MHL is also relevant to explore in future studies.

A relatively high percentage of children with parents with HL participated in this study. We used no specific requirement strategies that could explain this percentage. A high percentage (18%) was also reported in a recent study of Wong et al.. In many studies children with parents with HL are excluded, which might have caused a bias in these samples. This could be an important issue to address in future studies.

Clinical implications

While the groups did not differ in terms of the mean level of emotional availability, some parent-child interactions in both groups received low scores. This may indicate that early intervention is necessary for some parents and children with MHL, given the relationship between parent-child interaction and both language development. Further, the briefer episodes of joint engagement and the lower success rate of establishing joint engagement ask for effective interventions that enhance parent's communication strategies. Video-feedback interventions have proven to be effective in promoting emotional availability in hearing children with behavioral problems (Fukkink, 2008). In a recent study in children with HL, a short video-feedback intervention was used to promote parents' self-esteem and communication strategies (Lam et al. 2015). In addition, increases in emotional availability were also reported.

Limitations

One potential limitation of this study is the focus solely on the relation between parent-child interaction and language development. Since children with MHL are also at risk of social-emotional difficulties, it is also relevant to examine the relationship between parent-child interactions and children's social-emotional development. This would give a broader view of the interactions between important variables which are related to the development of children with MHL. Another limitation is the cross-sectional and correlational nature of the study, which did not allow specifying the direction of the associations between parent-child interaction and language ability. Although the results of Quittner et al. (2013) in CI children suggest that emotional availability is predictive of language outcomes, further studies in MHL children are needed.

Conclusions

The present study shows that there are comparable levels of emotional availability in the interactions between parents and toddlers with MHL, and the interactions between parents and NH toddlers. Since emotional availability is an important predictor of positive child outcomes, these findings are promising. Higher levels of emotional availability were related to better language ability. The episodes of joint engagement of MHL toddlers and their parents were briefer than those of their peers with NH and they had more difficulties in establishing joint engagement. These results suggest that it may be more difficult for parents to have ongoing interactions when their child has MHL. Given the relationship between emotional availability and various areas of child development, professionals working with the MHL population should be alert to less optimal interactions, and information about early parent-child interactions should be emphasized in early intervention programs.

REFERENCES

Ambrose, S. E., VanDam, M., & Moeller, M. P. (2014). Linguistic input, electronic media, and Communication Outcomes of Toddlers With Hearing Loss. *Ear and Hearing, 35*(2), 139-147.

Ambrose, S. E., Walker, E. A., Unflat-Berry, L. M., et al. (2015). Quantity and quality of caregivers' linguistic input to 18-month and 3-year-old children who are hard of hearing. *Ear and Hearing, 36*, 48S-59S.

Bakeman, R., & Adamson, L. B. (1984). Coordinating attention to people and objects in mother-infant and peer-infant interaction. *Child Development*, 1278-1289.

Barker, D. H., Quittner, A. L., Fink, N. E., et al. (2009). Predicting behavior problems in deaf and hearing children: The influences of language, attention, and parent-child communication. *Development and Psychopathology, 21*(2), 373-392.

Bernier, A., Carlson, S. M., Deschênes, M., et al. (2012). Social factors in the development of early executive functioning: A closer look at the caregiving environment. *Developmental Science, 15*(1), 12-24.

Biringen, Z. (2000). Emotional availability: conceptualization and research findings. *Amercian Journal Orthopsychiatry*, *70*(1), 104.

Biringen, Z., & Easterbrooks, M. A. (2012). Emotional availability: concept, research, and window on developmental psychopathology. *Developmental Psychopathology, 24*(01), 1-8.

Biringen, Z., & Robinson, J. (1991). Emotional availability in mother-child interactions: a reconceptualization for research. *American Journal of Orthopsychiatry, 61*(2), 258.

Bornstein, M. H., Suwalsky, J. T., Putnick, D. L., et al. (2010). Developmental continuity and stability of emotional availability in the family: Two ages and two genders in child-mother dyads from two regions in three countries. *International Journal of Behavioral Development,* 34(5), 385-397.

Cejas, I., Barker, D. H., Quittner, A. L., et al. (2014). Development of joint engagement in young deaf and hearing children: effects of chronological age and language skills. *Journal of Speech Language and Hearing Research, 57*(5), 1831-1841.

Cruz, I., Quittner, A. L., Marker, C., DesJardin, J. L., & Team, C. D. I. (2013). Identification of effective strategies to promote language in deaf children with cochlear implants. *Child Development, 84*(2), 543-559.

Depowski, N., Abaya, H., Oghalai, J., et al. (2015). Modality use in joint attention between hearing parents and deaf children. *Frontiers in Psychology, 6*.

Dirks, E., Uilenburg, N., & Rieffe, C. (2016). Parental stress among parents of toddlers with moderate hearing loss. *Research in Developmental Disabilities, 55*, 27-36.

Dirks, E., Ketelaar, L., van der Zee, R., et al. (2017). Concern for Others: A Study on Empathy in Toddlers with Moderate Hearing Loss. *Journal of Deaf Studies and Deaf Education, 22 (2): 178-186*.

Dunn, J., Brown, J., Slomkowski, C., et al. (1991). Young childrens understanding of other peoples feelings and beliefs - individual-differences and their antecedents. *Child Development, 62*(6), 1352-1366.

Easterbrooks, M., & Biringen, Z. (2005). The emotional availability scales: methodological refinements of the construct and clinical implications related to gender and at-risk interactions. *Infant Mental Health Journal, 26*(4), 291-294.

Emde, R. N. (2000). Next steps in emotional availability research. *Attachment & Human Development, 2*(2), 242-248.

Emde, R. N., & Easterbrooks, M. A. (1985). Assessing emotional availability in early development *Early identification of children at risk* (pp. 79-101): New York: Plenum Press.

Fay-Stammbach, T., Hawes, D. J., & Meredith, P. (2014). Parenting influences on executive function in early childhood: A review. *Child Development Perspectives, 8*(4), 258-264.

Fukkink, R. G. (2008). Video feedback in widescreen: A meta-analysis of family programs. *Clinical Psychology Review,* 28(6), 904-916.

Gale, E., & Schick, B. (2009). Symbol-infused joint attention and language use in mothers with deaf and hearing toddlers. *American Annals of the Deaf, 153*(5), 484-503.

Hammer, A., & Coene, M. (2016). Finite Verb Morphology in the Spontaneous Speech of Dutch-Speaking Children With Hearing Loss. *Ear and Hearing*, 37(1), 64-72

Koehlinger, K. M., Van Horne, A. J. O., & Moeller, M. P. (2013). Grammatical Outcomes of 3-and 6-Year-Old Children Who Are Hard of Hearing. *Journal of Speech, Language and Hearing Research, 56*(5), 1701-1714.

Kok, R., Lucassen, N., Bakermans-Kranenburg, M. J., et al. (2014). Parenting, corpus callosum, and executive function in preschool children. *Child Neuropsychologly, 20*(5), 583-606.

Kurtzer-White, E., & Luterman, D. (2003). Families and children with hearing loss: Grief and coping. *Mental Retardation and Developmental Disabilities Research Reviews, 9*(4), 232-235.

Lam-Cassettari, C., Wadnerkar-Kamble, M. B., & James, D. M. (2015). Enhancing Parent-Child Communication and Parental Self-Esteem With a Video-Feedback Intervention: Outcomes With Prelingual Deaf and Hard-of-Hearing Children. *Journal of Deaf Studies and Deaf Education, 20*(3), 266-274.

Laugen, N. J., Jacobsen, K. H., Rieffe, C., et al. (2016a). Emotion Understanding in Preschool Children with Mild-to-Severe Hearing Loss. *Journal of Deaf Studies and Deaf Education*.

Laugen, N. J., Jacobsen, K. H., Rieffe, C., et al. (2016b). Predictors of Psychosocial Outcomes in Hard-of-Hearing Preschool Children. *Journal of Deaf Studies and Deaf Education., 21*(3), 259-267.

Lederberg, A. R. (1984). Interaction between deaf preschoolers and unfamiliar hearing adults. *Child Development*, 598-606.

Lederberg, A. R., & Mobley, C. E. (1990). The effect of hearing impairment on the quality of attachment and mother-toddler interaction. *Child Development, 61*(5), 1596-1604.

Loots, G., Devisé, I., & Jacquet, W. (2005). The impact of visual communication on the intersubjective development of early parent–child interaction with 18-to 24-month-old deaf toddlers. *Journal of Deaf Studies and Deaf Education*. *10*(4), 357-375.

Lucassen, N., Kok, R., Bakermans-Kranenburg, M. J., et al. (2015). Executive functions in early childhood: the role of maternal and paternal parenting practices. *Britisch Journal of Developmental Psychology, 33*(4), 489-505.

MacTurk, R. H., Meadow-Orlans, K. P., Koester, L. S., et al. (1993). Social support, motivation, language, and interaction: A longitudinal study of mothers and deaf infants. *American Annals of the Deaf, 138*(1), 19-25.

McCreery, R. W., Walker, E. A., Spratford, M. et al. (2015). Speech recognition and parent-ratings from auditory development questionnaires in children who are hard of hearing. *Ear and Hearing*, 36(0 1), 60S.

McGraw, K. O., & Wong, S. P. (1996). Forming inferences about some intraclass correlation. *Psychological Methods*, 1, 30–46.

Meadow-Orlans, K. P., & Steinberg, A. G. (1993). Effects of infant hearing loss and maternal support on mother-infant interactions at 18 months. *Journal of Applied Developmental Psychology, 14*(3), 407-426.

Moeller, M. P., & Tomblin, J. B. (2015). An Introduction to the Outcomes of Children with Hearing Loss Study. *Ear and Hearing*, 36(0 1), 4S-13S.

Mitchell, R. E., & Karchmer, M. A. (2004). Chasing the mythical ten percent: Parental hearing status of deaf and hard of hearing students in the United States. *Sign Language Studies, 4*(2), 138-163.

Moreno, A. J., Klute, M. M., & Robinson, J. L. (2008). Relational and individual resources as predictors of empathy in early childhood. *Social Development*, 17(3), 613-637.

Netten, A. P., Rieffe, C., Theunissen, S. C., et al. (2015). Early identification: Language skills and social functioning in deaf and hard of hearing preschool children. *International Journal of Pediatric Otorhinolaryngology, 79*(12), 2221-2226.

Netten, A. P., Rieffe, C., Soede, W., et al. (2017). Can You Hear What I Think? Theory of Mind in Young Children With Moderate Hearing Loss. *Ear and Hearing,* 38(1):1-6.

Nittrouer, S. (2010). *Early Development of Children with Hearing Loss*. San Diego, CA: Plural Publishing.

Nowakowski, M. E., Tasker, S. L., & Schmidt, L. A. (2009). Establishment of joint attention in dyads involving hearing mothers of deaf and hearing children, and its relation to adaptive social behavior. *American Annals of the Deaf*, *154*(1), 15-29.

Pressman, L., Pipp-Siegel, S., Yoshinaga-Itano, et al. (1999). Maternal sensitivity predicts language gain in preschool children who are deaf and hard of hearing. *Journal of Deaf Studies and Deaf Education*, 4(4), 294–304.

Prezbindowski, A. K., Adamson, L. B., & Lederberg, A. R. (1998). Joint attention in deaf and hearing 22 month-old children and their hearing mothers. *Journal of Applied Developmental Psychology,* 19(3), 377–387.

Quittner, A. L., Cruz, I., Barker, D. H., et al. (2013). Effects of maternal sensitivity and cognitive and linguistic stimulation on cochlear implant users' language development over four years. *Journal of Pediatrics, 162*(2), 343-348 e343.

Schaerlaekens, A., Zink, I., & Van Ommeslaeghe, K. (1993). Reynell Taalontwikkelingsschalen. Handleiding Berkhout, Nijmegen

Schlichting, J. E. P. T., Eldik, M. V., Lutje Spelberg, H. C. et al. (1995). Schlichting test voor taalproductie.Lisse: Swets Test Publishers.

Stevenson, J., Kreppner, J., Pimperton, H., et al. (2015). Emotional and behavioural difficulties in children and adolescents with hearing impairment: a systematic review and meta-analysis. *European Child Adolescence Psychiatry, 24*(5), 477-496.

Stika, C. J., Eisenberg, L. S., Johnson, K. C., et al. (2015). Developmental outcomes of early-identified children who are hard of hearing at 12 to 18 months of age. *Early Human Development, 91*(1), 47-55.

Tomblin, J. B., Walker, E. A., McCreery, et al., (2015b). Outcomes of children with hearing loss: Data collection and methods. *Ear and Hearing 36*(0 1), 14S-23S.

Tomblin, J. B., Harrison, M., Ambrose, S. E. et al. (2015a). Language outcomes in young children with mild to severe hearing loss. *Ear and Hearing*, 36(0 1), 76S.

Vaccari, C., & Marschark, M. (1997). Communication between parents and deaf children: Implications for social-emotional development. *Journal of Child Psychology and Psychiatry, 38*(7), 793-801.

VanDam, M., Ambrose, S. E., & Moeller, M. P. (2012). Quantity of parental language in the home environments of hard-of-hearing 2-year-olds. *Journal of Deaf Studies and Deaf Education*, 17(4), 402-420.

Walker, E. A., Holte, L., McCreery, R. W., Spratford, M., Page, T., & Moeller, M. P. (2015). The influence of hearing aid use on outcomes of children with mild hearing loss. *Journal of Speec,h Language anding Hear Research,* 58(5), 1611-1625.

Ziv IV, Y., Aviezer, O., Gini, M., et al. (2000). Emotional availability in the mother–infant dyad as related to the quality of infant–mother attachment relationship. *Attachment and Human Development, 2*(2), 149-169.