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Talk with me! Parental linguistic input to toddlers with moderate hearing loss

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Abstract

This study examined the quantity and quality of parental linguistic input to toddlers with moderate hearing loss (MHL) compared with toddlers with normal hearing (NH). The linguistic input to eighteen toddlers with MHL and twenty-four toddlers with NH was examined during a 10-minute free-play activity in their home environment. Results showed that toddlers with MHL were exposed to an equivalent amount of parental linguistic input compared to toddlers with NH. However, parents of toddlers with MHL used less high-level facilitative language techniques, used less mental state language, and used shorter utterances than parents of toddlers with NH. Quantity and quality measures of parental linguistic input were positively related to the expressive language abilities of toddlers with MHL.

Keywords: parental linguistic input; hearing loss; language development

Introduction

Language acquisition occurs by means of interactions with knowledgeable others (Vygotsky, 1978). Parents have a crucial role in the language development of their young children. By talking to children about what they are seeing or doing, parents promote children's language abilities. Both the quantity and quality of parental linguistic input can impact a child's language development (Hart & Risley, 1995; Rowe, 2012; Weizman & Snow, 2001).

When a child has a moderate hearing loss (40–60 dB HL) (MHL), parents may encounter more challenges in providing optimal language input (in terms of amount and quality of talk) to their children. Since most children with hearing loss (HL) have hearing parents (Mitchell & Karchmer, 2004), parents often have no experience

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with HL, which may hamper their intuitive parent behavior. Given that children with MHL are more at risk for language difficulties (Moeller, Tomblin, Yoshinaga-Itano, Connor, & Jerger, 2007; Tomblin *et al.*, 2015), parents may need to adapt their linguistic input in order to enhance their child's language development. In the current study, the relationship between the quantity and quality of parental linguistic input and the language abilities of toddlers with MHL was examined.

Previous studies on linguistic input in children with HL have focused on children with a broader range of HL than solely MHL, and were conducted at research centers using pictures or story-book reading activities (Ambrose, Walker, Unflat-Berry, Oleson, & Moeller, 2015; DesJardin *et al.*, 2014). The current research adds to these two studies by looking specifically at MHL toddlers in their natural home environment during a free-play setting. The amount and quality of talk directed to children with MHL and in relation to their language abilities give insight that is relevant to supporting parents in providing an optimal linguistic environment. In addition, in contrast to work done in previous studies, the present study included an exploration of the use of complex abstract language (mental state language) as an indication of the quality of talk.

Parental linguistic input

A large body of research suggests that parental communication with children is related to children's language development (Hart & Risley, 1995; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Rowe, 2012; Weizman & Snow, 2001). The quantity of parental linguistic input (i.e., the number of word tokens, or the total number of words, or utterances, spoken) is an important determinant of children's vocabulary development (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Weizman & Snow, 2001). Children have better language skills when their parents talk more frequently to them and expose them to a larger number of words. The more talk a child is exposed to, the more opportunities they have to become familiar with certain words, and to practice skills important for word learning (Weisleder & Fernald, 2013).

The quality of parental talk is also associated with child language development (Huttenlocher *et al.*, 2010). Quality of talk is reflected by linguistic characteristics such as vocabulary diversity, grammatical complexity (mean length of utterance), and the complexity of words (e.g., mental state language), but quality is also reflected in the use of conversational skills such as the use of language-evoking techniques (Ambrose *et al.*, 2015; Golinkoff, Hoff, Rowe, Tamis-LeMonda, & Hirsh-Pasek, 2019; Rowe, 2012; Taumoepeau, 2016). The mean length of utterances (MLU) reflects the degree of complexity of language and as such is considered an indication of the richness of the linguistic input (Hoff & Naigles, 2002). Children who are exposed to longer utterances by their parents have better comprehension and expressive language vocabularies (Bornstein, Haynes, & Painter, 1998). The diversity of parent vocabulary input is also positively related to children's vocabulary (Hart & Risley, 1995; Hoff & Naigles, 2002; Taumoepeau, 2016).

Complexity of parent vocabulary is also a feature of the quality of linguistic input; for example the use of mental state language (Rowe, 2013). This is an abstract form of language referring to cognitive terms (e.g., 'think', 'know', 'believe'), desires (e.g., 'want', 'like', 'hope'), and emotions (e.g., 'happy', 'sad', 'angry'). Because mental state language does not pertain to concrete, visible objects, understanding its meaning can

be particularly challenging for children. In the development of mental state language parents first talk about a child's desires ("You want milk") and emotions ("You are happy"), and later about their knowledge or thinking ("You think there is milk in the fridge") (Taumoepeau & Ruffman, 2008). Between the age of 15 months through 33 months, there is an increase in mental state language uttered by the mother and child. Taumoepeau and Ruffman also found that maternal mental state language (particularly related to cognitive terms) was a predictor of a child's later use of mental state language.

Finally, the use of conversational skills such as language-evoking techniques reflects the quality of parental talk. The use of these techniques requires more complex responses by the child and they are positively related to child language skills (Rowe, Leech, & Cabrera, 2017). Parallel talk (talking about what a child is doing, seeing, or touching), expansion (restating and completing a child's utterance with correct grammar), recasting (changing a child's utterance into a question), and asking open questions (in and outside the immediate context, and sincere request) are examples of so-called high-level facilitative language techniques that are positively associated with receptive and expressive language skills (Cruz, Quittner, Marker, DesJardin, & Team, 2013; Girolametto, Weitzman, Wiigs, & Pearce, 1999). Examples of low-level facilitative language techniques are imitation (repeating a child's utterance), labeling (stating the name of an object or picture), linguistic mapping (putting into words what a child may be trying to communicate), and directive language (Ambrose *et al.*, 2015; DesJardin *et al.*, 2014; Rowe, 2008).

Research suggests that low-level facilitative language techniques promote language development in young children at the prelinguistic stage (Girolametto *et al.*, 1999; Yoder & Warren, 2001), whereas high-level facilitative techniques enhance this development in older children who use more complex language structures (Rowe, 2012).

This implies that different levels of linguistic input matter differentially across child language development. Rowe (2012) validated this perspective in a longitudinal study on vocabulary growth in children aged between 18 and 42 months. The total number of words that parents used was most important during the second year of life, whereas vocabulary diversity was more important in the third year, and the use of decontextualized language was most beneficial in the fourth year of life. Aside from the differential effect of quantity and quality input at different ages, these two measures are also inter-related (e.g., parents who talk more also produce more diverse talk; Hoff & Naigles, 2002).

Parental linguistic input to children with MHL

Children with MHL are more at risk for language difficulties than children with normal hearing (NH) (Moeller *et al.*, 2007; Tomblin *et al.*, 2015). Despite their use of hearing aids, most children with MHL have inconsistent access to speech, which may impact their language development (Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011; McCreery *et al.*, 2015; Stiles, Bentler, & McGregor, 2012). Early intervention programs for children with HL are often focused on optimizing children's language development; these programs emphasize the potential role that parents can play (Moeller, Carr, Seaver, Stredler-Brown, & Holzinger, 2013). The assumption is that rich conversations, consisting of a diverse vocabulary and of many opportunities for the child to engage, will boost the language abilities of children with MHL. It is

therefore important to identify strategies that promote high-quality language use by parents in their interactions with children with MHL.

A limited number of studies have been published on parental linguistic input in children with HL. Most of these studies examined children with a range of hearing loss (20–90 dB HL) (Ambrose, VanDam, & Moeller, 2014; Ambrose *et al.*, 2015; Desjardin *et al.*, 2014; VanDam, Ambrose, & Moeller, 2012). The current study focused specifically on children with MHL (40–60 dB HL). Outcomes of the previous studies showed that children (two years of age and younger) with mild to severe HL were exposed to a similar amount of parental talk (number of words) than children with NH (Ambrose *et al.*, 2015; VanDam *et al.*, 2012). These findings were in line with those of Nittrouer (2009) and Aragon and Yoshinaga-Itano (2012), who studied groups of children with a range of HL (both hard-of-hearing and deaf). Ambrose *et al.* (2015), however, reported differences between three-year-olds with mild to severe HL in terms of the quantity of parental linguistic input. Three-year-old children with MHL in their study were exposed to fewer words than their peers with NH. Furthermore, they also found that these children were exposed to a limited variety of words and shorter utterances (quality of language). Ambrose *et al.* noted that parents of children with HL may have adapted their own language levels as a result of their sensitivity to the lower language abilities of their children. While language differences between young children with HL and young children with NH are less obvious, they become more apparent when children grow older, and consequently parents may adapt their language levels accordingly. This reasoning may explain why differences in the number of words, the variety of words, and length of utterance were found between three-year-old children with HL and NH but not in two-year-olds.

The quality of linguistic input is also reflected by parents' use of facilitative language techniques. Ambrose *et al.* (2015) and Desjardin *et al.* (2014) examined the use of these techniques during parent–child interactions in children with mild to severe HL. Parents' use of high-level facilitative language techniques such as recasting, asking open-ended questions, and expansion was positively related to children's oral language abilities. These findings are in line with research on children with cochlear implants (Cruz *et al.*, 2013; Desjardin & Eisenberg, 2007) and on children with moderate to profound HL (Nittrouer, 2009). While parents' use of high-level language techniques is thus important in promoting the language abilities of children with mild to severe HL, parents of these children used high-level language techniques less frequently than parents of children with NH (Ambrose *et al.*, 2015).

Ambrose and colleagues (2015), however, also reported that parents of children with mild to severe HL used more directing language than parents of children with NH. This low-level language technique was negatively related to children's language abilities. Directing language is used to direct a child's attention or behavior (e.g., "Say Mummy"; "Look here"; "Don't touch that"). Not all low-level language techniques are (negatively) related to language abilities in children with mild to severe HL. Desjardin and colleagues (2014), for example, found that a composite score of low-level techniques (e.g., labeling, linguistic mapping, commenting, directing, asking closed-ended questions, and imitating) was not related to language abilities of children with mild to severe HL. The use of a composite score of low-level language techniques and the larger age range of the children included in the study may have resulted in different outcomes than those reported by Ambrose and colleagues (2015). Parents' talk to children with mild to severe HL did seem to change over

time: parents used less directive language and provided their children with more high-level language when their children were older (Ambrose *et al.*, 2015).

Parental use of mental state language is another feature of the quality of the linguistic input. The exposure to this complex abstract language is not only beneficial for children's language development, but also for their social-emotional development. This is especially of interest in children with MHL since they encounter difficulties in their social-emotional development (Dirks *et al.*, 2017; Laugen, Jacobsen, Rieffe, & Wichstrom, 2016, 2017; Netten *et al.*, 2015, 2017). Talking with children about their own and others' thoughts, desires, and feelings promotes their social-emotional development (Devine & Hughes, 2018; Drummond, Paul, Waugh, Hammond, & Brownell, 2014; Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Meins, 2013; Peterson & Slaughter, 2003).

Until now, two studies have examined parents' use of mental state language in interactions with children with HL (Moeller & Schick, 2006; Morgan *et al.*, 2014). In their study of deaf five-year-old children, Moeller and Schick (2006) coded signed references to mental states during mother-child interactions. Verbal expressions were coded for the hearing controls. Although there were no differences in the total number of utterances, mothers of deaf children made less frequent and less varied references to mental states than mothers of children with NH. The study also reported that children with mothers who made more mental state references showed a better false belief understanding. Reduced access to mental state language was also reported in a younger group of children with HL (Morgan *et al.*, 2014). Mothers of deaf children included in this study referred less often to mental states during spoken conversations about pictures showing social situations than mothers of children with NH. As far as we know, the use of mental state language by parents and children has not yet been examined in children with MHL.

Early intervention

Several studies emphasized the importance of early detection of hearing loss and an early start of intervention by showing better language outcomes in children with HL enrolled early in intervention (Meinzen-Derr, Wiley, & Choo, 2011; Moeller, 2000; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). For example, for infants with congenital hearing loss, early hearing aid fitting (before six months of life) has been shown to be related to better speech and language outcomes compared to later fitting (Ambrose *et al.*, 2014; Tomblin *et al.*, 2015). Hearing aids provide children with better access to spoken language and thus better access to parental talk. Additionally, early enrollment in family-centered intervention programs in which parents are guided in promoting their child's language development result in better language outcomes than later enrollment (Ching *et al.*, 2017; Holzinger, Fellinger, & Beitel, 2011; Meinzen-Derr *et al.*, 2011; Moeller, 2000; Yoshinaga-Itano *et al.*, 1998).

Present study

Recently, studies on young children with mild to severe HL have received increasing attention in the literature (e.g., Koehlinger, Van Horne, & Moeller, 2013; Laugen *et al.*, 2016; Moeller & Tomblin, 2015; Netten *et al.*, 2017; Stika *et al.*, 2015). These studies indicate that even children with less severe HL are at risk for language delays (Koehlinger *et al.*, 2013; Netten *et al.*, 2015; Tomblin *et al.*, 2015). It is therefore

essential that further research is conducted in order to gain insights into how the language development of children with less severe HL (MHL) can be facilitated. Parents play a crucial role in enhancing children's language development. The focus of the current study is on the quality and quantity of parental linguistic input in relation to the language abilities of 30-month-old toddlers with MHL.

In order to examine the quality of parental linguistic input, a number of factors were considered, including the diversity of parent vocabulary and the mean length of utterances parents employed, as well as parents' use of mental state language and use of language-evoking techniques. Quantity of linguistic input was reflected by the number of utterances and words used by parents. Although there are some relevant differences between the current study and the one of Ambrose and colleagues (2015), such as our specific focus on children with MHL, the free-play setting in the home environment (current study) instead of using pictures at the research center, and our additional focus on complex language use (mental state language), it was of interest to use their coding system to examine the use of language-evoking techniques.

In line with the findings of Ambrose *et al.* (2015), we expected that parents of toddlers with MHL would use more low-level language and expose their children to less high-level language than parents of children with NH. Further, we expected the parents to use less mental state language during the interactions (Moeller & Schick, 2006; Morgan *et al.*, 2014). Positive relations between language ability and high-level language use were expected, in addition to negative relations between language ability and low-level language.

We expected that parents of children with MHL would use fewer words during parent-child interactions than parents of children with NH (Ambrose *et al.*, 2015). Furthermore, positive relations were expected between the quantity of parental linguistic input and language abilities (Ambrose *et al.*, 2015). In addition to the relation between linguistic input and language abilities, the relation between hearing loss-related variables (e.g., degree of HL and start intervention) and linguistic input was examined.

Method

Participants

This study is part of a larger study on the psychosocial functioning of toddlers with MHL and their families (Dirks & Rieffe, 2019; Dirks, Uilenburg, & Rieffe, 2016; Dirks *et al.*, 2017). In total, 42 children between 29 and 33 months of age participated in this study. The 18 children with MHL were recruited from two family-centered early intervention centers in the Netherlands. The control group of 24 children with NH was recruited via a well-baby clinic. The children with NH were included in the study if they had passed the neonatal hearing screening and had no known medical or developmental disabilities. Children with MHL were included in the study if 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. Characteristics of the samples are reported in Table 1. Age, gender and maternal education level did not differ between the groups.

The hearing children were born to parents with NH. Of the sample of children with MHL, four fathers and one mother had MHL and one father was deaf. None of the

Table 1. Demographic characteristics of the MHL and NH groups

	MHL	NH
No. of children	18	24
Age, mean (SD) months	30.7 (1.0)	31.0 (0.9)
Age, range months	29–33	30–33
Gender, no (%)		
Male	6 (25%)	12 (50%)
Female	12 (75%)	12 (50%)
Maternal educational level, mean (SD) ^{*1}	2.9 (1.7)	3.2 (0.9)
Degree of hearing loss (dB), mean (SD)	53.6 (8.7)	NA
Age at start FCEI (months), mean (SD)	7.3 (7.5)	NA
Age at start FCEI (months), range	1–24	NA
Age at HA fit (months), mean (SD)	6.5 (5.7)	NA
Age at HA fit (months), range	1–22	NA

Notes. Abbreviations: MHL Moderate Hearing Loss; NH Normal Hearing; SD Standard Deviation; NA Not Available; FCEI, Family-Centered Early Intervention; HA Hearing Aid. ^{*1} (1 = no/primary education, 2 = lower general secondary education, 3 = higher general education, 4 = college/university).

children had more than one parent with hearing loss. At home the children used spoken language in the interactions with their parents (6 parents and children supported their spoken language often with signs, 1 always, 9 sometimes, and 2 never). All children with MHL wore hearing aids and received care from an audiologist. A total of 87% of the children began wearing hearing aids within the first six months of life. Furthermore, all children with MHL participated in a family-centered early intervention program for children with HL, and 78% of the children started in the program within their first six months of life. The family-centered early intervention program included frequent house visits by early interventionists and speech-language therapists. During these house visits, professionals provided support to parents and offered strategies of engagement to promote their child's development. For example, the professionals gave information about the use of hearing aids and the beneficial effects of consistent auditory access on children's language development. Professionals also guided parents in obtaining and directing their child's attention to achieve joint attention, and they discussed language facilitating strategies. In addition to these house visits, parents attended several courses (e.g., sign courses, communication courses, and interactive reading courses) at the center together with other parents. The children attended specialized treatment groups for toddlers with HL

Procedure

Members of the research team visited the families at home. The children and their parents engaged in a 10-minute free-play session with standardized toys. The toys were age appropriate and included building blocks (that could be used to build and as a puzzle), animal figures, and a tea set. Parents were asked to play with their child the way they usually did. All interactions were videotaped. The majority of parent-

child interaction videos (93%) included the mother, and the remaining interactions included the father (MHL = 2 and NH = 1). In the majority of videotaped interactions, parents with NH interacted with their child; one parent-child interaction included a mother with MHL.

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. 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

Linguists assessed the children's receptive and expressive language abilities via two language tests that have been developed and standardized for children between two and five years of age. These tests are widely used for children with and without HL within the Netherlands. Receptive language ability was assessed with the Reynell Developmental Language Scales – Dutch Version (Schaerlaekens & Van Ommeslaeghe, 1993). Expressive language ability was assessed with the Sentence Development Scale of the Schlichting Expressive Language Test (Schlichting, Eldik, Lutje Spelberg, Van der Meulen, & Van der Meulen, 1995). Raw scores are converted to age equivalents and language quotients. The quotient scores are normally distributed scores, with a mean score of 100 and a standard deviation of 15.

Parental linguistic input

Three research assistants transcribed video-recordings of the parent-child interactions. They followed conventions that allow for coding and transcribing speech using the Codes for the Human Analysis of Transcripts (CHAT). The Computerized Language Analysis (CLAN) software (MacWhinney, 2000) was used to analyze the transcriptions in CHAT format. CLAN was used to calculate the number of total utterances (NTU) and number of total words (NTW) for the quantity of talk, and the number of different words (NDW) and mean length of utterances (MLU) for the quality of parent talk. Because the parent-child interactions were between 9.5 and 12 minutes in length (mean: 10.55 min; SD: 0.39) the counts were divided by the number of minutes in the sample and then multiplied by ten to normalize all count variables to 10 minutes. Ten percent of the videos were transcribed independently from each other to calculate inter-rater reliability. The percent agreement of transcribed utterances ranged from 81 to 98% (mean: 90%).

Using a coding procedure developed by Ambrose *et al.* (2015), the quality of parent utterances were coded as serving one of ten mutually exclusive functions: basic acknowledgments, clarification questions, informative statements, informative questions, simple social phrases, test questions, directing utterances, conversational-eliciting utterances that were open ended, conversational-eliciting utterances referencing topics outside the immediate context, and real utterances. Ambrose *et al.* used the latter four types of utterances (directing, two conversational-eliciting types, and real utterances) in their paper because previous literature had indicated that these utterances may specifically enhance or hinder language development (Cruz *et al.*, 2013; DesJardin & Eisenberg, 2007; Hoff-Ginsberg, 1985; Taumoepeau & Ruffman, 2006; Zimmerman *et al.*, 2009). In line with Ambrose *et al.* (2015) we used

these four types of utterances in the current study. Directing utterances are considered lower-level functions which are used to direct a child's attention and/or to tell a child to do something (e.g., "look", "don't touch", or "bring me that cup") (Ambrose *et al.*, 2015; Cruz *et al.*, 2013; DesJardin & Eisenberg, 2007). Conversational-eliciting utterances (open or outside) and real utterances are considered high-level functions. Conversational-eliciting utterances were divided into open utterances and outside utterances. Open utterances invite the child to talk; for example "What kinds of animals do you see?", "Who is in this picture?". Outside utterances require the child to think outside the immediate context to respond (e.g., Ambrose *et al.*, 2015; Cruz *et al.*, 2013; DesJardin & Eisenberg, 2007). Examples of outside utterances are "tell me about the animals at grandparents' home", "Who has a boat?", "Do you have a toy like this at home?". Real utterances are sincere requests for information to which the parent does not necessarily know the answer; for example "What color is your favorite toy?" or "Why do you think the dog is hungry?". These three types of utterances were added together to calculate the number of high-level utterances. Then, the proportion of high-level utterances and directing utterances were calculated.

Two research assistants (linguists) who also transcribed the video-recordings used the 10-level mutual exclusive coding system to code parents' utterances. Intra-class coefficients (ICC) were calculated separately for each variable to assess the absolute agreement between the independent raters. ICC was used because the data was measured on a continuous scale (Mandrekar, 2011). The research assistants coded 20% of the sample independently. The intra-class reliability coefficients ranged from .81 to .95 (mean .87).

Mental state language

The normalized 10-minute parent-child interaction transcriptions were also used to code the number of genuine mental state terms used by both parents and children during interaction. Mental state terms included references to cognitive terms (e.g., 'think', 'know', 'remember', or 'believe'), desires (e.g., 'want', 'like', 'don't like', 'hope', or 'wish'), and emotions (e.g., 'happy', 'sad', 'angry', or 'worried') (Ensor & Hughes, 2008; Moeller & Schick, 2006; Morgan *et al.*, 2014). In the analyses we combined the three categories of mental state terms into one category for two reasons: parents rarely mentioned emotion words, and there were no differences within either group between the number of utterances for desires or beliefs. Because the parent-child interactions were between 9.5 and 12 minutes in length (mean: 10.55 min; SD: 0.39), the counts were divided by the number of minutes in the sample and then multiplied by ten to normalize all count variables to 10 minutes. All of the videos were coded independently from each other by two members of the research team to calculate inter-rater reliability. The intra-class reliability coefficient was $r = .97$.

Statistical analyses

Because of the small sample size and the fact that not all variables met the assumptions of parametric testing, non-parametric tests were used. Group demographics were compared using Mann-Whitney tests. These tests were also used to test for differences between groups in language ability and parental linguistic input. Effect size was estimated with Cohen's *d*. Correlations between the measures were calculated with Spearman's rho correlations. The Bonferroni method was used to control for Type 1 error at the .05 level across comparisons and correlations.

Results

Between-group differences

Table 2 shows the summary statistics and between-group differences in child language abilities and parental linguistic input. Children with MHL had lower receptive and expressive language scores and used less mental state language than the children with NH. No significant differences were found for the quantity of parental linguistic input to children with MHL and NH. Parents of children with MHL used a similar number of words and utterances during the interactions compared to parents of children with NH. Differences between groups were found for quality measures of language input. Children with MHL were exposed to shorter utterances, less high-level language, and less mental state language. No significant differences were found in the exposure to low-level language (directing utterances) and number of different words.

Associations between linguistic input and hearing loss related variables

The associations between parental linguistic input and hearing loss related variables are shown in **Table 3**. No significant associations were found between these variables with the exception of the degree of HL and high-level language. The degree of HL was negatively related to high-level language input; children with more decibels HL were exposed to less high-level language.

Associations between parental linguistic input and child language abilities

Table 4 shows the associations between parental linguistic input and children's language abilities by group. First, no associations were found between children's receptive language and parental talk. Second, for children's expressive language abilities, positive associations with parental talk were found but only in the MHL group. Parents who used more words, longer utterances, and more mental state language had children with better expressive language abilities. Third, parents' use of mental state language was positively related to children's use of mental state language, but only in the MHL group.

Associations between quantity and quality measures of parental linguistic input

Table 5 shows the associations between the quantity and quality of parental linguistic input measures by group (with the MHL group above the diagonal gap and the NH group below the diagonal). Quantity of linguistic input in terms of total numbers of words was positively related to all quality measures in the MHL group except to high- and low-level language techniques. In the NH group no significant correlations between quantity and quality measures were found.

Discussion

Having a MHL puts children at risk for language difficulties (Tomblin *et al.*, 2015) and therefore it is important to optimize their language environment. Parents play a crucial role in promoting young children's language abilities (Hart & Risley, 1995). This study examined the quantity and quality of parental linguistic input to toddlers with MHL

Table 2. Summary statistics of child language and parental linguistic input

	Mean scores (SD)		<i>M</i>	<i>p</i>	<i>d</i>
	MHL (n = 18)	NH (n = 24)			
Child language ability					
Receptive language	99.4 (13.3)	111.6 (10.2)	101.5	0.004	1.01
Expressive language	94.6 (18.3)	110.3 (10.8)	101	0.012	1.01
Mental states	0.9 (1.81)	2.50 (2.39)	101.5	0.002	0.75
Parental linguistic input					
NTU	128.9 (31.7)	129.0 (30.6)	207	0.819	0.00
NTW	548.8 (197.2)	623.4 (156.0)	159	0.147	0.41
NDW	148.9 (44.3)	181.1 (31.7)	128.5	0.026	0.84
MLU	4.0 (0.8)	4.8 (0.6)	113	0.009	1.13
High level^a	0.10 (0.05)	0.16 (0.04)	100	0.003	1.32
Low level ^b	0.15 (0.05)	0.15 (0.07)	212	0.919	0.00
Mental states^c	4.4 (3.4)	9.0 (5.7)	98	0.003	0.98

Notes. Abbreviations: MHL Moderate Hearing Loss; NH Normal Hearing; SD Standard Deviation; NTU Number of Total Utterances; NTW Number of Total Words; NDW Number of Different Words; MLU Mean Length of Utterance. In bold are the significant differences between groups after Bonferroni correction. ^{a,b} proportion of parental utterances that were high/low; ^c number of mental state references.

Table 3. Spearman's rho correlations for HL-related variables and parental linguistic input variables and child language scores for MHL children (n = 18)

	Degree of HL	Age at HA fit (months)	Age at start FCEI (months)
NTU	-0.09	-0.08	-0.05
NTW	-0.29	-0.19	-0.11
NDW	-0.21	-0.09	-0.29
MLU	-0.44	-0.17	-0.13
High level ^a	-0.82*	0.16	0.00
Low level ^b	0.35	-0.63	-0.35
Parental mental states ^c	-0.59	0.01	-0.15
Receptive language	-0.17	-0.09	-0.15
Expressive language	-0.24	-0.31	-0.30
Child mental states	-0.36	-0.26	-0.46

Notes. Abbreviations: HA Hearing Aid; FCEI Family-Centered Early Intervention; **p* < .005; ^{a,b} proportion of parental utterances that were high/low; ^c number of mental state references.

and toddlers with NH in relation to their language abilities. The outcomes revealed that parents of toddlers with MHL were as talkative to their children as parents of children with NH. However, the quality of their linguistic input differed from that of parents of

Table 4. Spearman's rho correlations for parental linguistic input variables and child language scores

	Receptive language		Expressive language		Child mental states	
	MHL (n = 18)	NH (n = 24)	MHL (n = 16)	NH (n = 24)	MHL (n = 18)	NH (n = 24)
NTU	0.44	-0.05	0.52	0.02	0.08	0.26
NTW	0.49	-0.04	0.72*	-0.05	0.31	0.29
NDW	0.27	-0.10	0.53	0.06	0.33	0.17
MLU	0.36	-0.01	0.62*	0.00	0.39	0.07
High level ^a	0.25	-0.08	0.44	0.09	0.51	-0.21
Low level ^b	-0.25	-0.38	0.03	-0.28	-0.19	0.14
Parental mental states ^c	0.36	-0.24	0.65*	-0.10	0.61*	0.15

Notes. Abbreviations: NTU Number of Total Utterances; NTW Number of Total Words; NDW Number of Different Words; MLU Mean Length of Utterance. ^{a,b} proportion of parental utterances that were high/low; ^c number of mental state references; *p < .007.

Table 5. Spearman's rho correlations for parental linguistic measures by group, with the MHL group above the diagonal gap and the NH group below the diagonal

	NTU	NTW	NDW	MLU	High level	Low level	Mental states
NTU		0.78*	0.60	0.24	0.14	0.20	0.56
NTW	0.83*		0.77*	0.77*	0.28	0.20	0.73*
NDW	0.55	0.60		0.70*	0.26	0.23	0.66
MLU	-0.01	0.44	0.19		0.41	0.14	0.64
High level ^a	-0.02	0.15	0.18	0.27		-0.38	0.66
Low level ^b	0.25	0.19	0.10	0.14	-0.24		-0.02
Mental states ^c	0.41	0.59	0.43	0.26	0.41	0.38	

Notes. Abbreviations: NTU Number of Total Utterances; NTW Number of Total Words; NDW Number of Different Words; MLU Mean Length of Utterance. ^{a,b} proportion of parental utterances that were high/low; ^c number of mental state references; *p < .002.

children with NH. Parents of toddlers with MHL used less high-level language, fewer mental states references, and shorter utterances than parents of toddlers with NH. The exposure to low-level language (directing utterances) did not differ between toddlers with MHL and NH.

Quantity and some quality measures of parents' linguistic input were positively related to the expressive language abilities of children with MHL and to each other. Only the quality measures reflected by linguistic characteristics were related to the quantity of talk, as parents of children with MHL who used more different words, longer utterances, and more mental state language also used more total words. The quality measures reflected by parents' conversational skills (e.g., the use of language-evoking techniques) were not related to the quantity of parental talk. The

fact that significant associations between quality and quantity of talk were only found in the MHL group and not in the NH group might be due to a lack of power because of the small sample size. The correlations in the NH group tended to be significant. On the other hand, it may be that parents of children with MHL repeat their utterances more because they are not sure their child heard them well enough. In that case a difference between groups in the number of diverse words would be expected. Again, this difference between groups tended to be significant. To conclude, a larger sample size is needed to find out if the associations between quantity and quality parental talk are indeed differential between groups.

Children with MHL were exposed to similar numbers of (diverse) words and utterances compared to children with NH. These findings are in line with Ambrose *et al.* (2015), who reported no differences between 18- and/or 36-month-old children with mild to severe HL and NH in the number of exposed utterances. However, Ambrose and colleagues reported that three-year-olds with HL in their study were exposed to fewer (diverse) words in the interactions with their parents. This difference was not found in the 18-month-olds in the Ambrose *et al.* study, or in the 30-month-olds in the present study. Parents of children with NH might increase their vocabulary during parent–child interactions at an earlier time in their child’s life than parents of children with MHL. This may explain why differences between groups were found in three-year-olds but not in the younger children. In addition, the language difficulties of children with HL become more prominent with age, and parents may adapt their language input accordingly.

Unlike parents in the studies by Ambrose *et al.* (2015) and Desjardin *et al.* (2014), parents of children with and without MHL in our study used a similar amount of low-level language (directing utterances). However, Ambrose *et al.* (2015) and Desjardin *et al.* (2014) coded the parent–child communication during a structured art gallery task (Ambrose *et al.*, 2015) or while reading a picture book (Desjardin *et al.*, 2014). Both tasks may have elicited more directive behavior than the free-play activity that was used in the present study. Shifting the child’s attention between the object of conversation (a picture or a book) and themselves in the other studies might have required parents to use more directive language. Another explanation for the inconsistency in the above findings may be related to differences between the studies in the degree of HL in the children studied. In the present study, only children with a HL between 40 and 60 dB were included (moderate hearing loss), while Ambrose *et al.* (2015) and Desjardin *et al.* (2014) included children between 20 and 90 dB HL.

Quality differences in parental talk were reflected by parents of toddlers with MHL using shorter utterances and less high-level language. These results were in line with the earlier study of three-year-old children with mild to severe HL (Ambrose *et al.*, 2015). Another feature of the quality of linguistic input is the use of mental state language, an abstract form of language. In line with the findings of Moeller and Schick (2006) and Morgan *et al.* (2014), the results of the current study showed that parents of children with MHL used less mental state language than parents of children with NH. This is one of the first studies that also examined children’s use of mental state language in a group of children with HL. Children with MHL used fewer mental state references than did children with NH, although neither group used many mental state terms during their interactions. Past research indicated an increase in normal hearing children’s use of mental state language between one and four years of age (Taumoepeau & Ruffman, 2008). Since the children in our sample were 30 months of age, an increase in their use of this language was expected.

In line with findings documented by Ruffman, Slade, and Crowe (2002), parental use of mental state language was positively related to the MHL children's use of it themselves. The findings concerning mental state language are also of interest because of the association with social-emotional development (Devine & Hughes, 2018; Drummond *et al.*, 2014; Dunn *et al.*, 1991; Meins, 2013; Peterson & Slaughter, 2003). Since children with MHL more often encounter social-emotional difficulties (Dirks *et al.*, 2017; Laugen *et al.*, 2016, 2017; Netten *et al.*, 2015, 2017), early interventionists should guide parents in talking about beliefs, knowledge, desires, and emotions while interacting with their children.

In line with our expectations, and consistent with the results of other studies (Ambrose *et al.*, 2015; Cruz *et al.*, 2013; Desjardin *et al.*, 2014; Nittrouer, 2009), children with MHL who had better expressive language abilities had parents who used more words and longer utterances. Interestingly, this association was only found for the children with MHL. This might indicate that, because of their inconsistent access to speech and sounds, parental input might be missed and more exposure to words be needed for children with MHL to develop their expressive language skills to their full potential.

Contrary to our expectations, no associations between high-level language exposure by the parents and children's language abilities were found. The 30-month-old children in the present sample might be too young to benefit from this quality feature of parental talk. Yet, as children grow and their language abilities increase, they may be more capable of taking advantage of this high-level input. In the study of Ambrose *et al.* (2015), three-year-olds showed a beneficial effect of high-level language input on their language abilities while the 18-month-olds did not.

The reported negative association between the degree of HL and high-level language input by Ambrose *et al.* (2015) was also found in this study, despite the smaller dB range in our study: children with more severe HL were exposed to less high-level language than those with less severe HL. It is unclear what the impact of this limited exposure to high-level language is on the future language development of children with MHL. One possibility is that it may impede further language development: parents of children with MHL may underestimate their capacities and therefore provide insufficient stimulation for children to attain the next level of development. Another possibility is that parents may appropriately modify their language use to fit the poorer language abilities of children with MHL, relative to children with NH. Parents of children with MHL may in fact be highly sensitive to their children's abilities and adapt their linguistic input accordingly (Dirks & Rieffe, 2019). From a social constructivist perspective, language learning takes place in the 'zone of proximal development' (Vygotsky, 1978): parental linguistic input should be sufficiently challenging for a child to learn new words, neither too simple nor too difficult. This requires parents to be sensitive enough to acknowledge a child's changing language abilities and to provide them with more complex input when appropriate. Longitudinal research is needed to examine whether parents of children with MHL are indeed that sensitive that they adapt their talk to their children's needs.

The current findings have several implications for family-centered early intervention programs for children with MHL and their families. The results suggest that parent-child interactions are related to the language development of children, and that the language abilities of children with MHL are lower than those of their hearing peers. Several implications for practice can be drawn from these findings. First, it is important to carefully monitor a child's language development so that their current

level of language abilities can be determined. Next, observations of parent–child interactions are needed to gain insights into the current linguistic input by parents. Based on this information, the appropriate level of parental linguistic input that is needed at that moment to promote children’s language development can be determined. Early interventionists may coach parents in providing this linguistic input during daily activities by modeling and video-feedback techniques. Interactive story-book reading may be one of the activities that could be used to elicit rich parent–child conversations to promote children’s language and social-emotional development (Dirks & Wauters, 2015).

Interventions in which story-books are used to promote mental state language are of interest because story-book reading enhances language development in general in children with HL (DesJardin *et al.*, 2014; Fung, Chow, & McBride-Chang, 2005). Research on reading story-books to promote mental state language is mostly focused on hearing children (Adrian, Clemente, Villanueva, & Rieffe, 2005; Aram, Fine, & Ziv, 2013; Taumoepeau & Reese, 2013). Aram *et al.* (2013) examined the effect of an intervention to promote parents’ use of mental state language during story-book reading with hearing children. After the intervention, parents and children referred more often to mental state terms than parents and children who did not follow the intervention. Story-book reading could be useful in exposing MHL children to high-level language and mental state language; however, parents do not do this naturally and we need to support them (Dirks & Wauters, 2018).

One limitation of this study is the cross-sectional design, due to which the causality of relationships between linguistic input and children’s language abilities cannot be specified. Future studies could longitudinally examine the linguistic input to younger hearing brothers or sisters of children with MHL and compare them with the input to children with MHL at that age. Future studies could also include hearing children with the same language levels as those of children with MHL to compare their linguistic input.

Another limitation is the relatively small sample size, which prohibits the establishment of firm conclusions at this time. A larger sample size would enable researchers to examine which aspects of parental talk are most important to predict a child’s language. It is recommended that future research incorporate larger samples to better address these questions. This was one of the first studies that examined parental and child mental state language in the interactions of young children with MHL. Future studies should investigate the relationship between mental state language and social-emotional development in this group of children.

In this study we examined the linguistic interactions of toddlers with MHL and their parents in their home environment. When children grow up, they also spend time with peers in daycare or playgroups. Given that early interactions between peers are important for children’s development, future studies could examine the (linguistic) interactions of children with MHL and their peers.

Conclusions

In this first study on linguistic input to toddlers with MHL it was found that the amount and quality of parental talk was related to the expressive language abilities of these children. The quantity of parents talk to children with MHL is similar to that of parents of children with NH. The input is, however, of a lower quality, with parents using less high-level language, less mental state language, and shorter

utterances. A question that requires further examination is whether these parents actually appropriately adapt their language use to their child's current capacities, or whether they could further challenge their child with MHL by using more high-level language. Early interventionists should carefully monitor children's language abilities and their exposure to (parental) linguistic input in order to optimize and promote their language development.

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