

Early years language and development in deaf children – a best evidence scoping review

Synthesis of key findings

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Purpose and methodology

This paper summarises the main findings of a scoping review of the best evidence on deaf children's early language and communication, conducted for NDCS in December 2016 – January 2017. This review had a wide scope, aiming to survey the research literature across a range of domains that have a bearing on how deaf children's language and communication skills and related cognitive and social skills develop, and can be supported, during infancy and the preschool years. The main purpose of this review is to provide a strong evidence base to inform the implementation of the new NDCS strategy. It is hoped that the main findings of the review will also prove a useful resource for NDCS members. Given its wide remit, this review is not intended to be exhaustive in any way, and it was not conducted as a systematic review; the purpose is instead to capture and map some of the best available evidence across a wide spectrum of relevant literature, to provide a corpus of trusted evidence to inform the development of NDCS's future outputs and activities in the area of early years support.

The review method was based on the methodology for a scoping review outlined by Arksey and O'Malley (2005), which is suited to a wide-ranging review of this type, combining standard structured database searches with the purposive selection and sampling of articles and follow-on searches informed by the early finds and new insights gained from the first round of searches. The main literature searches were conducted using Google Scholar and the British Library catalogue using a large number of relevant search terms (including 'deaf child | children | infants', 'hearing impaired', 'early language development | acquisition', 'communication', 'cognition', 'speech perception', 'cochlear implants | implantation', 'Theory of Mind', 'parents', 'intervention'), restricting the results in the main to items published within the last ten years. Out of over 2,000 titles scanned from the search results, approximately 300 references were initially identified on the basis of the title and the abstracts were scanned for potential relevance; of these, approximately 200 references were selected for closer review and grouped according to main focus. A final sample of 65 journal articles and book chapters was selected for detailed review on the basis of salience/relevance, and/or frequency of citations in other articles, and/or corroboration of the main findings across related studies (redundancy), and an assessment of evidence quality. Articles included in this final sample were read closely and the bibliographic information, evidence rating and a summary/extract of main evidence and findings were collated in a series of tables organised by main theme (see annexes) and scrutinised to identify the most salient findings summarised below. There was insufficient time to use a snowball procedure in addition to the main literature searches, but important references cited within articles included in the final sample were included in the collated summaries/extracts. The presentation of the collated evidence into the thematic tables is intended to enable further updating and additions to the resource going forward.

Introduction

Although early access to digital hearing aids and cochlear implants has led to substantial improvements in deaf children's communication, language and other developmental outcomes over the past two decades, there is still significant variability in outcomes that a number of studies have sought to explain. Variation in outcomes is seen not only in deaf children's core language and communication skills, but also across a wider spectrum of (associated) cognitive and psychosocial skills. The main factors that account for this variation ('predictors') fall into three main categories (cf. Boons et al., 2012):

- Auditory factors (including auditory rehabilitation, e.g. fitting of hearing aids or CIs; age of identification and rehabilitation / implantation has been shown to be a major factor accounting for differences in language and communication outcomes)
- Child-related factors, i.e. characteristics that are inherent to the child (including medical cause of deafness, other disability(s) or nonverbal cognitive abilities)
- Environmental factors, i.e. external characteristics determined by a child's environment (social environment, acoustic environment, etc.)

These factors – auditory, child-related and environmental – interact powerfully to affect individual outcomes, and, for this reason, variation in outcomes cannot be predicted simply by differences in levels of hearing loss. The extent to which non-auditory factors influence outcomes means that any degree of hearing loss can put a child at risk for language and associated cognitive and psychosocial development (Moeller and Tomblin, 2015).

This review focuses primarily on environmental factors as these are most amenable to being influenced or addressed positively to improve children's developmental outcomes, not least by families themselves. The evidence shows clearly that it is within the family that environmental factors have the greatest impact in the early years (positively or negatively), so this review focuses on what happens, or what can be done, within the family, particularly in the context of day-to-day parent-child interaction.

The research evidence highlights three key areas in which environmental factors play a particularly important part in supporting and shaping deaf children's early communication, language and broader cognitive and psychosocial development. These are known to be important for the development of all children, however, they are all the more crucial for deaf children because of the significant additional developmental risks posed by hearing impairments in early childhood:

1. Factors affecting early speech perception
2. Factors affecting early attention to speech and language
3. The quality and quantity of parents/carers' language input

The best current evidence across these three areas supports the following key findings on what parents and carers can do (and on how they can be supported) to improve language, communication and associated development in their deaf children during infancy and the preschool years:

1. THE IMPORTANCE OF EARLY SPEECH PERCEPTION (AUDITORY AND VISUAL):

- 1.1 Deaf children's language development can be significantly affected by their speech perception skills (cf., for example, Levine et al., 2016, citing Werker and Hensch, 2015).
- 1.2 Speech-reading: To help deaf infants and young children to perceive speech and acquire spoken language, it is important that they are encouraged and supported to lip-read ('speech-read') as well as to listen to speech. The best evidence from neuroscience shows that lipreading is a natural and important part of acquiring spoken language for all children (and a normal part of speech perception for hearing adults), as the brain actively tries to integrate redundant auditory and visual speech information to make sense of spoken language – what can be termed 'auditory-visual integration' or 'auditory-visual speech perception'. At 8 to 10 months of age, for instance, hearing babies begin to focus their attention on a talker's mouth (Boisferon et al., 2016). Whereas it used to

be assumed that deaf children should be helped to develop spoken language by focusing primarily on their listening and perhaps even restricting their visual attention to speech, deaf children's listening and spoken language skills are in fact more likely to be helped by enabling them to watch as well as to listen to people speaking around them (cf., for example: Levine et al., 2016; Nittrouer, 2016; Strelnikov et al., 2015; de Boisferon et al., 2016; Tomalski, 2015; Yeung and Werker, 2015).

- 1.3 Auditory-Verbal Therapy: Evidence on the importance of early auditory-visual speech perception presents a challenge to proponents of Auditory-Verbal Therapy (AVT) as AVT prioritises children's auditory learning by focusing on listening-only and downplays / discourages children's use of visual strategies to perceive and process speech and language. A recent systematic review of the evidence on the effectiveness of AVT reported a lack of any robust evidence to support AVT as an approach (Brennan-Jones et al., 2014; see also Wood Jackson and Schatschneider, 2014; Dornan et al., 2010; Rhoades, 2006).
- 1.4 Cued Speech: Cued Speech (CS) is a lesser-known but potentially useful tool that can enhance / enable deaf children's auditory-visual or visual-only perception of speech. It can complement and support what children can perceive with their hearing, or it can substitute entirely for auditory speech perception if a child has no useful hearing in the speech range (e.g. pre-CIs, or if a child cannot benefit from CIs). CS involves the speaker using a simple system of hand cues near the mouth that is synchronised with natural speech; the hand shapes and movements provide additional visual information for each speech sound as it is spoken, in real time. The system can be learnt and used by parents in a relatively short space of time and used in combination with normal speech in day-to-day spoken communication within the family. It has shown to have the greatest positive impact on a child's language development if used by parents with their child from infancy. Research evidence accrued over three decades demonstrates that CS can support or enable deaf children's (receptive) acquisition of spoken language (and subsequent reading skills) from a young age, with or without the help of CIs or hearing aids. Since it can convey visually all the phonological detail of a spoken language, it can support the full neurocognitive acquisition and processing of spoken language (cf., for example: Leybaert and LaSasso, 2010 & references cited within their review).
- 1.5 Auditory Neuropathy Spectrum Disorder (a special case as regards speech perception): It is estimated that around 10% of children with a permanent hearing impairment have one or other form of 'Auditory Neuropathy Spectrum Disorder' ('ANSD'). Although ANSD incorporates a range of different conditions, this group of children are generally found to have some level of difficulty discriminating auditory speech information; hearing thresholds do not provide a reliable indication of their ability to perceive or process speech using their hearing. As advised in the latest NHS guidance on ANSD (Feirn et al., 2013), for children with ANSD, language development should be supported visually; the evidence indicates that an auditory-only approach (e.g. AVT) is very unlikely to be successful. As there is usually a high level of uncertainty over the child's potential to develop auditory discrimination skills, it is advised that communication approaches that incorporate visual support can be put into place at an early stage to lay the foundations of communication and language development regardless of the child's functional hearing status, before behavioural thresholds and the child's 'true' hearing ability are known (see also contributions to Newborn Hearing Systems Conference, 2008).
- 1.6 Consistency of device use: Consistent use of hearing aids or CIs is essential to support deaf children's auditory (and auditory-visual) speech perception from the earliest stages following hearing aid fitting / cochlear implantation; the risk of language and other developmental delays are significantly reduced by the provision of early and consistent access to hearing aids and/or early access to CIs that provide optimised audibility (cf., for example, Tomblin et al., 2015). Recent studies suggest, however, that:

- Daily hearing aid and CI use varies substantially between families (cf., for example, Walker et al., 2015; Moeller et al., 2009). Through data-logging, Walker et al. found that most parents overestimated daily hearing aid use. Although the majority of parents have been found to increase the use of hearing aids for their children over time, a sizable minority demonstrate a low level of use or decreased use over time. Walker et al. found that the level of maternal education was a key predictor of consistent hearing aid use both for infants and school-age children. According to another recent study looking at the experiences and outcomes for children with mild and unilateral hearing loss (Fitzpatrick et al., 2016), parents reported that professionals minimised the importance of milder hearing loss (see also Haggard and Primus, 1999) and left parents feeling uncertain about the need for hearing aids. The findings of both studies suggest that parents need specific guidance about the importance of consistent hearing aid and CI use. Walker et al. and Moeller et al. recommend practical demonstrations of the benefits of hearing aid use, such as hearing loss simulations, examples of listening in noise with and without hearing aids, or listening to malfunctioning hearing aids; simulations may be effective to enable parents to experience the sensory deficit. Their findings suggest that unrealistic expectations could influence parental perceptions of benefit from device use, particularly when encountering difficulties with using devices, and parents may find it difficult to recognise the subtle (or undiscernible) changes or development in an infant in response to amplification, especially early in development. It is recommended that family education about the benefits of hearing aids should strive to help families make a strong connection between the infant's hearing / speech perception and the development of speech, language and learning (much of which will not be visible in the early stages), and parents of children with mild degrees of hearing loss should be fully informed about recent studies pointing to the significant consequences of minimal hearing loss on cognitive and other aspects of child development.
- Even with consistent use of hearing aids or CIs, sufficient audibility is not guaranteed for individual children. A recent multi-centre study by McCreery et al. (2015) tracking the amplification experiences and outcomes for over 280 young children with permanent hearing loss found that, while two-thirds of children in the study were found to have adequate aided audibility of speech and stable hearing during the period of the study, a third of the children had aided audibility that was below the average for the expected range for speech intelligibility, based on level of hearing loss. The study identified a group with consistently low aided audibility, and others with decreasing audibility over time. Limited audibility was correlated with higher degrees of hearing loss and larger gaps between targets and actual progress. A second related study (Tomblin et al., 2015) confirms that all children with mild to severe hearing loss are at risk for delays in language development, but better audibility is associated with faster rates of language growth in the preschool years.

1.7 The acoustic / noise environment: The variation in device use and in aided audibility among infants and young children underlines the importance of supporting families to optimise the acoustic / noise environment to help their children's speech perception and speech recognition. Homes and families' daily routines are not usually very acoustically-friendly, containing many sources of noise (Mulla, 2011). A recent study of speech perception in noise by children with CIs (Caldwella and Nittrouer, 2013) found that adding background noise to the speech signal had significant effects on all children (regardless of hearing status), but that children with CIs performed significantly more poorly than children with normal hearing when it came to recognising speech in noise. This difference appeared to be related to differences in language skills between the two groups: not only do the device limitations of CIs (and hearing aids) make it more difficult for implanted children to discriminate speech sounds from background noise, but language delays also mean that the deaf children have more difficulty understanding speech in noisy environments. For a hearing aid or CI user, the optimal distance from the speaker for speech perception is not more than a metre. While infants are often very close to their primary carer, as children begin to crawl and walk they will

often be further away than a metre; much of a young child's day is spent at a distance from meaningful speech, as well as in the presence of background noise (Mulla, 2011). Mulla reports that parents using FM systems with young deaf children reported overall improvements in their children's listening in noise, in quiet, at a distance and in auditory-only situations; parents also identified the potential benefits that the FM system could provide for their children to overhear speech. According to a recent study of the effects of electronic media on communication outcomes of toddlers with hearing loss (Ambrose et al., 2014) found that the frequency of conversational turns between the hearing impaired children and their parents / carers was lower in households with high rates of electronic media exposure, and the authors conclude that parents should be encouraged to reduce their children's exposure to electronic media.

In sum:

- Deaf children's language development can be significantly affected by their speech perception skills.
- To help deaf infants and young children to perceive speech and acquire spoken language, it is important that they are encouraged and supported to lip-read ('speech-read') as well as to listen to speech.
- Evidence on the importance of early audio-visual speech perception presents a challenge to proponents of Auditory-Verbal Therapy (AVT) as AVT prioritises children's auditory learning by focusing on listening-only.
- Cued Speech (CS) can be used to enhance / enable deaf children's visual (&/ audio-visual) perception of speech, particularly for children with little or no auditory speech perception capabilities.
- For children with Auditory Neuropathy Spectrum Disorder (ANS) language development should be supported visually; the evidence indicates that an auditory-only approach (e.g. AVT) is very unlikely to be successful.
- Consistent use of hearing aids or CIs is essential to support deaf children's auditory (and audio-visual) speech perception from the earliest stages following hearing aid fitting / cochlear implantation. Parents need specific guidance about the importance of consistent hearing aid and CI use.
- Variation in device use and in aided audibility among infants and young children underlines the importance of supporting families to optimise the acoustic / noise environment to help their children's speech perception and speech recognition. Parents should be encouraged to reduce their children's exposure to electronic media, and could be supported to use an FM system during the early years.

2. THE IMPORTANCE OF MAXIMISING DEAF INFANTS' AND YOUNG CHILDREN'S ATTENTION TO SPEECH AND LANGUAGE:

- 2.1 'Infant-directed speech' (IDS): IDS (sometimes termed 'motherese') is thought to be important to communicate affection, to regulate infants' attention, and to encourage their attention to speech and facilitate speech perception and language development. Hearing infants prefer to listen to IDS compared with adult-directed speech, and they show greater responsiveness to IDS. Evidence suggests that it is a combination of infants' auditory experience and the exaggerated characteristics of IDS (slower tempo, higher pitch and wider range of pitch, frequent use of proper names, short utterances, etc.) that stimulates infants' attention to speech, and mothers appear to adapt their IDS to infants' abilities and needs. Mothers of deaf infants with cochlear implants, for example, have been shown to adjust their IDS to their infants' hearing experience rather than chronological age, and they tend to exaggerate the prosodic characteristics of IDS (cf. Saint-Georges et al., 2013; & Bergeson et al., 2006). Attention to speech could be particularly important for deaf infants due to their potential difficulties with recognising and processing speech, but there is also a greater likelihood of 'motherese' interactions being disrupted between caregivers and deaf infants. The possibility that hearing-impaired infants might pay less attention to IDS is indicated by the finding that normally hearing infants attend less to IDS in noisy conditions (Newman and Hussain, 2006, cited by Houston and Bergeson, 2014). Houston et al. (2003) and Houston (2009) also found that profoundly deaf infants with CIs showed no preference for IDS, ADS or silence initially, and that they required extensive hearing experience before the preference for IDS developed. It is also possible the CIs do not transmit the pitch aspects of IDS very well, making IDS less obvious or helpful to these infants. As well as limiting the developmental benefits of IDS, deaf infants' reduced attention to IDS might also result in the mother or other caregiver reducing their use of IDS, since IDS has been shown to be primarily affected by the infants' feedback (Houston and Bergeson; Saint-Georges et al., 2013). Maternal depression can also result in less exaggerated IDS and negative knock-on effects on infants' learning abilities (Saint-Georges et al., 2013; Kaplan et al., 2001; Herrera et al., 2004). Dilley and Bergeson (2010, cited by Houston and Bergeson, 2014) found variation in the IDS used by mothers of infants with CIs: some used a lot of vowel extension which would help their infants' attention to vowel sounds, and other mothers used very little. Given its importance for early language development, parents and carers should be encouraged and supported to use IDS with their deaf infant; mothers experiencing anxiety or depression may need additional support with this.
- 2.2 Joint engagement: Joint engagement and parents' responsiveness to the child's focus of attention have both been found to predict language growth in young children (cf., for example, Levine et al., 2016). Parents' ability to redirect infants' attention in the first year of life appears to be important for later language learning (following an adult's gaze, etc.), and from one year old, joint attention emerges and is fully established by 15- to 24 months in typically developing children; at this point, parents' ability to respond to the infants' object of interest becomes critical. Tomasello and Farrar (1986) found that both mothers and children produce more utterances and engage in longer conversations during episodes of joint attention. Mothers' references to objects that the child was already focused on in joint attention episodes were positively correlated with the child's vocabulary development, while references that attempted to redirect the child's attention were negatively correlated. A child's ability to respond to the caregiver's bids for joint attention has been found to be a predictor of receptive language at 18- to 21 months and at 29 months (cf. Raver et al., 2012). However, several studies of deaf children with hearing parents have reported delays in establishing and using joint attention and differences in the quantity of time spent in joint attention and the quality of interaction during episodes of joint attention compared with hearing children with hearing parents (and compared with deaf children and deaf parents) (cf., for example, Morgan et al, 2016; Morgan et al., 2014; Gale and Schick, 2009). The lack of a common language for directing attention and sharing experiences and/or the deaf child's lack of access to auditory cues (including

the caregivers' speech) can frustrate the establishment of joint attention and reciprocal interaction/conversational turn-taking. Early studies of the interaction style of hearing mothers of deaf children demonstrated a more directive style resulting in less participation and initiation from the children, and significantly fewer 'connected turns' (utterances related to the interaction partner's previous turn) than observed between hearing parents of hearing children (Morgan et al., 2014; Morgan et al., 2016). It is possible that deaf children's lack of early experiences with joint attention and verbal turn-taking can impact negatively on their development of pragmatic skills over the longer term. Hearing parents of deaf children may need additional support and advice to help them establish effective strategies to facilitate early joint attention and responsive two-way interactions with their child, and to raise their awareness of the importance of following the attention lead of their child.

In sum:

- Given the importance of 'motherese' or 'infant-directed speech' for early language development, parents and carers should be encouraged and supported to use infant-directed speech with their deaf infant; mothers experiencing anxiety or depression may need additional support with this.
- Hearing parents of deaf children may need targeted support and advice to help them establish effective strategies to facilitate early joint attention and responsive two-way interactions with their child, and to raise their awareness of the importance of following the attention lead of their child.

3. THE IMPORTANCE OF OPTIMISING THE QUALITY AND QUANTITY OF PARENTS' LANGUAGE INPUT FOR GOOD LANGUAGE OUTCOMES:

- 3.1 Language(s) used in day-to-day parent-child interaction & first language acquisition: There are relatively few multi-centre studies that allow for a large sample and coverage of a spectrum of socio-economic and other demographic variables. One such study, looking at predictors of linguistic performance for children with CIs (Boons, Brokx, et al., 2012), showed the accumulating effect of a number of environmental factors over time; in particular: (i) the positive correlation of high socioeconomic level with the child's language development was confirmed in this study, and is in line with the findings of several other previous studies (citing Geers et al., 2003; Gerard et al., 2010; Niparko et al., 2010); (ii) multilingualism (more than one spoken language) was consistently correlated with lower language scores; (iii) at two years post-implantation, the level of parental involvement in the rehabilitation process was found to be a significant factor, which is possibly linked with the effects of lower socio-economic status on factors affecting parental involvement such as parental availability; (iv) by three years after implantation, children of parents using oral communication outperformed children of parents using total communication or sign language (the authors note that auditory speech perception skills would also be expected to all have an accumulating impact over time, but speech perception was not included as a variable in this study). While the correlation between oral communication and higher language skills was clearly demonstrated in this study, the authors note that further research is needed to explain this correlation.

It is possible that the difficulties that hearing parents typically face in providing their children with rich and fluent sign language input early in life accounts, at least partially, for the lower language scores reported for children with CIs whose hearing parents use total communication or sign language (see, for example, Lu, Jones and Morgan, 2016). In an exhaustive review of extant evidence on the use of BSL in deaf children's early language development, Knoors and Marschark (2012) report that, on average, the sign language skills of deaf children with hearing parents lag far behind the skills of deaf children with deaf parents, and that the poorer signing skills among the former group is likely to be linked with a lack of sign language proficiency among most hearing parents. They note the importance of establishing a rich language input for deaf children before the

age of 3 and preferably from birth, which presents problems for hearing parents seeking to learn sign language for the first time. Thus, the unavailability (or impossibility) of hearing parents providing early fluent language models in sign language for deaf children is a significant problem. They note that while research consistently shows positive language outcomes resulting from early cochlear implantation, no comparable results have been found for sign-bilingual education for deaf children (with or without implants), and they note a surprising lack of studies examining academic outcomes associated with the sign-bilingual approach (on this, citing also Mayer and Leigh, 2010).

Marschark and Knoors (2012) also note a lack of research into the effect of speech supporting signs. Giezen et al. (2013) report that the evidence on outcomes associated with total communication are contradictory, although the majority of studies find an advantage for oral communication. A recent systematic review of early sign and oral language interventions for children with permanent hearing loss (Fitzpatrick et al., 2016) found important gaps in evidence on the effectiveness for spoken language outcomes of sign + oral language intervention compared with oral language intervention only; the review found no evidence that adding sign language facilitates spoken language acquisition, but nor did it find any conclusive evidence that adding sign language interferes with spoken language development. A 2014 retrospective cohort study comparing language outcomes for children with CIs found no significant differences in language outcomes according to communication approach (sign and spoken language / auditory-oral / auditory-verbal therapy), but age at diagnosis of hearing loss and family involvement were significantly associated with language outcomes (Yanbay et al., 2014).

The importance of early exposure to fluent language models within the family has been investigated by Mayberry (e.g. Mayberry, 2007; Mayberry et al., 2011), who has found that delayed exposure to an accessible first language in early life affects the outcome of all subsequent language learning, both in the first language and in any other languages learnt subsequently (see also Pénicaud, Klein et al., 2013). The harmful effects of delayed first language acquisition are apparent at all levels of linguistic structure, including syntax, phonology and the lexicon. Early exposure to an accessible language is a critical factor in creating a lifelong ability to learn language, and is more important than the specific language / modality. Hence, early acquisition of a spoken language as a first language supports later learning of sign language as a second language, and vice-versa.

In sum:

- There is robust evidence of a positive correlation between parents' use of oral communication and good language outcomes for children with CIs, but for deaf children with hearing parents, no comparable association has been demonstrated between good language outcomes and parents' use of sign language or total communication.
- While there is no evidence that adding sign language facilitates spoken language acquisition, nor is there any conclusive evidence that adding sign language interferes with spoken language development.
- For all children, early exposure to a rich fluent language model is critically important for all later language learning.
- Hearing parents can provide a rich, fluent language model most easily in their native spoken language, which hearing aids or CIs make accessible for most deaf children. The evidence therefore indicates that hearing parents should be encouraged and supported to communicate with their children in their native language(s).
- Early acquisition of a first spoken language can support later learning of a sign language.

3.2 'Parent talk': the quantity and quality of parents' language input: A large number of studies point to the importance of a rich communication foundation between the primary caregivers and their deaf child from early infancy (cf., for example, Levine et al., 2016, citing DesJardin and Eisenberg, 2007 and Fagan et al., 2014; see also Moeller and Tomblin, 2015; Ambrose et al., 2015; Quittner et al., 2014; Quittner et al., 2013; Cruz et al., 2013; Vohr et al., 2010). Both the quantity and quality of the language provided by parents / carers have been shown to be important in influencing the child's language development, hence a great deal of attention has been given to the specific effects of 'parent talk', since the most important language learning for any child will take place in the context of social interaction with caregivers and playmates. Deaf children are particularly sensitive to the influences of their language environment compared with typically-developing children, and late-implanted children are more sensitive than early-implanted children. The negative effects of early language deprivation and/or reduced auditory perception and auditory processing abilities (i.e. lack of access) can be compounded by the exaggerated effects of a language-poor environment (lack of input) (Levine et al., 2016). Hence, variations in the quantity and quality of language input is likely to play a significant part in determining individual differences in language development and associated outcomes (Moeller and Tomblin, 2015). The fact that many deaf children have a limited range of social partners who can communicate freely with them, restricted parental language input can be a particularly serious issue for many deaf children (Schick et al., 2007).

The risks of reduced or deficient early language input are exacerbated for deaf children by the fact that children's language abilities are known to influence the quality of caregiver language input. Research since the early 1980s has shown that hearing parents of deaf children tend to use less complex language structures and less high-quality talk than parents who share the same hearing status with their children (VanDam, Ambrose and Moeller, 2012; Ambrose et al., 2015, citing: Cross et al., 1980; Nienhuys et al., 1984 & 1985; Spencer et al., 1992; Galloway and Woll, 1994; Moeller and Schick, 2006; Morgan et al., 2014). Observational studies have also indicated that mothers of deaf children tend to be more intrusive and directive in their interactions with their children (Cruz et al., 2013, citing Koester et al., 2000). A recent multi-centre study comparing the early language input of parents to normally hearing children with the input of parents to hard-of-hearing children found significant differences between the two groups, with the hard-of-hearing children exposed to fewer words and lower quality input (Ambrose et al., 2015). Caregivers were found to increase the complexity of their talk over time, but the findings also showed that caregiver talk was associated with child language, with parents of children with more limited language using a more limited range of vocabulary, producing less complex sentences and/or asking fewer open-ended questions. Some simplification of language is necessary in interactions with all young children (cf. the importance of IDS), and research has shown that mothers talk to their deaf children in ways that reflect their child's language level (rather than chronological age) (Quittner et al., 2013). Further research is needed to investigate how a child's hearing status may influence the qualitative aspects of parental linguistic input, and the extent to which this variability is related to language outcomes. There is a risk that, whatever the child's stage of language development, oversimplified linguistic input combined with less responsive communication strategies would provide a sub-optimal language learning environment for deaf children. Ambrose et al. (2015) found that children with greater degrees of hearing loss are being exposed to poorer quantity and quality of language input, indicating a risk that reduced or inconsistent language exposure is likely to reduce these children's language learning opportunities.

The quantity of language input, i.e. average length of utterance and word types, is also strongly associated with deaf children's early development of receptive and expressive language skills (cf., for example, Quittner et al., 2014; DesJardin and Eisenberg, 2007); DesJardin and Eisenberg (2007) found that mothers' mean length of utterance accounted for most of the variation in children's receptive and expressive language skills. Children who are exposed to higher amounts of linguistic input demonstrate stronger vocabulary growth and faster lexical processing than children who are

exposed to lower rates of linguistic input (cf., for example, Hurtado et al., 2008), as exposure to high amounts of linguistic input give children more opportunities to for language learning, including its phonemes, the boundaries between words and sentences, to learn correspondences between words and objects and events in their environment, and to learn syntactic patterns (cf., for example, Ambrose et al., 2015; Kuhl, 2010).

The quality of caregivers' language input is also a key predictor of deaf children's language outcomes. The quality of language refers to a range of linguistic characteristics including the breadth of vocabulary, the complexity of utterances, use of techniques that can engage a child in conversational interactions, and verbal interaction style (e.g. responsive or directive). Studies with both hearing and deaf children on the influence of qualitative aspects of language input, have found that children's language outcomes are positively associated with:

- The complexity of utterances (reflected in the average length of utterances) used by parents and the number of different words they use
- High frequency of conversational interactions
- Parents using a responsive, rather than controlling, interaction style, responding to the child's behaviour and attention rather than seeking to (re)direct the child's behaviour and attention, and parents being verbally responsive to their children's communication attempts
- Parents' use of higher-level 'facilitative language techniques' (FLT), particularly recasts and open-ended questions

(Cf., for example, DesJardin and Eisenberg, 2007; DesJardin et al., 2014; Szagun and Stumper, 2012; Ambrose et al., 2014; Ambrose et al., 2013; Cruz et al., 2013; Vohr et al., 2010; Nittrouer, 2010; VanDam et al., 2012)

The significance of quality of language input is likely to be one of several mediating factors that account for the association between higher socioeconomic status and children's positive language outcomes that has been consistently reported in the research. For example, Hart and Risley (1995) found that, on average, parents from professional families directed thousands more words each day to their children and were more responsive to children's communication efforts than parents from lower socio-economic groups. Quittner et al. (2014) found that socioeconomic status was significantly related to the number of word types used by parents, although it was not found to be associated with parents' use of FLT.

A number of studies have investigated the association between FLT and language outcomes in children with cochlear implants (cf. Quittner et al., 2014; Cruz et al., 2013; DesJardin et al., 2009; DesJardin and Eisenberg, 2007). A recent multi-centre investigation looking at children's language and other outcomes over three years post-cochlear implantation (the Child Development after Cochlear Implantation investigation – CDaCI) showed that higher-level FLT such as parallel talk and open-ended questions predicted language growth, but lower-level FLT had no positive effect (Quittner et al., 2014; see also Cruz et al., 2013). The findings also showed that parents use lower-level FLT more frequently than higher-level FLT. The authors suggest that the positive effects of higher-level FLT may be explained in part by the associated differences in parents' level of involvement and the differing demands for the child's attention, for example open-ended questions are likely to provide more complex language and encourage the child to attend and respond with two or more words, whereas closed-ended questions tend to be simpler and can be answered with a single word or even nonverbal response.

Data from the CDaCI investigation also indicated that maternal sensitivity is a significant predictor of children's oral language growth – indeed, it was found to be as significant an influence as found for age at implantation (before or after age 2): at 48 months post-implantation, which with CIs whose parents demonstrated higher maternal sensitivity and associated linguistic stimulation

demonstrated 1.52 years less delay in language acquisition than those scoring lower on maternal sensitivity and linguistic stimulation. It is therefore significant that the study found significant differences overall in maternal sensitivity between hearing mothers of deaf children and hearing mothers of hearing children, with the former group tending to be less sensitive and responsive to their children, less supportive of independence and more hostile than mothers of hearing children (Quittner et al, 2014; see also Niparko et al., 2010).

The CDaCI and other studies looking at the influence of parents' linguistic input suggest that parenting behaviours are a critical target for intervention to support optimal language outcomes for deaf children, with or without CIs. Based on the findings of the CDaCI study, Cruz and Quittner et al. (2013) suggest that a 'coaching model' in which parents receive hands-on training and practice in using FLT's could be an important way to empower parents to support their children's language and communication skills (on this, see also: DesJardin, 2009, and Lam-Cassettari et al., 2015). Any baseline differences between parents of different socioeconomic status can potentially be mitigated through coaching families to help them to provide high quality linguistic and conversational interactions with their children (cf. evidence on parent coaching, reviewed further below).

In sum:

- Deaf children are particularly sensitive to the influences of their language environment compared with typically-developing children, and late-implanted children are more sensitive than early-implanted children.
- Both the quantity and quality of the language provided by parents / carers have been shown to be vitally important in influencing the child's language development and outcomes. The quality of language refers to a range of linguistic characteristics including the breadth of vocabulary, the complexity of utterances, use of techniques that can engage a child in conversational interactions, and verbal interaction style (e.g. responsive or directive).
- Research since the early 1980s has shown that hearing parents of deaf children tend to use less complex language structures and less high-quality talk than parents who share the same hearing status with their children.
- Further research is needed to investigate how a child's hearing status may influence the qualitative aspects of parental linguistic input, but there is a clear risk that parents' use of oversimplified language combined with less responsive communication strategies will provide a sub-optimal language learning environment for deaf children.
- Higher-level facilitative language techniques (FLT's), such as parallel talk and open-ended questions, predict language growth, whereas lower-level FLT's do not; parents of deaf children have been found to use lower-level FLT's more frequently than higher-level FLT's.
- Parenting behaviours are a critical target for intervention to support optimal language outcomes for deaf children. A 'coaching model' in which parents receive hands-on training and practice in using FLT's could be an important way to empower parents to support their children's language and communication skills

4. THE IMPORTANCE OF OPTIMISING THE QUALITY AND QUANTITY OF PARENTS' LANGUAGE INPUT FOR GOOD COGNITIVE AND PSYCHOSOCIAL OUTCOMES:

4.1 Development of 'Theory of Mind': The ability to understand and react to thoughts, emotions and feelings in oneself and in others is often referred to as Theory of Mind (ToM). An understanding of mental states such as desires, beliefs, knowledge and emotions of other people is essential for successful and meaningful relationships with others (cf. Sundqvist et al., 2014); for example, Fink et al. (2015) have shown that an unusually slow start in the development of ToM understanding at age 5 is a powerful predictor of chronic friendlessness from age 5 through to age 7. The development of ToM has been shown to be associated with how a mother uses language when interacting with her infant as early as 6 months of age; a child's experiences of social interaction, including connected conversations, and early exposure to language – including mental state language – have been suggested as important determinants of ToM development during the first years of life. Deaf children with hearing parents often display a delayed development of ToM compared with typically developing hearing children (and compared with deaf children with deaf parents using sign language) (cf., for example, Morgan et al., 2014 and the various studies cited in their review). Studies into deaf children's ToM development have found that:

- The frequency of mothers' mental talk is correlated with deaf children's performance on ToM tasks, after controlling for the effects of child language and age (Moeller and Schick, 2006). Hearing parents of deaf infants and young children have been found to use significantly less cognitive mental state language and their conversations are characterised by less effective turn-taking compared to parents of hearing infants and children, so deaf children of hearing parents experience reduced exposure or access to conversations about the mind (Morgan et al., 2014; see also Peterson and Siegal, 2000).
- Deaf children with deaf parents who sign have been found to develop ToM skills on a par with typically hearing children with hearing parents; for deaf children with hearing parents, there appears to be little significant differences between deaf children with CIs and those with hearing aids, or between those in oral-only versus sign-plus-oral settings. The performance of deaf children with hearing parents has been found to be on a par with children with autism (Peterson, 2004)
- The age at which children with severe-to-profound hearing loss receive their first CI seems to be associated with ToM development, with ToM skills found to be more developed in children implanted before the age of two years, suggesting that early access to fluent verbal interaction between mother and child might set the foundations for early social cognitive development and the subsequent development of ToM skills observed later in the preschool years (Sundqvist et al., 2014)
- It is not simply the language of ToM tasks that causes deaf children with language delay to demonstrate delay in ToM tasks: even when the language demands are minimised, deaf children with hearing parents show delays with ToM development (Schick et al., 2007; Wiefferink et al., 2012)
- Longer auditory experience with CIs or hearing aids, together with early intervention, can positively influence children's acquisition of emotion comprehension competencies (Mancini et al., 2016)

Morgan et al. (2014) observe that ToM delay may be related to deaf children's difficulties in understanding conversations, but it is also likely that more general features of early communication and interaction play a role. They have therefore studied both conversational input and communicative interaction between hearing parents and very young children to try to identify the origins of subsequent social cognitive delays in deaf children. They found that parents of deaf infants and young children not only used significantly less cognitive mental state language but also

that their conversations were characterised by less effective turn-taking compared with parents of hearing infants and children. Even though parents were usually using their native spoken language, they were found to still produce a restricted amount of mental state language. They suggest that it is the child and adults' skills in communicating with each other which triggers parents to employ more sophisticated mental state language in their conversations (cf. also Meristo et al., 2012): deaf children who exhibit delayed language development do not communicate effectively and thus do not stimulate the increase in sophistication of the parent's mental state input. They find that parents adapt their language using simplified conversations. Where home-signs are used by hearing parents, these can be used to make effective reference to concrete and observable concepts but encounter severe obstacles with abstract notions such as beliefs. Moeller and Schick (2006) found that hearing mothers varied in their ability to use signs for mental state terms and that mothers' ability and willingness to talk about the mind was correlated with their own child's abilities in ToM tasks. Equally important is the lack of connected conversation in the deaf child-hearing mother dyads, with the consequence that children are not experiencing shared talk about joint references and have less time in a 'culture of minds'; deaf infants also cannot easily learn from overhearing the conversations of others (Morgan et al., 2014; see also Ensor and Hughes, 2008).

Morgan et al. also report that, in the sample of hearing parents with hearing children, only 2-5% of the total utterances related to cognitive mental states. They conclude from this that just a small increase in talk about mental states to deaf children could make a significant difference to their development of ToM. They recommend that future early interventions for families with deaf children should include training in conversation about the mind, as well as support to manage communication more generally, including responsive connected conversational interaction with their children. Theory of Mind training research (e.g. Lohmann and Tomasello, 2003, cited by Fink et al., 2014) also shows that typically developing preschoolers' understanding of minds can be enhanced through brief, targeted interventions, so there is a possibility that similarly targeted interventions could prove helpful with young deaf children.

According to Zupan (2013), the degraded auditory information that hearing aids and CIs provide, particularly as regards audibility of acoustic information associated with expressions of emotion, may contribute to deaf children's difficulties with perceiving and developing an understanding of emotion. Most and Michaelis (2012) studied the accuracy of auditory, visual and auditory-visual emotion perception among children with hearing loss and found that the accuracy of emotion perception among children with hearing loss was lower than that of normally hearing children; perception through the combined audio-visual mode surpassed the auditory or visual modes alone. Importantly, they found no significant differences according to degree of hearing loss, or between hearing aid and CI users. They suggest that rehabilitation that emphasises the supra-segmental and paralinguistic aspects of verbal communication could help to improve hearing impaired children's ability to perceive emotion (see also Wang et al., 2013; and Mancini et al., 2016).

In sum:

- Compared with typically developing hearing children and deaf children with deaf parents, and regardless of communication mode, deaf children with hearing parents often display a delayed development of 'Theory of Mind' (ToM) (the ability to understand and react to thoughts, emotions and feelings in oneself and in others); this, in turn, can affect their social cognitive development over the longer term.
- ToM development is affected by the frequency of parents' 'mental talk' and connected conversation turns in parent-child interactions; hearing parents of deaf children tend to use less cognitive mental state language and their conversations are characterised by less effective turn-taking compared to parents of hearing infants and children.

- A small increase in talk about mental states to deaf children could make a significant difference to their development of ToM. Future early interventions for families with deaf children could include training in conversation about the mind, as well as support to manage communication more generally, including the importance of parents' responsive and connected conversational interactions with their children.
- Young children's early habilitation to hearing aids and CIs could emphasise those aspects of speech and verbal communication, such as intonation, that help with emotion perception.

4.2 Social, psychosocial and neurocognitive functioning: Language age has been found to be closely correlated with the development of social competence in both deaf and hearing children, reflecting the extent to which delays or deficits in one area of development can have cascading effects on others (Hoffman et al., 2015). Generally, studies demonstrate lower social competence and more social behaviour / psychosocial problems in hearing impaired children compared to children with normal hearing (cf., for example, Hoffman, 2015; Laugen et al., 2016; Topol et al., 2011). Laugen et al. (2016) investigated the psychosocial behaviour of hard-of-hearing preschoolers and found that they showed significantly more psychosocial problems than normally hearing children, and that this difference remained significant even after controlling for a range of covariates. They note that the fact that psychosocial difficulties appear as early as preschool age has important implications for early intervention planning. They cite Netten et al., who found that communication skills may account more than core language skills (vocabulary or syntax) for psychosocial functioning in preschool children with hearing loss. This means that psychosocial development risk should be considered even for children who perform well on traditional language measures; their findings show that even a mild to severe hearing loss is a risk factor for psychosocial difficulties and adverse mental health, with the study by Laugen et al. suggesting that this risk is considerable even in preschool-age children.

Thus deafness is not only a risk factor for difficulties in language acquisition and development, but it can also disrupt early social experiences and interactions that are mediated by language. Early pragmatic skills have been shown to be important for children's development of joint attention and joint engagement skills, and vice-versa (cf. Tomasello and Farrar, 1986); there is evidence that children with CIs show significant delays in pragmatic skills compared with their hearing peers (Most & Michaelis, 2012). Rinaldi et al. (2013) also found that most of the children with CIs had poor pragmatic skills and delays in the development of specific pragmatic skills such as assertiveness, and that these delays were greater than delays in lexical (i.e. core language) skills. They attribute the deficits in pragmatic skills development, in part, to the quality of parent-child interactions, noting that expressive language production among children with CIs is more often elicited through explicit requests made by the parents, with the children themselves rarely initiating verbal or non-verbal communication spontaneously. However, a child's poor conversational ability may adversely affect the child's capacity to interactively engage the parents, which in turn reduces the quantity and quality of parents' language input, and this in turn inhibits the child's development of pragmatic / social conversational skills. The authors conclude that early intervention should not be limited to the development of language skills, but should also aim at scaffolding communicative and social experiences in which acquired language skills may be effectively applied and further developed by the child. The findings of a large sample multi-center study that formed part of the CDaCI investigation, which tracked the development of social competence of children pre- and post-CI also point to the importance of early intervention programmes that target social skills development as well as language for deaf pre-schoolers (Hoffman, Quittner & Cejas, 2015).

On the basis of a recent small sample observational study, Raver et al. (2014) suggest that children with hearing loss often lack the language to interact with their peers, and that simply placing children together in the same setting is often not sufficient to adequately improve communication and related social deficits shown by some children with hearing loss. They report that typical

playmates initiated interactions less often with children with hearing loss and ignored their initiations more often than those of other children in mainstream settings; the findings of a short intervention using social stories point to the need for an explicit focus on fostering friendships and communication in young children with hearing loss, such as through the use of social stories.

Recent research also suggests that children with severe-to-profound hearing loss who have experienced a period of auditory deprivation and language delay may also experience delays and deficits in basic neurocognitive development. To help explain individual differences in language and speech outcomes among deaf children following cochlear implantation, Pisoni et al. have investigated processes such as executive function, cognitive control and self-regulation. Their findings suggest that some children with CIs show delays in immediate memory capacity, working memory, sequence memory and learning, verbal rehearsal speech and other aspects of executive functioning compared with their typically developing hearing peers. Although early sensory deprivation is an important factor in the difficulties and delays seen in deaf children's neurocognitive development, social influences also play a part in early cognitive development, as suggested by studies of normally hearing infants that have found a link between the quality of mother-child interactions and a child's development of executive function in the first two years of life (cf. e.g. Bernier et al., 2016). The quality of parents' linguistic input has also been shown to influence children's executive function skills, with expansion utterances relating to the child's focus of attention related to the child's executive function, but directive utterances having no positive influence (cf. Bibcock et al., 2009, cited by Holt et al., 2012 & Holt et al., 2013). Overall, children who experience higher levels of maternal sensitivity, maternal cognitive stimulation and access to stimulating resources in the home have been shown to score significantly higher on measures of sustained attention, impulsivity, and short- and long-term memory, even after controlling for family income, number of hours in child care and maternal vocabulary (Holt et al., 2012, citing the findings of a 2005 (US) National Institute of Child Health and Human Development Early Child Care Research Network study). Holt et al. (2012) found evidence of a close link between family environment and executive function in children who are deaf and use CIs. They note that because family dynamics are fluid and can be changed with explicit communication and intervention, there is the possibility that families can be helped to function in ways that maximise the likelihood of successful outcomes from cochlear implantation, including optimising children's development of executive function skills.

As with language development, deaf children's neurocognitive development may be particularly sensitive to the communication environment within the family, as early auditory deprivation is likely to have a number of non-auditory neurocognitive effects that carry risks for children's overall development. Kral (2013) reports, for example, that deaf children have been shown to pay more attention to the peripheral visual field (cf., for example, Bottari et al., 2010) as if they are constantly 'scanning' the periphery; this, in turn, may affect interaction with caregivers and limit joint attention and capabilities for sustained attention. Even though the deficit in sustained attention may reduce with age, learning in early infancy is extensively affected by this deficit. Kral suggests that training post-implantation may help to compensate for attention and other deficits that result from early auditory deprivation.

In sum:

- Deficits in one area of development can have cascading effects on others, and language development has been found to be closely correlated with the development of social competence in both deaf and hearing children. Studies generally demonstrate lower social competence and more social behaviour / psychosocial problems in hearing impaired children compared to children with normal hearing. For example, there is evidence that children with CIs show significant delays in pragmatic skills compared with their hearing peers.

- Poor conversational ability may adversely affect a child's capacity to interactively engage the parents, which in turn reduces the quantity and quality of parents' language input, and this further inhibits the child's development of pragmatic / social conversational skills.
- Psychosocial development risk should be considered even for all preschool children with hearing loss, including those who perform well on traditional language measures and children with lesser degrees of hearing loss.
- A number of recent studies point to the importance of early intervention programmes that target social skills development as well as language for deaf pre-schoolers.
- Recent research also suggests that children with severe-to-profound hearing loss who have experienced a period of auditory deprivation and language delay may also experience delays and deficits in basic neurocognitive development.
- Although early sensory deprivation is an important factor in the difficulties and delays seen in deaf children's neurocognitive development, there is also strong evidence for social influences. For example, the quality of parents' linguistic input and communicative interaction has been shown to influence children's executive function skills. Overall, children who experience higher levels of maternal sensitivity, maternal cognitive stimulation and access to stimulating resources in the home have been shown to score significantly higher on measures of sustained attention, impulsivity, and short- and long-term memory. As with language development, deaf children's neurocognitive development may be particularly sensitive to the communication environment within the family.
- Because family dynamics are fluid and can potentially be changed with explicit communication and intervention, there is the possibility that families can be helped to function in ways that help to optimise children's development of executive function skills.

5. PROGRAMMES AND INTERVENTIONS HELPING PARENTS TO HELP THEIR CHILDREN:

5.1 Parents as agents of their children's language development: Given the critical effect that parents have on children's early language environments, parents are well poised as the primary agents of giving their deaf children the language and communication support and enhancement that their children need (Leffel and Suskind, 2013). However, a recent multi-centre study following almost 100 families of pre-schoolers with CIs in the USA found that not all parents were aware of 'best input practices' for their at-risk children (Cruz et al., 2013; see also Ratner, 2013).

DesJardin (2005) suggests that early intervention should seek to enhance the competence and confidence of children's caregivers so as to optimise their children's chances of developing to their full potential. Parents' sense of self-efficacy is of central importance: parents who exhibit high self-efficacy are more likely to put their knowledge and skills into action and thereby elicit more positive interactions with their children and employ strategies that support their children's learning. Self-efficacy is not a fixed personality trait – it can be actively supported and developed (ibid.). Based on observational and questionnaire-based studies, she reports that mothers who perceived themselves as less knowledgeable and competent in their child's language learning used lower-level language strategies. Low parental self-efficacy has also been found to be associated with maternal depression (citing Teti and Gelfand, 1991) and maternal perceptions of children difficulty (citing Coleman and Karraker, 1998). Less efficacious parents are also reported to experience higher parenting stress (ibid.), and less effective take-up of new skills. Based on her findings, DesJardin (2005) warns that information regarding the use of a sensory device and how to develop children's speech and language skills may not be enough for some mothers; instead, they might need to be explicitly taught the relevant skills. This can be done through help-giving practices and programmes (e.g. providing opportunities for families to learn strategies and techniques), interventions designed explicitly to elevate parents' self-efficacy beliefs (e.g. one-to-one sessions involving professional modelling and constructive feedback), or family-to-family support. Parents may also need direct encouragement and support to involve themselves in their children's education and development; studies show that parents who are involved in their children's early intervention programme tend to have better communication with their children and contribute more to their children's progress than parents who do not participate. Parental involvement in the earliest stages of development is critical for future language acquisition and educational development (see also Yoshinaga-Itano, 2000).

In a meta-analysis of eighteen studies of parent-implemented language interventions, Roberts and Kaiser (2011) found that parent-implemented interventions have positive, significant effects on children's expressive and receptive vocabulary and language skills, rate of communication and expressive morpho-syntax. Across different intervention approaches, they found that parents successfully implemented interventions with modest training. Most of the interventions included in their study focused on broad social communication, seeking to address the type and amount of parent input by incorporating linguistic strategies that can be integrated into daily routines. Parents receiving intervention were found to be more responsive, and to use more language models, with their children (although note that most parents participating in these interventions were from middle socioeconomic social groups, so the findings cannot be assumed to apply to a broader spectrum of social groups). It is important that parents believe that their child's intelligence and cognition are malleable and able to be enhanced through language input, therefore incremental theories of intelligence need to be emphasised; frequent and objective feedback on parent behaviour is also very helpful to support qualitative and quantitative enhancements in parent linguistic input (ibid.).

5.2 Evidence from parent-focused support programmes: Researchers at the University of Chicago have reported on the outcomes of two parent-focused programmes for children from families of low socioeconomic status: 'Project ASPIRE' and the 'Thirty Million Words Project' (Leffel and Suskind, 2013). Both are intended to enrich the early home language environment of children in low socioeconomic status groups through parent-directed, home-based interventions delivered by trained coaches. Project ASPIRE is intended specifically for children with hearing loss, whereas the Thirty Million Words project has been developed to improve school readiness in typically developing children. To maximise uptake, emphasis is placed on matching language-enhancing strategies with daily routine activities so as to encourage generalisation and secure adoption of positive linguistic practices. Both programmes encourage practices that have been proven to positively impact development and school readiness in all children, including responsive parenting, conversational turns, use of decontextualized language, etc. Through knowledge, skills-building, and supportive behaviour-change techniques, the curricula support parents' sense of self-efficacy in fostering their children's development, through the lens of their own linguistic style and unique relationship with their child. Home-based interventions include the use of video modelling to help build parents' skills and enhance parents' mindfulness, and use of the 'LENA' system to provide parents with weekly quantitative linguistic feedback. Both programmes promote incremental theories of intelligence by teaching parents that "your talk is what grows your baby's brain" and "children aren't born smart; they're made smart" to help parents develop a sense of agency as the key to their children's development and outcomes. The outcomes of these studies indicate that parents' linguistic behaviours reverted to previous behaviours to some extent after intervention but still remained above initial baseline levels; continuing support is needed to help parents to maintain the gains made during intervention. Both projects have shown that parents can become active participants in changing their children's language environments when they are given the proper tools, encouragement, and an understanding of their own importance in their children's development (ibid.; on the positive impacts of parental guidance using video feedback, see also Lam-Cassettari et al., 2015).

Hubel et al. (2017) report on the outcomes of a US-wide nationally-funded home visit programme known as 'Early Head Start' (EHS) designed to promote parents' abilities to create stable, nurturing care environments for their children. The findings suggest that parents' engagement increased when the EHS reduced social isolation by forming connections among parents and when the programme focused on involving parents directly in helping their child to meet important developmental milestones. The findings also indicate that influencing or establishing positive parenting behaviours requires parenting intervention across both the early (infancy) and later (toddler / preschool) periods.

In sum:

- Parents are key to giving their deaf children the language and communication support and enhancement that their children need, but not all parents are aware of 'best input practices' for their children.
- Early intervention should seek to enhance the competence and confidence of children's caregivers: parents with higher self-efficacy are more likely to put their knowledge and skills into action and use strategies that support their children's learning. Self-efficacy is not a fixed personality trait – it can be actively supported and developed.
- Information about how to develop children's speech and language skills may not be enough for some parents; instead, they might need to be explicitly taught the relevant skills. Parents may also need direct encouragement and support to involve themselves in their children's education and development.

- Parent-implemented interventions have been found to have significant positive effects on children’s expressive and receptive vocabulary and language skills, rate of communication and expressive morpho-syntax; parents receiving intervention were found to be more responsive and to use more language models with their children.
- It is important to emphasise incremental theories of intelligence in parenting intervention programmes, so that parents understand that they can enhance their child’s intelligence and cognition through language input and good communication strategies.
- Experience from programmes such as ‘Project ASPIRE’ in the US suggests that parents’ uptake can be supported by matching language-enhancing strategies with daily routine activities.
- Continuing support is likely to be needed to help parents to maintain the gains made during any parenting intervention.

-- End --