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# Early Parent Interaction with Deaf children: Developing the EPID Tool

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# Declaration

I, Martina Curtin declare that this thesis has been composed by myself and that the work has not been submitted for any other degree or professional qualification. I confirm that the work submitted is my own, except where work which has formed part of jointly authored publications. My contribution and those of the other authors to this work have been explicitly indicated below. I confirm that appropriate credit has been given within this thesis where reference has been made to the work of others.

The work presented in Chapter 2 was published in Current Opinion in Otolaryngology in 2021 by myself, Martina Curtin, and co-authors and supervisors Prof Rosalind Herman, Prof Madeline Cruice and Prof Gary Morgan. My contribution and the contributions of my supervisors and co-authors are presented in the table below.

| **Author Order** | **Contributions** | **Estimated % of the work** |
|---|---|---|
| Curtin, Martina | Conceptualization; Investigation; Writing – original draft; Writing -review and editing; | 70% |
| Herman, Rosalind | Conceptualization; Writing -review and editing; Supervision | 10% |
| Cruice, Madeline | Conceptualization; Writing -review and editing; Supervision | 10% |
| Morgan, Gary | Conceptualization; Writing -review and editing; Supervision | 10% |

The work presented in Chapter 3 was published in the Journal of Clinical Medicine by myself, Martina Curtin, collaborator Dr Evelien Dirks, co-authors and supervisors Prof Rosalind Herman, Prof Madeline Cruice and Prof Gary Morgan and co-authors and mentees Lucy Rodgers and Lauren Newman. My contribution and the contributions of my supervisors, collaborator, and co-authors are presented in the table below.

| **Author Order** | **Contributions** | **Estimated % of the work** |
|---|---|---|
| Curtin, Martina | Conceptualization; Project Administration; Methodology; Resources – Software; Data Collection; Validation; Formal Analysis; Writing-Original Draft; Writing—review and editing; Funding acquisition | 40% |
| Dirks, Evelien | Methodology; Data Collection; Validation; Writing—review and editing | 20% |
| Cruice, Madeline | Conceptualization; Methodology; Data Collection; Validation; Writing—review and editing; Supervision | 10% |
| Herman, Rosalind | Conceptualization; Methodology; Data Collection; Validation; Writing—review and editing; Supervision | 10% |
| Newman, Lauren | Data Collection; Validation; | 5% |
| Rodgers, Lucy | Data Collection; Validation; | 5% |
| Morgan, Gary | Conceptualization; Methodology; Data Collection; Validation; Writing—review and editing; Supervision | 10% |

The work presented in Chapter 4 was published in the International Journal of Language and Communication Disorders by myself, Martina Curtin and co-authors and supervisors Prof Gary Morgan, Prof Madeline Cruice and Prof Rosalind Herman. My contribution and the contributions of my supervisors and co-authors are presented in the table below.

| **Author Order** | **Contributions** | **Estimated % of the work** |
|---|---|---|
| Curtin, Martina | Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Validation; Writing - original draft; Writing - review & editing | 60% |
| Morgan, Gary | Conceptualization; Writing -review and editing; Supervision | 10% |
| Cruice, Madeline | Conceptualization; Writing -review and editing; Supervision | 10% |
| Herman, Rosalind | Conceptualization; Validation; Writing -review and editing; Supervision | 20% |

The work presented in Chapter 5 was published in Frontiers in Psychology by myself, Martina Curtin and collaborator Tina Wakefield, and supervisors Prof Rosalind Herman, Prof Gary Morgan and Prof Madeline Cruice. My contribution and the contributions of my supervisors and co-authors are presented in the table below.

| **Author Order** | **Contributions** | **Estimated % of the work** |
|---|---|---|
| Curtin, Martina | Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, Writing—original draft, Writing—review and editing. | 55% |
| Wakefield, Tina | Data curation, Investigation, Validation. | 5% |
| Herman, Rosalind | Conceptualization, Methodology, Supervision, Validation, Writing—review and editing. | 10% |
| Morgan, Gary | Supervision, Writing—review and editing. | 10% |
| Cruice, Madeline | Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing—review and editing, Project administration. | 20% |

The work presented in Chapter 6 was published in PLoS ONE by myself, Martina Curtin and co-authors and supervisors Prof Madeline Cruice, Prof Gary Morgan and Prof Rosalind Herman. My contribution and the contributions of my supervisors and co-authors are presented in the table below.

| Author Order | Contributions | Estimated % of the work |
|---|---|---|
| Curtin, Martina | Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing – original draft, Writing – review & editing | 60% |
| Cruice, Madeline | Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – review & editing | 15% |
| Morgan, Gary | Funding acquisition, Supervision, Writing – review & editing | 10% |
| Herman, Rosalind | Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing – review & editing | 15% |

## Supporting Declaration

As supervisors and co-authors on each of the publications submitted, we certify that:

- The declaration made above by the graduate researcher correctly reflects the extent of their contribution to the work included in this thesis.
- The graduate researcher was responsible for the planning, executing, and preparations of the work.
- The graduate researcher has met the minimum period of candidature.
- The graduate researcher wrote the first full draft of all the publications and performed the subsequent editing of the publication in response to the co-authors, peer reviewers, and editors' review.
- The first paper (Current Opinion in Otolaryngology) allows for the final, peer-reviewed manuscript to be reused in a thesis (print and electronically) 12 months after the publication date. This article was published in June 2021.
- The remaining four publications are open access and distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.
- All co-authors have permitted the use of the work to be included in this thesis and agreed to the contributions listed above (see individual declarations in Chapter 8 'Supporting information').
- This thesis is suitable in presentation and content for onward submission to the appointed examiners.

## Signed by:

Gary Morgan.

**Prof Gary Morgan** (Primary supervisor May 20– Jul 22)

**Prof Madeline Cruice** (Secondary Supervisor)

**Prof Ros Herman** (Primary supervisor Jul 22 – June 24)

## COVID-19 Impact Statement

This statement is provided for the aid and benefit of future readers to summarise the impact of the COVID-19 pandemic on the scope, methodology, and research activity associated with this thesis. The academic standards for a research degree awarded by City, University of London and for which this thesis is submitted remain the same regardless of this context.

**Title of the research project:** Early Parent Interaction with Deaf children: Developing the EPID Tool (May 2020-May 2024).

1. **Summary of how the research project, scope or methodology has been revised because of COVID-19 restrictions**

The only revision to the proposed research was *how* data in the focus groups study (see Chapter 5) was collected. Due to COVID-19 restrictions, focus groups were held online.

2. **Summary of how research activity and/or data collection was impacted because of COVID-19 restrictions, and how any initially planned activity would have fitted within the thesis narrative**

The main impact was that focus groups needed to be shorter in time. We originally hoped for a two-hour session, but participants (all practitioners working with deaf children and young people) were already delivering services and attending work meetings online. We tried to be sensitive to this by limiting each focus group to 90 minutes in length with one mid-way break.

3. **Summary of actions or decisions taken to mitigate for the impact of data collection or research activity that was prevented by COVID-19**

    - Focus group facilitators (Martina Curtin and Tina Wakefield) attended the course ‘Conducting Online Focus Groups’ from the Social Research Association.

    - Participants were asked to join from home or work in a private space where they would not be interrupted to ensure confidentiality.

    - Eighteen hearing and deaf participants agreed to participate. Some used English, some used British Sign Language, some used both. Some needed access to written text as well as audio-visual information. It was decided to host focus groups smaller in size to provide good language access to all attendees and to ensure all participants had time to share their perspectives within the 90 minutes. Each of the four online focus group had two facilitators, one person responsible for providing technical support, and two qualified BSL/English interpreters. Two of the four focus groups also had closed captioners present.

4. **Summary of how any planned work might have changed the thesis narrative, including new research questions that have arisen from adjusting the scope of the research project**

Coronavirus and its impact on the assessment of PCI was naturally raised in discussions in the focus groups and these findings are presented in chapter 5, p 9-10. Beyond this, adaptations to data collection methodology outlined above did not change the thesis narrative.

**Date of statement: 28.05.2024**

# Acknowledgements

Sincere thanks go to my three supervisors for a truly fantastic experience at City, University of London. To Professor Herman and Professor Morgan, your expert knowledge and experience in the field of deafness, in parent-child interaction, and in child language acquisition were instrumental in shaping my study and deepening my understanding. After many of our fruitful discussions in supervision, my brain felt stimulated in a way I hadn't experienced before. I often left feeling excited, inspired, and curious. Together with Professor Cruice, you created a supportive research environment where I was able to grow as a clinical researcher. Thank you all, for your guidance, mentorship, and the perfect way you balanced encouragement with constructive criticism and challenge. To Professor Cruice, not only were you a critical source of intellectual support for the qualitative work, the e-Delphi and all aspects of patient and public involvement, you were also a phenomenal critical friend. Your 'outsider-ness' as an aphasiologist and your truly excellent eye for detail and noticing small but important things is remarkable. Thank you also for wading through the murky waters of 'clinical academic posts' with me during all our career mentorship meetings over the years.

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It seemed apt that for a doctorate that focused on the role of parents, I reflected on the role of mine. They arrived in the UK with not much and were so dedicated to building a better life for themselves, and for me and my brother. Their incredible work ethic and family-centredness made a huge dent on us both. As a grown woman, I still seek and value their company, their advice, and their praise. To Jane and Martin, two of the most loving and hardworking people I know, and to whom I owe it all: thanks for always being so responsive, supportive and encouraging.

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# Abstract

Ninety percent of deaf children are born to hearing parents who have little experience of deafness and may need support with adapting their communication. Despite early identification and the provision of audiological amplification, delays in language skills in deaf children continue to exist. Good quality parental interaction is a key predictor for the successful development of language.

As parent-child interaction (PCI) is important, it is necessary to have tools to assess it. Each parent and child are different; time spent assessing their individual characteristics is important for target setting and tailoring intervention. A deaf-specific assessment tool to observe PCI is yet to be developed. This three-phase doctorate addresses this by developing the core content of a new assessment by synthesising research, practice, and parent preferences.

**Aim:**
To develop the core content of a deaf-specific assessment tool for practitioners and parents to use when observing PCI with deaf children aged 0-3.

**Methods:**
1. A systematic review (SR) to identify which parent behaviours are assessed, how they are assessed and which are associated with deaf children's language scores.
2. National survey and follow-up, explanatory focus groups to understand professional practice in the assessment of PCI.
3. An international e-Delphi study using results from (1) and (2) to gain consensus on the core content of the EPID tool.

**Results:**
Though methods of assessment are different between researchers and practitioners, both tend to assess the following parental skills: attention getting, joint engagement, parental sensitivity, and how a parent provides access to, and enriches language. The e-Delphi gained consensus on 36 parent behaviours that are now the core content of the EPID tool (Early Parent Interaction with Deaf children) and 22 recommendations on how to use the EPID with parents.

**Conclusions:**
This doctorate synthesised the parent behaviours that are assessed in research and in practice, and how these behaviours are assessed. The findings of these investigations have led to the creation of the core content and recommended approach of a novel PCI assessment for families with deaf children aged 0-3 years.

**Patient and public involvement:**
The involvement of parents of deaf children and hearing and deaf professionals working with families was embedded throughout. This meant that the core role that parents play in their deaf child's development was centred, as was parent voice, and parent wellbeing. The language used within the tool and the tool's functionality will be co-produced with parents of deaf children.

# Abbreviations

AA – Assessment Approach

AVT - Auditory Verbal Therapists

BATOD – British Association of Teachers of Deaf Children

BSL - British Sign Language

CHERRIES - The Checklist for Reporting Results of Internet E-Surveys (Eysenbach, 2004)

CI – cochlear implant

CJE – coordinated joint engagement

COREQ – Consolidated criteria for reporting qualitative research (Tong, Sainsbury, and Craig, 2007)

COSMIN - Consensus-based Standards for the selection of health status Measurement Instruments

CRIDE - Consortium for Research into Deaf Education

DHSC - Department of Health and Social Care

EAS – Emotional Availability Scales (Biringen, 2008)

EASPD - European Association of Service providers for Persons with Disabilities

ED – Evelien Dirks

EPID - Early Parent Interaction in Deafness

GDPR - General Data Protection Regulation

GM – Gary Morgan

GRADE - Grading of Recommendations, Assessment, Development, and Evaluations

FCEI-DHH - Family Centred Early Intervention for Deaf and Hard of Hearing

HL FLTs - higher level facilitation language techniques

IJLCD – International Journal of Language and Communication Disorders

IQR – Interquartile Range

JCM – Journal of Clinical Medicine

LENA – Language Environment Analysis

LN – Lauren Newman

LR – Lucy Rodgers

MCr – Madeline Cruice

MCu – Martina Curtin

MDT - Multi-Disciplinary Team

NDCS - National Deaf Children's Society

NICE – National Institute for Health and Care Excellence

NIHR – National Institute for Health Research

(N)DCAMHS – (National) Deaf Child and Adolescent Mental Health Services

PB – Parent Behaviour

PCI – parent child interaction

PPI - Patient and Public Involvement

PICCOLO - Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (Roggman et al., 2013)

PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Page et al., 2021)

QToD / ToD - Qualified Teachers of Deaf Children / Teachers of Deaf Children

RCSLT – Royal College of Speech and Language Therapists

RCT – Randomised Control Trial

RH – Rosalind Herman

SJE – supported joint engagement

SLT(s) - Speech and Language Therapist(s)

SR – Systematic Review

UK – United Kingdom

UNESCO - United Nations Educational, Scientific and Cultural Organization.

USA – United States of America

WEIRD - western, educated, industrialised, rich, and democratic

WHO - World Health Organisation

# 1: Introduction

The aim of this PhD was to develop the core content of a new, evidence-based, observational assessment tool to monitor parents' interaction skills when they are communicating with their deaf children aged 0-3 years. The tool's content has been developed through several stages of deaf-specific research, starting with a systematic review and ending with an international consensus study. Some recommendations on how to use the assessment in practice have also been developed across each of these stages. The core content of the assessment tool will be the evidential underpinning of a future coproduction phase, where hearing and deaf parents and practitioners will codesign the tool's functionality and use. The coproduction stage is not included in this thesis.

Within this introductory chapter, I will begin by defining the terms 'deaf', 'parent', 'child' and 'parent-child interaction'. I will describe the current understanding of the potential influence of parent-child interaction (PCI) on a child´s language development. Next, a review is presented of how deafness can impact the interactions between a parent (or caregiver) and their child, with particular focus on consequences for communication and language development. Later in the chapter I will explore the parental skills that are correlated with growth in deaf children's language and conclude with a rationale for why a robust, clinical assessment tool is important to assist professionals in appraising PCI.

This is a PhD by prospective publication and each published research study is presented following this introduction, all with a similar rationale and evidence base.

## 1.1 Definitions and framing

Throughout this thesis, the term 'parent' refers to any parent, guardian, or caregiver of any gender. The term 'child' in this thesis refers to young children aged between 0-3 years. The term 'deaf' will be used to refer to the entire spectrum of deafness that can be seen in childhood, from mild to profound, congenital and late onset/acquired. We follow the recommendation from the British Association of Teachers of Deaf Children (2020) to use the term 'deaf' rather than 'hearing loss' and 'hearing impairment'. Although not the focus of the current research, there are different conceptions of the term 'deaf' in the literature. The socio-cultural model sees deafness as a 'difference' that needs to be accommodated within a mainly hearing world. Within this model, research indicates that some parents agree that deaf children should not be seen as a 'pair of ears needing repair' (Flaherty, 2015; p.74). In contrast, the medical model views deafness as a feature that needs to be fixed, with aims to restore hearing and reduce the risks of delays in spoken languages (Padden and Humphries, 2005; Bruijnzeel et al., 2016). For reflexivity and transparency, my perspectives on deafness sit within the social model. Whilst I appreciate the value of early identification and early fitting of audiology equipment, these interventions do not restore hearing. I believe deafness should not be seen as a barrier to participation, to attainment, or to a good quality of life. I hold my deaf colleagues and parents of deaf children in mind as they advocate the notion that anything is possible with positive framing and the correct support.

## 1.2 Early child development

'Giving every child the best start in life' (with a focus on the first 1001 days) is a priority for the UK government and supported by the National Health Service and local authorities (Department of Health and Social Care, 2021). This policy runs parallel to government initiatives in other countries such as 'Zero to Three' in the USA and 'First 1000 days' in Australia. Within the first three years of a child's life, critical developments happen within the brain of the child which support vision, hearing, language, cognition, and social and emotional capabilities. It is the peak period of brain development (Fox, Levitt and Nelson, 2010). The growth and modifications of neural pathways are influenced by early experiences, and optimal outcomes occur during this period when the baby has a consistent, nurturing and responsive parent (Ilyka, Johnson, and Lloyd-Fox, 2021). Positive parenting (characterised by sensitivity, responsive caregiving, co-regulation, nurturance and stimulation) can have a long-lasting impact on a child's cognition (Ramos et al., 2023), social-emotional functioning (Stern et al., 2024) and language (Romeo et al., 2018). Conversely, there is evidence that brain structure and functioning can be adversely affected by abuse and neglect (Belsky and De Haan, 2011). More recent research on 'harsh parenting' (i.e., non-abusive but negative parenting within normal ranges) suggests that negative parental behaviours, albeit mild, can delay the child's brain maturation (Whittle et al., 2016). Positive parental interaction benefits and promotes many features of child development, but for the purposes of this PhD, the focus will narrow on how parents' interactive behaviours can impact communication development.

## 1.3 Parent-child interaction (PCI) and its influence on children´s language development

There exists variation across typically developing, hearing children in the rate and level of competence that they acquire their native language(s) (Kidd and Arciuli, 2016). Much research has attempted to explain this variability by identifying factors that influence a child´s learning of language. The factors stem from the internal abilities of the infant (e.g. working memory, social skills) as well as those coming from outside the child (e.g. nutrition, availability of early enriching activities such as positive parental interaction). Any potential explanation is made more complex because variability is additionally linked to the interaction between these internal and external influences (Rowland, 2013; Dale et al., 2015). Even very early research has shown that the child themself influences the environment in which they are developing (Snow, 1977).

PCI has been studied for decades; it is a fundamental part of family life, beginning with a mother's response to the child's signals in the womb (Zapf et al., 2023). Early research suggested that parents with low socioeconomic status (a composite score of wealth, parental education, and parental occupation) used fewer different words in the language they addressed to their children, compared to parents with high socioeconomic status (Hart and Risley, 1999). This association between culture, language exposure, and language outcomes has since been studied widely. Rindermann and Baumeister (2015) re-analysed data from Hart and Risley (1999) and Hoff (2003) to find that the educational levels of parents was more strongly associated with differences in children's cognitive development than socioeconomic status. This suggests parental education and knowledge of child development (rather than income or occupation) was more important. Recent research supports this finding with slightly more refinement: children who access good quality child-directed talk, in one-on-one interactions, have larger vocabularies and process language quicker (Rowe, 2008; Ramírez-Esparza, García-Sierra, and Kuhl, 2014). Further research gives a robust indication of what 'good quality' in PCI means: communicative turn taking between parent and child is an important long-term predictor of children's language development (Gilkerson et al., 2018; Romeo et al., 2018; Donelly and Kidd, 2021).

'Turn taking' aptly describes the reciprocal, bi-directional, face-to-face, dyadic relationship between a parent and child experiencing good quality PCI. Mostly, it involves the parent giving appropriate, responsive, and effective input (during their turn) to facilitate positive social-emotional development and communication skills within the child (Dodici, Draper, and Peterson, 2003). Within this social-communicative framework, children build the foundations of language through 'serve and return interactions' (Donnelly and Kidd, 2021; Chen, Cabrera, and Reich, 2023) with their parent. This happens first through paralinguistic means (eye contact, facial expressions, gestures, pointing) and then through language use (Tomasello, 2008). Teaching and modelling language through responding to one's child is often a natural role that a parent takes on. Parents are seen as the main provider of the social and linguistic stimulation required for successful child development (Peacock-Chambers, Ivy, and Bair-Merritt, 2017). Parents provide scaffolds to this development through prompt and contingent (i.e., semantically related) reactions to their child's behaviour (Bornstein, et al., 2008; Shonkoff and Bales, 2011; Chen, Cabrera, and Reich, 2023). This in turn encourages and reinforces a child's communicative intentions (Tomasello and Todd, 1983). For example, relationships have been found between a parent's responses to child gesture and vocalisation, and child vocabulary development (Olson and Masur, 2015). As mentioned, a child can also influence the interaction; when a child has delayed or disordered communication skills, research suggests parents use less responsive language facilitation within their communicative turns (van Balkom, Verhoeven, and van Weerdenburg, 2010; Kaiser and Roberts, 2013; Blackwell et al., 2015).

The preceding description of good quality PCI and child language acquisition is the standard western view and may not be relevant for a global population. In studies comparing families in Mozambique and the Netherlands (Vogt, Mastin and Schots, 2015), Mayan families in Guatemala and American families in Chicago (Shneidman and Goldin-Meadow, 2012), and Tsimane forager-horticulturalists of Bolivia (Cristia et al., 2017), it appears that young infants globally hear much less child-directed speech than their westernised, industrialised counterparts, but still develop normal language. The levels of child-directed speech from primary caregivers are also different; mothers provided 31% of the speech in Mayan recordings compared to 79% from mothers in American recordings (Shneidman and Goldin-Meadow, 2012). As researchers in this field suggest, further work on the diversity of early language experiences and early language acquisition is needed to address this research bias (Cristia et al., 2017).

The responsiveness, connectedness, frequency, consistency, and accessibility of a parent's communication predicts a child's communicative development (Baumwell, Tamis-LeMonda, and Bornstein, 1997; Tamis-LeMonda, Bornstein, and Baumwell, 2001; Koester and Lahti-Harper, 2010; Trivette, Dunst, and Hamby, 2010). Theoretically, PCI and its effects on language development in deaf children raises many interesting questions, such as: What is the function of parental input? When PCI is affected by a mismatch in hearing status, which are the most important parental behaviours to promote language? What is the impact of reduced language access in otherwise healthy infants? Whilst the programme of study for this PhD is not experimental or intervention-based, it is hoped that the PCI assessment tool that is developed from this thesis may prove to be helpful within longitudinal intervention studies in the future, both in deafness and perhaps developed for other conditions.

## 1.4 Language development in deaf children

The most recent surveys report that there are over 52,000 deaf children in the UK aged 0-19 (CRIDE, 2023). The prevalence of deafness at birth (1 in 1000 births) has remained consistently low over time (Butcher et al., 2019). The prevalence of deafness by aged 18 is estimated to be much higher however (13% of a pooled sample of 3.4 million), due to delayed onset in childhood (Wang et al., 2019). Delayed onset of deafness can be caused by many factors such as genetics, neurological disorders, infections, or trauma to the head or ear specifically.

Approximately 90% of deaf children are born to hearing parents who have little experience of deafness and no signing skills (Mitchell and Karchmer, 2004). Deafness reduces a child's access to (and understanding of) spoken language, which impacts the development of spoken vocabulary, grammar, and speech sounds (Hoffman, Cejas and Quittner, 2015; Cupples et al., 2018). In countries where there is newborn hearing screening (i.e., in the USA since 1992 and in the UK since 2001), deaf children are now identified much earlier than previously and are provided with hearing aids shortly after birth. For those who do not benefit sufficiently from hearing aids, cochlear implants (CIs) are increasingly provided at younger ages, i.e., at 10 months, documented by Dettman et al., (2007) and at 5.9 months in more recent research from Hoff et al., (2019). Deaf children's spoken language is reported to be 1 – 1.5 standard deviations lower than hearing peers (expressive and receptive spoken language in Ching and Dillon (2013) and expressive spoken language vocabulary in Yoshinaga-Itano et al. (2017)). Many deaf children arrive at nursery with delayed language skills, including difficulties with joint attention and joint engagement (Geers et al., 2009; Caselli et al., 2012; Rinaldi et al., 2013; Quittner et al., 2014, Werfel, Reynolds and Fitton, 2022). In the UK, only 38% of deaf children achieve expected levels of development in their early learning goals, compared to 74% of their hearing counterparts (UK Government, 2023).

Even with the early provision of audiological equipment, a deaf child does not become a hearing child, and the risks of not being able to access spoken language effectively still exist. Deaf children are unable to access as much spoken language as hearing children, and additionally miss out on opportunities to pick up on information via incidental learning (Morgan, 2015). There can also be difficulties with consistent hearing aid use (Visram et al., 2021) and/or a significant wait time between deafness being detected and cochlear implantation, with one study in Canada reporting an average implantation age of 36 months (Fitzpatrick, Ham, and Whittingham, 2015). Some scholars refer to this issue as 'language deprivation', where there is reduced or no access to the spoken language of the home and reduced or no access to a visually accessible sign language. This terminology is insensitive to a parent's learning journey, yet the message is important. Sign language may be introduced as an alternative option when listening and spoken language does not develop, yet this is often at a point when optimal language learning periods have passed (Hall, 2017). The Family-Centred Early Intervention for Deaf and Hard of Hearing Children (FCEI-DHH) committee addressed this in their revised principles by stressing the importance of providing families with comprehensive, accurate, and impartial information (Szarkowski et al., 2024b). Evidence suggests early exposure to a signed language supports spoken language learning post implantation (Goodwin and Lillo-Martin, 2019; Pontecorvo et al., 2023). Further, many research studies report on samples of children who *are* bimodal bilingual, with spoken language and sign both part of their communicative repertoire (Spencer, 1996; Quittner et al., 2013; Choo and Dettman, 2016; Ahmad and Brown, 2016).

As mentioned in section 1.3, child outcomes are diverse due to a range of external and internal factors, such as maternal education, socio-economic status, culture, levels of family involvement, premature or full-term gestation periods, genetics, and cognition. As well as these factors, deaf child populations have additional reasons for greater heterogeneity and language outcomes (Holzinger et al., 2020), such as differences in levels of deafness; audiological equipment provision; age of fitting and consistency of equipment use; language choices; levels of early intervention, and a higher incidence of comorbid cognitive difficulties (40% according to Cejas, Hoffman and Quittner, 2015).

The identification of a young child's deafness within a hearing family can trigger a range of feelings such as shock, guilt, blame, overwhelm, and fear or worry regarding the deaf child's future (Gilliver, Ching, and Sjahalam-King, 2013; Erbasi et al., 2018; Robinson, Bowman and Barker, 2023). When asked about stressors, parents of deaf children do often identify deaf-specific issues such as language development, language choices, and hearing devices (Adily et al., 2024). Parents require a great deal of emotional support, as well as information, signposting, and connections with other parents.

## 1.5 PCI with deaf infants

An important foundation for language development within PCI is joint engagement, i.e., two people with a mutual focus. Establishing and maintaining joint engagement can be difficult for parents with young deaf infants (Dirks and Rieffe, 2019) because of a mismatch in hearing status between parent and child, and the child's difficulties in co-ordinating signals. This can manifest as increased interruptions to the child's attention by parents initiating new, unrelated activities to those the infant is engaged in (Meadow-Orlans and Spencer, 1996). Higher rates of directive behaviours from hearing parents of deaf children (Ambrose et al., 2015) are less conducive for maintaining attention and building the foundations of communication. The mismatch in hearing status means that hearing parents need to adapt their communication skills to attain successful joint engagement. This is achieved by explicitly gaining or waiting for the deaf child's attention before starting to communicate and then sequentially shifting attention between the environment/objects and each other.

Success in joint engagement is related to parental sensitivity. This is defined as a set of skills that enable a parent to be emotionally connected, in tune, and responsive to their child's needs, goals, and communicative attempts. A parent with a high level of sensitivity will be positive and accepting of their child and will strive for interactive congruence. Dirks and Rieffe (2019) found positive relationships between parental sensitivity and total duration of joint engagement, with both features correlating with higher scores in deaf children's language. The less intrusive a parent was, the longer their joint engagement, and the higher the child's language scores. This supports earlier work from Pressman and colleagues (1999) showing that maternal sensitivity positively predicted expressive language scores and accounted for 10% of the observed variance. In their 1998 study, Pressman and team uncovered that maternal sensitivity had a larger positive effect on language in their sample of deaf children compared to their hearing sample.

The communication behaviours a parent uses are also important for developing a deaf child's signed or spoken language. Quittner and colleagues (2013) found parents with above-average skills in maternal sensitivity *and* language stimulation had children with 1.52 years less of a language delay. Further to this, Pressman et al. (1999) found that maternal sensitivity was not correlated with children's initial expressive language scores but was positively correlated in their follow up assessments 12 months later. In a systematic review by Holzinger et al. (2020), a meta-analysis of four longitudinal studies found that parental linguistic input explained 31.7% of the variance in deaf children's expressive language scores. Parents who are trained in facilitative language techniques such as sitting face to face, waiting and observing the child, expanding and recasting language, have deaf children with improved communication skills (Glanemann et al., 2013; Roberts, 2019; Nicastri et al., 2021).

Differences have been reported in the language and cognitive profiles of deaf children born to deaf parents who use sign language. These children are often seen to develop language in parallel ways to hearing children born to hearing parents (Hall et al., 2017). Deaf parents use attention-gaining strategies at an early age with their deaf infants (Loots, Devisé, and Jacquet, 2005; Wille, Van Lierde, and Van Herreweghe, 2019) and there is a corresponding earlier tuning-in of the deaf child's gaze to the adult's (Bosworth and Stone, 2021). Deaf parents who use sign language with their deaf children also use specific strategies to aid age-appropriate language development. These are: displacing signs into the child's line of sight; timing utterances so that the child is looking at the mother when she signs; using exaggerated positive affect so that the facial expression provides a clue to the parent's reaction/thought, and the use of tactile or visual attention getting strategies (Harris and Chasin, 2005; Day et al., 2018;  Wille, Van Lierde, and Van Herreweghe, 2019). In addition, deaf parents are more likely to interpret any visual communication as an attempt to use language (Ambrose, 2016) whereas hearing parents may miss these opportunities or be more responsive to sound signals.

To conclude this section, good PCI in deafness requires the parent to: wait for or gain the child’s attention; maintain a shared, synchronous focus with their child; follow their child’s lead; provide contingent and attuned responses to the child’s interests and needs; and use multi-modal methods to interpret, enrich and expand their child’s communicative attempts.

## 1.6 Deaf children’s outcomes in later life

Parents who have not yet developed skills in communicating with their deaf children are likely to provide reduced language input that in turn affects how a child develops their own understanding and use of language (Levine et al., 2016). If not addressed and supported early, reduced quality of PCI, can lead to life-long difficulties in communication and cognition (Morgan, 2015; Hall et al., 2017), as can be seen in studies assessing deaf adults’ language skills as a consequence of reduced access to language in childhood (Cheng, Halgren, and Mayberry, 2018; Woll, 2018).

Poor speech and language skills impact on reading skills and educational attainment (Herman, Roy and Kyle, 2017). As deaf children move through the education system in the UK, and the curriculum imposes greater demands, the attainment gap between hearing and deaf children widens significantly, i.e., an eight-month attainment gap at 7 years old, a 12-month gap at 11 years old, and an 18-month gap at 16 years of age (EPI, 2023). At age 16, all students in the UK sit their GCSEs. Deaf students achieve an average grade of 2.5 (EPI, 2023), which is significantly lower than the national average grade of 5 (a grade of ‘4’ is a pass and equivalent to a ‘C’). Deaf students experiencing social deprivation and/or cognitive difficulties face even greater disruption to their learning and future options (ibid). Chorozoglou et al. (2018) found that the total average societal costs for a deaf adolescent in education was £10,031 more than a matched hearing peer, with costs increasing with deafness severity.

Conversational difficulties are linked to emotional issues and peer problems experienced by deaf children (Holzinger and Fellinger, 2022). In older deaf children, continued negative experiences when communicating with people who are unfamiliar with deafness can lead to feelings of loneliness, isolation, and frustration and result in low self-esteem and behavioural issues (Schick et al., 2013; Theunissen et al., 2014). Young deaf adults have much lower well-being and health-related quality of life scores than their hearing counterparts (Young et al., 2023), with 40% of deaf children and young people experiencing mental health problems compared to 25% of their hearing peers (DHSC, 2005). Rates of maltreatment, and sexual and physical abuse are higher in deaf children (Knutson, Johnson, and Sullivan, 2004; Kvam, 2004; Admire and Ramirez, 2021; Hammad, Al-Otaibi and Awed, 2024). The communication environment of the family is a crucial variable affecting the well-being of deaf children, with early access to effective communication a protective factor (Fellinger, Holzinger, and Pollard, 2012).

## 1.7 The need for an assessment

Age at identification, age at amplification, and amount of early intervention sessions are strong predictors of how well a deaf child develops language (Boons et al., 2012; Wiggin et al., 2021). As discussed in this chapter, the quantity and quality of parental interaction is another strong predictor of deaf children's language outcomes (Pressman et al., 1999; Desjardin, 2003; Yoshinaga-Itano, 2003; Ambrose et al., 2015; Holzinger et al., 2020). A parent who provides timely, accessible, responsive and semantically meaningful language in response to their deaf child's gaze, behaviour, interests and utterances will positively impact their deaf child's language learning.

As PCI is so important, it is necessary to have a valid and reliable tool to assess its quality and role in supporting child language development. In research, we often see video-based PCI assessments used to monitor the effects of intervention (Lyon and Budd, 2010; de Oliveira et al., 2024). There is a dearth of research that reports specifically on the assessment of parent-child interaction in routine, clinical practice. A handful of research reports on PCI practice with children with language difficulties (Christakis, et al., 2019) and in Development Language Disorder (Law et al., 2019), but neither refer to assessment approaches specifically.

There is a strong need for a consistent and comprehensive approach in PCI assessment practice for a range of client groups; a robust video-based approach that extends and formalises identification and clinical reasoning. Each parent and child are different, and time spent assessing individual characteristics is important for understanding the family's communicative strengths and needs. Assessments also improve validity and reliability as behaviours can be defined and consistently identified by different professionals, especially where video tools are used. Assessments are also an efficient way of deciding on targets for intervention so that therapy is tailored, family-centred and meets needs (Kaderavek and Henbest, 2024). Assessments provide the opportunity to measure changes in outcomes through reassessment and comparison with earlier baseline measures (O'Hara et al., 2019; Ambrose et al., 2023).

PCI with deaf children warrants an even stronger case for video-based assessment tools. PCI is more than just spoken language. Eye gaze supported joint engagement, parental sensitivity, watchful waiting, gesture and sign language are facets of PCI that are highly appropriate to examine and are likely of great importance for promoting optimal outcomes among DHH children. Reciprocal interactions and "intuitive parenting" can, at times, be challenged when a child has identified deafness (Traci & Koester, 2003). Differences in hearing status between parents and the DHH child can cause difficulties with gaining and maintaining the DHH child's attention (Barker et al., 2009; Loots, Devisé, & Jacquet, 2005; Gale & Schick, 2009; Wille, Van Lierde, & Van Herreweghe, 2019; Morgan, Curtin, & Botting, 2021; Lammertink et al., 2022), and ensuring the DHH child has access to language such as being face to face, adjusting positioning to be near to amplification devices, or emphasizing child directed speech or sign (Houston et al., 2003; Mayberry & Squires, 2006; Wang, Bergeson, & Houston, 2017). Many of these features of PCI are multi-modal and simultaneous, video recordings therefore enable the capture of complex, multi-layered, naturalistic parent-child interaction (Lam-Cassettari, Wadnerkar-Kamble, & James, 2015; Wadnerkar-Kamble, Lam-Cassettari, & James, 2020).

To date, there is no clinical assessment tool that evaluates a parent's interaction skills when they are communicating with their deaf child aged 0-3 years. Deaf-specific measures such as the Ski-Hi Language Development Scale (Watkins, 2004) track the deaf infant's expressive and receptive language development but do not measure the quality of parent input. Tools used to assess parent interaction in research (DesJardin and Eisenberg, 2007; Vohr, et al. 2010; Szagun and Stumper, 2012; Cruz, et al., 2013; Ambrose, et al., 2015) are experimental in nature (i.e., often designed for frame-by-frame coding of videos) or only analyse spoken language (i.e., Language Environment Analysis (LENA) belts).

Qualified Teachers of Deaf Children (QToDs) and Speech and Language Therapists (SLTs) are often the first professionals to support families and deaf children at home. Roles and responsibilities overlap between the two professions and joint working is encouraged (BATOD/RCSLT, 2019). QToDs often lead with supporting the family's emotional journey regarding the diagnosis, and their understanding of audiology. Both QToDs and SLTs take responsibility for monitoring language acquisition and providing guidance on PCI. Prior to this PhD, an investigation of professionals' assessment practices in PCI with deaf children did not exist. The absence of a reliable, deaf-specific, evidence-based assessment tool may mean that professionals lack agreement on which skills are important to appraise in the home. It also raises the chance that there is disparity between professionals on how to identify strengths, needs, and targets for intervention, which could impinge on the child's development if therapy goals are not appropriate. It is also not known how acceptable a PCI assessment is to parents of deaf children.

Research has shown that it is possible to educate and coach parents of deaf children in good quality PCI with positive effects on deaf children's language (Glanemann et al., 2013; Roberts, 2019; Nicastri et al., 2021). Research also indicates that positive PCI may be even more important where the child is deaf (Pressman, et al., 1998; Jamsek et al., 2021). In practice, many QToDs and SLTs focus their efforts on PCI intervention (Rees et al., 2015). Modelling and coaching are crucial parts of family-centred intervention but may be more effective when the support is tailored to the individualised context. To know which skills to support parents with, and where to begin with intervention, an assessment tool is vital.

## 1.8 Early Parent Interaction with Deaf Children: The EPID Tool

This thesis presents three completed phases of research that have led to the development of the core content and recommended approach for a new PCI assessment tool. The EPID tool will be an evidence-based assessment for professionals and parents to use collaboratively to appraise and monitor how parents interact with their deaf children aged 0-3 years. The tool's core content was developed as follows:

*Phase One (May 2020 – March 2021)*
Phase one was a systematic review with a narrative synthesis. The purpose of this study was to uncover how researchers assess parents when they are interacting with their child aged 0-3 years. More specifically, the systematic review investigated which parent behaviours are assessed by researchers and how are they assessed. A third aim was to identify parent behaviours that correlated with higher child language scores. Chapter three presents the published systematic review.

Systematic reviews aim to identify, evaluate, and synthesise all the relevant research on a particular topic. As summarised by Gusenbauer and Haddaway (2020), systematic reviews must include *all* relevant papers, the search must be reproducible, and the process must be conducted and reported with complete transparency. Systematic reviews provide readers with up-to-date summaries on an area of research. They report collective (and therefore larger) sample numbers which potentially provide generalisable population information and can lead to powerful decision making (Harris et al., 2014). They have become increasingly popular in healthcare and are often used as a starting point when developing clinical practice guidelines (Gopalakrishnan and Ganeshkumar, 2013) and informing policy decisions (Shojania et al., 2007). Reviews are only as strong as the papers that are included, and assessments of each paper's rigor is an important feature in limiting bias (Harris et al., 2014).

*Phase Two (May 2021 – June 2022)*

Phase two was a mixed-methods study with an explanatory sequential design. In this study, professional practice was investigated to determine which parent behaviours were assessed by professionals and the methods used. With a mixed-methods approach, results are more likely to converge in closer proximity to the real phenomenon in question (Suleman and Hopper, 2014) and provide a more accurate and comprehensive understanding of the topic, better than the outcome of either approach in isolation (Bishop, 2015).

First data were collected via an online, quantitative survey. The analysis of this data then informed the second stage of the study, four qualitative focus groups. In brief, the survey paper provided us a broad understanding of what is being assessed in PCI, and the focus groups paper provided the how and why. The survey and focus group data were analysed and reported separately and are presented in this thesis as chapters four and five respectively. A mixed-methods paper that integrates the qualitative and quantitative findings is planned post-doctorate.

*Phase Three (December 2021 – July 2022)*
Phase three was an e-Delphi consensus study. The Delphi technique is a structured decision-making process that uses a series of questionnaires that progressively become narrower in focus to reach a consensus. The Delphi process must involve the recruitment of an expert panel, anonymity of their responses when voting, and controlled feedback to members following each voting round. It has been used in many healthcare studies (Ardolino et al., 2012; Hitzig et al., 2020; McMillan, King, and Tully, 2016) to generate consensus with regards to clinical practice where guidelines are not yet established.

In this phase, the authors included in the systematic review (phase one) and the participants of the survey (phase two) as well as other eligible professionals were invited to participate in an online e-Delphi. A range of international participants voted on behaviours and assessment approaches (extracted from the outcomes of phases one and two) over two rounds of questionnaires. The outcome of this study (chapter six) has formed the approach and the core content of the EPID tool.

## 1.9 Stakeholders and Patient and Public Involvement

'No decision about us without us is for us' (Rahman et al., 2022) is a statement that explicitly demonstrates the moral and ethical rights patients and carers *should* have in being involved in research that impacts them and/or their families. It is the responsibility of researchers to exercise and embed this right when planning and applying for funding. Patient and public involvement (PPI) is a mandatory requirement within funding proposals for the National Institute for Health Research, the UK's largest funder of health and care research (NIHR, 2024). PPI has been shown to improve the effectiveness and value of research by increasing relevance to patients, ensuring patients benefit, increasing the accountability and transparency of research, improving recruitment and retention of participants, and improving dissemination efforts beyond the field of academia (Ghate, 2018; Greenhalgh et al., 2019, Tembo et al., 2021).

There were two key PPI groups involved in this project. The first, a group of hearing and deaf professionals working with deaf babies and their families, included three QToDs, two SLTs, a neuroscientist, the chair of a deaf children's charity and two deaf parents (also working in education and deaf support services). The second group included fourteen hearing parents of deaf children (not all involved at once). Both groups were seen as partners in the project and had activities assigned throughout the course of this PhD programme. These activities are explored in each chapter under the PPI section of each paper. Table 1 below summarises the meeting schedules and activities over the three years. All meetings were held online for two hours, except meeting 1 of 2022.

**Table 1.1: PPI Meetings and activities throughout the PhD programme**

| 2020 | 2021 | 2022 |
|---|---|---|
| 1 Professional partners: Introductions, design extraction form for SR, and Equality, Diversity and Inclusion strategy for PPI formed. | 1 Whole group: Review SR results and design survey questions | 1 Professional partners: Remote review of proposed e-Delphi statements |
| 2 Parent partners: Introductions and exploring the early parent journey | 2 Whole group: Review survey results and design focus group questions | 2 Parent partners: Review proposed e-Delphi statements and create missing statements from parents' perspective |
| 3 Parent partners: (As above, alternative meeting option offered) | 3 Multiple meetings with co-facilitator (a deaf QToD from professional partner group) to plan, facilitate and debrief on the focus groups | 3 Professional partners: Review and discuss e-Delphi statements not achieving consensus following round 1. |
| **To assist in the design of:**<br>PPI recruitment video<br>Published papers in chapters 2 and 3 | **To assist in the design of:**<br>Survey recruitment video 1<br>Survey recruitment video 2 (British Sign Language)<br>Recruitment strategies<br>Focus group facilitation<br>Published papers in chapters 4 and 5 | 4 Parent partners: Review and discuss e-Delphi statements not achieving consensus following round 1. |
| | | 5 Whole group: Review and discuss 'near to consensus' statements, following round 2. |
| | | **To assist in the design of:**<br>E-Delphi recruitment materials<br>Published papers in chapter 6 |

## 1.10 Summary

This chapter has defined and reviewed PCI within the context of hearing and deaf infants. Most deaf children are born to hearing parents, where the deaf child can encounter difficulties accessing the language of the home. Many studies suggest that hearing parents who are new to deafness, need support to adapt their communication skills to provide language input that is accessible and meaningful for the child. The associated risks and costs of not addressing these differences were highlighted. As PCI with deaf children is so important, a valid and reliable tool is required to assess it. This would provide a summary of communicative strengths and needs which would then influence goal setting and the direction taken in intervention. Parent-focused interventions have been shown to improve PCI and a deaf child's language. To know which skills to focus on explicitly, a thorough assessment of strengths and needs is required. The three-phase plan for the development of the EPID tool's core content was outlined with some initial rationale given for each stage.

# Assessing parent–child interaction in infant deafness

*Martina Curtin[a,b], Ros Herman[b], Madeline Cruice[b], and Gary Morgan[b]*

**Purpose of review**

To highlight the importance of parent–child interaction (PCI) in infant deafness and address the lack of robust assessment tools in clinical practice.

**Recent findings**

Most deaf babies are born to hearing parents with little experience in deafness. Deafness can reduce access to spoken language. Despite advancements in amplification technology, deaf children still present with delays in attention and communication skills at the start of nursery. Research reports that hearing parents of deaf infants can be more directive during interaction, spend less time following the child's focus of attention, and have more difficulty achieving successful turn-taking in conversation. Much research tells us that these factors impact on the quality and quantity of PCI. Good PCI, in all infants, but especially so in deafness, is a strong predictor of child language outcomes. Teachers of the Deaf and Speech and Language Therapists are the first professionals to support families in the home. For these professionals, having an objective way of assessing PCI would greatly assist and standardise their practice. However, to date, there are no deaf-specific assessments to observe and appraise a parent's communication behaviours when interacting with their deaf child.

**Summary**

Intervention studies with families of deaf children have shown success in improving parental sensitivity and facilitative language techniques. An observational assessment in parent–deaf child interaction would ensure that communication interventions are appropriately targeted on the individual family's needs.

**Keywords**

assessment, deaf, early years, parent–child interaction, speech and language therapy

## INTRODUCTION

The focus of this review article is to discuss parent–child interaction (PCI) in deafness and the absence of tools available for professionals to use when supporting parents and caregivers with their newly diagnosed deaf infants. The paper will begin with defining the terms 'deafness' and 'parent–child interaction'. We will then review how deafness can impact the interactions between a caregiver and their child, with particular focus on consequences for communication development. The paper will then identify parental skills that are correlated with child language and conclude with a rationale for why a robust assessment tool to assist professionals in appraising PCI in practice is important.

## THE TERM 'DEAFNESS'

In this paper, we use the term 'deaf' to refer to the entire spectrum of deafness in childhood, from mild to profound. We follow the recommendation from the British Association of Teachers of the Deaf (BATOD) in 2020 [1] to use the terms 'deafness' and 'deaf' rather than 'hearing loss' and 'hearing impairment'.

## PARENT–CHILD INTERACTION

PCI focuses on the reciprocal, face-to-face, dyadic relationship between caregiver and child. Good interaction involves the parent (or caregiver) giving appropriate, responsive, and effective language input to facilitate positive social-emotional development and communication skills within the child [2].

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## KEY POINTS

- Despite advancements in amplification technology, deaf children present with delays in attention and communication skills.
- Research shows that the quality and quantity of parent–child interaction in deafness is a strong predictor of child language outcomes.
- Teachers of the Deaf and Speech and Language Therapists require an evidence-based observational tool to assess and monitor parent-deaf child interaction.
- A psychometrically robust clinical assessment of parent-deaf child interaction would ensure that communication interventions are appropriately targeted on the individual communication needs of each family.

Parents who are sensitive or receptive to their child's needs will provide prompt, contingent responses to their child's communicative behaviour [3]. Responses include language (words, signs, repetitions, questions and modelling of sentences) as well as additional communicative behaviours (facial expressions, gesture, touch, and tone). Much research suggests it is the quality, frequency, consistency, and accessibility of a parent's communication that predicts a child's communicative development [4–6].

## THE IMPACT OF DEAFNESS

The most recent figures indicate that there are over 50,000 deaf children in the UK [7]. Since the start of New-born Hearing Screening throughout the UK in 2006, deaf children are now identified earlier than previously and provided with hearing aids and/or cochlear implants. Despite these advances, many deaf children start nursery with delayed language skills, including difficulties with joint attention and engagement [8–11]. A major cause of delay is that even with optimal amplification, deaf children are unable to access as much spoken language as hearing children, and miss out on opportunities to pick up on information via incidental learning [12]. Moreover, 90% of deaf children are born to hearing parents who have little experience of deafness, no signing skills, and use spoken language as the communication mode. Therefore, families need to rapidly develop knowledge and skills in how best to communicate with their deaf children.

## WHY IS INTERACTION IMPORTANT

Many studies have found the quantity and quality of parental involvement and interaction is the greatest predictor of deaf children's developmental outcomes [13▪,14–17]. Parents who have not yet developed skills in communicating with their deaf children are likely to provide reduced language input that in turn affects how a child develops their own understanding and use of language [18].

Studies have reported that often hearing parents of deaf children tend to be more likely to lead or direct the attention of infants in their interactions compared to deaf parents of deaf children and hearing parents of hearing children [19,20]. They can often struggle with using appropriate visual cues for the infant to attend to language, and can be less sensitive to timing as deaf infants need to visually scan the environment for meaning [21,22]. Hearing parents can spend less time in co-ordinated joint attention with their deaf children [23,24] and are more likely to interrupt their children's attention by initiating new, unrelated activities [25]. Hearing parents have also been shown to elicit language from their deaf children through requests rather than in conversations, meaning deaf children have less experience of two-way interaction and receive less feedback on their communicative attempts [11].

If not addressed and supported early, reduced quality of PCI and access to language can lead to long-term difficulties in communication and cognition [12,26▪]. Reduced interaction can also lead to feelings of loneliness, frustration and low self-esteem in deaf children and young people [27,28].

## PARENT SKILLS THAT RELATE TO IMPROVED CHILD LANGUAGE

This section will refer to 'parent sensitivity'. This concept refers to the attunement of a parent to their child's attempts to communicate and encapsulates the responsiveness of the parent to the child's needs and goals [29]. Sensitivity is not just focused on one member in isolation but within an interactive context; it refers to how a parent reads and responds to their child's signals (both signals of distress and more positive signals of intrigue and pleasure within the interaction) [30].

Parental sensitivity and nonintrusiveness (following the child's lead) were correlated with more words produced by deaf children [31]. Pressman *et al.* [17] found the same correlations; mothers with higher scores in sensitivity had deaf children with higher language scores in their follow up assessments. Through regression analyses, Pressman and team found that parental sensitivity positively predicted follow-up language scores and accounted for 10% of the variance [17].

Further evidence of the importance of sensitivity in interaction was highlighted by Quittner *et al.*

[32]; even after controlling for family demographics and child amplification experience, maternal sensitivity and cognitive stimulation by the parent predicted increases in deaf children's language growth. Using measures of maternal sensitivity and language stimulation skills, they found parents with above mean scores had children who showed 1.5 years less delay in language, than parents with lower ratings of the same skills [32].

Parental sensitivity is not the *only* important factor in interaction. Dirks and Rieffe [24] compared the interactions between parents of children with moderate hearing loss and parents of children with normal hearing. The authors found differences in child language and in the time spent jointly attending in play, (parents did not differ in ratings of parent sensitivity). Dirks and Rieffe found time spent in joint attention was also positively related to child language [24]. This suggests that monitoring skills in how parents gain and maintain their child's attention are another important area for professionals to assess and support.

With strong correlations between good PCI and child language, it is clearly important professionals monitor and support parent's abilities to attend and appropriately respond to child-led, child-initiated communication.

## THE ASSESSMENT OF PARENT–DEAF CHILD INTERACTION IN DEAFNESS

To date, there is no clinical assessment tool that evaluates a parent's interaction skills when they are communicating with their deaf child. Measures such as the Ski-Hi Language Development Scale [33] track the deaf baby's expressive and receptive language development but do not measure the quality or quantity of parent input. Tools used to assess parent interaction in research are often experimental in nature (i.e. designed for in-depth coding of videos made for research projects) and not appropriate for professionals to assess behaviours in the family home. Additionally, whilst practitioners use interventions aimed at improving parent-deaf child interaction e.g., Hanen, the assessment stage is not standardised.

NICE guidelines on assessment or therapeutic interventions that support deafness in childhood do not exist. The Royal College of Speech and Language Therapists (RCSLT) does not provide any specific information relating to assessments or interventions for SLTs to use when working on interaction between deaf babies and their care givers. Whilst the BATOD and RCSLT's position paper [34] lists many language and speech assessments, none relate to PCI.

The absence of a reliable, evidence-based assessment tool means that professionals may lack agreement on which skills are important to appraise in the home. It also raises the chances that there is disparity between professionals on how to identify strengths, needs and targets for intervention, which could impinge on the child's development if therapy goals are not appropriate.

Many intervention studies in deafness have shown us that is it possible to educate and train parents of deaf children on how to improve their responsiveness [35], sensitivity, language use and shared attention [13▪], and overall communicative support strategies [36▪]. We also know that higher ratings of self-efficacy in parents of deaf children are positively correlated to higher quality facilitative techniques [16]. Intervention, coaching, and support are crucial, but it is more effective when targeted, individualised and family focused [37]. An assessment tool for practitioners will ensure therapy approaches are directed at areas of identified need.

## FUTURE RESEARCH

The authors are currently preparing a systematic review of which PCI behaviours are most often included in the research of deaf infants, and how these behaviours are assessed [38]. Following this, a national survey will ask the same questions of practitioners to investigate whether the systematic review findings are reflected in current clinical practice.

## CONCLUSIONS

This paper has defined and reviewed PCI within the context of infant deafness. Deafness can reduce access to spoken language and many studies report hearing parents are less sensitive in their use of interaction strategies. The review also highlighted the relationship between good interaction and deaf children's language skills. Parent-focused interventions have been shown to improve PCI, but in order to know which skills to focus on explicitly, a thorough assessment of strengths and needs is required. In conclusion, there is a need for an evidence-based, observational tool specific to deafness to assist professionals with standardising the assessment, appraisal and monitoring of parent–child communication.

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## Conflicts of interest

*There are no conflicts of interest.*

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Papers of particular interest, published within the annual period of review, have been highlighted as:

- ■ of special interest
- ■■ of outstanding interest

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# Assessing Parent Behaviours in Parent–Child Interactions with Deaf and Hard of Hearing Infants Aged 0–3 Years: A Systematic Review

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**Abstract:** Background: Despite early identification and advancements in cochlear implant and hearing aid technology, delays in language skills in deaf children continue to exist. Good-quality parent–child interaction (PCI) is a key predictor for the successful development of deaf children's signed and/or spoken language. Though professionals have standard assessments to monitor child language, a clinical tool to observe the quality of parental interaction is yet to be developed. Aims and methods: This systematic review with narrative synthesis aims to uncover which parent behaviours are assessed in PCI studies with deaf infants aged 0–3 years, how these behaviours are assessed, and which are correlated with higher scores in child language. Results: Sixty-one papers were included, spanning 40 years of research. Research included in the review assessed parents' skills in gaining attention, joint engagement, emotional sensitivity, and language input. PCI was mostly assessed using coding systems and frame-by-frame video analysis. Some of the parent behaviours mentioned previously are associated with more words produced by deaf children. Conclusion: The results of the review provide the evidence base required to develop the content of a future clinical assessment tool for parent–child interaction in deafness.

**Keywords:** deaf; parent–child interaction; assessment; early interaction; speech and language therapy; clinical research

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## 1. Introduction

Much research describes the importance of good-quality parent–child interaction for children's language development [1]. Parents are seen as the main provider of the social and linguistic stimulation required for successful child language development [2].

Children develop the foundations of language through the 'serve and return' of communicative interactions with their caregiver. This happens first through vocal and visual means (exclamations, babbling eye contact, facial expressions, gestures and pointing) and then through language use [3]. Parents scaffold this development through prompts and contingent reactions to their child's behaviours [4]. These behaviours in turn encourage and reinforce a child's communicative intentions [5]. For example, relationships have been found between a parent's responses to child gesture and vocalisation, and child vocabulary development [6].

### 1.1. Parent–Child Interaction (PCI) and Deafness

Deafness impacts the child's ability to access spoken language. However, with 95% of deaf children born to hearing families, this can bring challenges for successful communication, and long-term consequences for language development and academic success [7]. In this paper, we use the term 'deaf' to refer to all levels of deafness, from mild to profound. We also follow the recommendation from the British Association of Teachers of the Deaf and use the terms 'deafness' and 'deaf' rather than 'hearing loss' and 'hearing impairment' [8]. In addition, this review is intended to be inclusive of deaf children developing signed and/or spoken language.

Despite earlier identification and advancements in hearing aid and cochlear implant technology, delays in receptive and expressive language skills in deaf children continue to exist [9,10]. Many studies have found the quantity and quality of parental interaction to be one of the main predictors of deaf children's language outcomes [11–15]. Parents who have not yet developed skills in effectively communicating with their deaf child may provide lower-quality language input [16], which in turn affects the child's language development.

To illustrate, studies have reported that hearing parents of deaf children can often be more directive in their interactions compared to deaf parents of deaf children and hearing parents of hearing children [9,17]. This manifests as increased interruptions to the child's attention by parents initiating new, unrelated activities [18]. Hearing parents also elicit language from their deaf child through requests rather than conversations, meaning deaf children have less experience of two-way interaction and receive less feedback on their communicative attempts [19]. An important foundation for language development is joint attention, i.e., two people with a mutual focus. Hearing parents struggle to establish and maintain this behaviour with their young deaf infants [20,21]. Higher rates of directive behaviours from hearing parents of deaf children [17,22], are less conducive for maintaining attention. The mismatch of hearing status means that hearing parents need to adapt their communication skills to attain successful joint engagement in by gaining or waiting for the deaf child's attention before starting to communicate and sequentially shifting attention between the environment/objects and each other. In comparison, deaf parents are using these social engagement strategies at an early age with their deaf infants [23,24] and we see an earlier tuning in of the deaf child's gaze [25].

### 1.2. Improving Parent's Skills in Interaction

Despite the association between parental interaction and child language development, enhancing hearing parents' communication with deaf children is a complex issue. Parents of deaf children receive multiple home visits and attend appointments for medical and audiological purposes where they learn about deafness, communication, and future education [26]. To reduce the communication difficulties that can cause increased family stress [27], hearing parents are required to adapt their communication style and often receive family-centred interventions that incorporate new strategies to enhance their interaction skills. The level of parental involvement in these interventions varies and can be associated with acceptance of the child's deafness, parental self-efficacy, and the amount of support a family receives [28].

In wider research, the impact of parent-implemented interventions on at-risk children within hearing populations is well documented in Autism Spectrum Disorders [29], Developmental Language Disorder [30], stuttering [31] and in families with low socio-economic status [32]. There has been less research on the effect of PCI interventions in deafness, with some studies suggesting that parents who received intervention had deaf children with better communication and/or language skills [13,33,34].

### 1.3. The Assessment of Parent–Child Interaction (PCI)

As PCI is important, it is necessary to have valid and reliable tools to assess it. Each parent and child is different, and clinical time spent assessing each individual's characteristics is important for target setting, as well as tailoring and implementing the intervention successfully.

Research studies of PCI typically use video recordings and analyse pre-determined target behaviours, i.e., the behaviours of the parent and child, and the reciprocity between them. However, there is much variability across studies in the analysis of this interaction and the use of the same tools across studies is sparse. For example, a recent systematic review identified more than 500 observational tools used for measuring PCI [35]. The population of focus in Lotzin et al. was parents with infants aged 0 to 12 months and was not specific to deafness. Lotzin et al. concluded that only 24 of these tools met their criteria of being psychometrically tested and published in peer-reviewed journals. The authors further highlighted that only 10 tools provided evidence in 4 out of 5 domains of validity; tools often lacked a user manual, were based on interactions from samples in North America and Western Europe only, and were not thoroughly validated on fathers [35]. The authors recommend that researchers and clinicians should use tools with some evidence of validity.

### 1.4. The Current Study

A paper by Moeller and colleagues entitled 'Best Practices in Family-Centered Early Intervention for Children Who Are Deaf or Hard of Hearing' [36] highlighted the importance of parents' interactions and the need for regular assessment of PCI. Yet, to our knowledge, there is no valid clinical assessment tool that evaluates a parent's interaction skills when they are communicating with their deaf child.

The current systematic review forms part of a larger project to develop an assessment tool for PCI in deafness and aims to address the following three research questions. It is the first review to synthesise all the available evidence on the following three questions:

(1) Which parent behaviours are being assessed in parent–child interaction studies in deafness for infants aged 0–3 years?
(2) How are parent behaviours being assessed?
(3) Which parent behaviours are associated with higher child language scores?

## 2. Materials and Methods

This systematic review was conducted following guidance from the Cochrane Handbook for Systematic Reviews. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement [37] was used to ensure robust reporting. The review protocol was uploaded to PROSPERO, ref: CRD42020198567. The research team and expert advisory board agreed on and approved the protocol.

### 2.1. Selection Criteria

For this work, all peer-reviewed, published studies available in English that included deaf infants aged 0–3 years with any level of deafness, any amplification (or none) and any communication modality were included. Parents could be hearing or deaf. Included papers had to investigate free, unstructured play between the deaf child and parent in any context (i.e., in a home, lab or clinic). Play was selected as this is often the activity observed in professional practice. Parent–child dyads had to be video recorded, with video data used for the analysis.

All study types (quantitative, qualitative or mixed methods) and any research designs (RCT, intervention or observational studies) were included. PCI assessment had to be objectively measured by the study research team, through non-validated and/or validated measures. Results of papers had to report on parent behaviours and interaction.

Papers were excluded if: they used subjective data (i.e., parent self-report) to analyse PCI; only reported on child behaviours; included children who were deaf and also had either Autism Spectrum Disorder or a Visual Impairment (as parent behaviours and strategies may be significantly different within this sub-population); or only analysed verbal recordings. The latter is because PCI, particularly in deafness, is more than spoken words a parent says. It also encompasses how parents engage with their child though eye contact, facial expression, touch and gesture. These aspects of PCI are all important parts of the language learning process. As such, this last criterion ensured research studies that assessed these behaviours as well as language-based communication (spoken and signed), were captured in the review.

The first author and an information specialist librarian searched the following eight databases on 26 June 2020: Medline, PsycINFO, CINAHL, Communication Source, Cochrane Databases, Embase, Web of Science and Scopus, through two platforms: Ovid and EBSCOhost.

### *2.2. Search Strategy*

Synonyms were used for ‘deaf’, ‘infant’, ‘parent’ and ‘interaction’. Please see Appendix A for full search strategy.

### *2.3. Selection Process*

Covidence software was used in the review and data collection process. All search results were uploaded, and duplicates were automatically removed. As an initial trial, 30 papers (1% of the search results) were reviewed independently by authors M.C. (Martina Curtin) and E.D., with arising conflicts discussed. Each paper was then independently reviewed for inclusion based on article title and abstract, with authors M.C. (Madeline Cruice) and E.D. achieving 95% agreement (k = 0.64) at this stage.

Full texts were retrieved for the articles that met the inclusion criteria. Despite contacting authors, 5% were unable to be retrieved. Each paper was independently reviewed by M.C. (Martina Curtin) and E.D. Discrepancies were resolved every 1 to 2 weeks. Authors met 82% agreement (k = 0.59).

### *2.4. Data Collection Process*

Each paper included in the review was independently extracted and reviewed by the first author and at least one other author. All authors were involved in meetings to gain consensus, check discrepancies, and make final decisions.

### *2.5. Data Items*

The extraction form (Appendix B) was written by the first author, then reviewed and amended by the other authors and members of the project advisory board, before being added to Covidence.

To answer research questions 1 and 2, the main outcome variables included information about the PCI assessment including which behaviours were assessed and how the interaction was assessed (i.e., where, for how long and how often) and by what means (i.e., coding systems or scales, by whom and what reliability information). The results of the assessments were also collected to answer research question 3.

In order to provide an overview of the papers included in the review, the following variables were included on the extraction form: study characteristics (country of study, research design, aims, conflicts declared) and participant characteristics (child age, deafness level, amplification used, communication mode used, parent age, social economic status, parent education level). This detailed information gives us an understanding of the similarities and differences between studies, their applicability to populations seen clinically, as well as highlighting repeated samples.

Information on intervention characteristics (intervention name, delivery, dose) were also extracted. Finally, conclusions, confounding factors, and limitations identified by the authors were also extracted. Whilst not reported in our review, these were used to verify the results of the analysis and assist our assessments of bias. Missing information was labelled as 'not reported'.

### 2.6. Risk of Bias Assessment

The Joanna Briggs Institute Critical Appraisal Checklist for Cross-Sectional Studies [38] was used as the Risk of Bias Assessment for all the observational studies. For intervention studies, the ROBINS-I [39] was used. No adaptations were made to either tool. Both tools included an overall risk of bias judgement at the end with guidance on how to reach this. Similar to data extraction, each study's risk of bias was independently reviewed by the first author and at least one other author, with differences resolved in regular meetings.

### 2.7. Synthesis (Preparation and Approach)

Extracted data were exported into Excel from Covidence and a table summarising the included papers was created. Table 1 outlines the key features of each paper in relation to the review's questions (parent behaviours assessed, methods of assessment and whether child language was assessed). We also indicate the risk of bias outcome for each study.

Included papers were then grouped into sub-sets of conceptually similar PCI behaviours. Due to the qualitative nature of the extracted data, a narrative synthesis approach [40] was taken using extra guidance on concept mapping [41].

**Table 1.** Papers included in the review ($n$ = 61) and the associated research questions.

| Paper No | First Author | Year | Reported Country of Study | Study Design | Degree of Hearing Loss | No of Dyads | PCI Behaviours Assessed | PCI Measure (Method) | Child Lang Assessed? | Risk of Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Beatrijs. W., et al. [23] | 2019 | Belgium | Two between-groups, observational studies | No Report | 13 | Attention-Getting Strategies | Coding | N | Moderate |
| 2 | DesJardin, J. L. [42] | 2006 | USA | Within-group, observational study | Mod–Prof | 32 | Attention-Getting Strategies and Parental Communication | Coding | Y | Moderate |
| 3 | Loots, G. et al. [43] | 2003 | Belgium | Between-groups, observational study | Mod–Prof | 33 | Attention-Getting Strategies | Coding | N | Low |
| 4 | Waxman, R. et al. [44] | 1997 | USA | Between-groups, observational study | Mild–Prof | 77 | Attention-Getting Strategies | Coding | N | Moderate |
| 5 | Chasin, J. et al. [45] | 2008 | UK | Between-groups, observational study | Profound | 9 | Attention-Getting Strategies and Child Eye Gaze | Coding | N | Moderate |
| 6 | Harris, M. et al. [46] | 1989 | UK | Within-group, longitudinal observational case series | Profound | 4 | Attention-Getting Strategies and Child Eye Gaze | Coding | Y | Serious |
| 7 | Harris, M. et al. [47] | 1997 | Australia and UK | Between-groups, observational study | Profound | 11 | Attention-Getting Strategies and Child Eye Gaze | Coding | N | Critical |
| 8 | Harris, M. et al. [47] | 2005 | UK | Between-groups, observational study | Profound | 26 | Attention-Getting Strategies and Child Eye Gaze | Coding | N | Moderate |
| 9 | Lederberg, A. R. et al. [48] | 1998 | USA | Between-groups, observational study | Sev–Prof | 40 | Attention-Getting Strategies and Child Eye Gaze | Coding | Y | Moderate |
| 10 | Prendergast, S. G. et al. [49] | 1996 | USA | Between-groups, observational study | Sev–Prof | 16 | Attention-Getting Strategies and Child Eye Gaze | Coding | N | Moderate |
| 11 | Gabouer, A. et al. [50] | 2018 | USA | Between-groups, observational study | Sev–Prof | 18 | Attention-Getting Strategies and Joint Engagement | Coding | N | Serious |
| 12 | Loots, G. et al. [24] | 2005 | Belgium | Between-groups, observational study | Mod–Prof | 31 | Attention-Getting Strategies and Joint Engagement | Coding | N | Low |
| 13 | Nowakowski, M. et al. [51] | 2009 | Canada | Between-groups, observational study | Sev–Prof | 56 | Attention-Getting Strategies and Joint Engagement | Coding | Y | Moderate |

**Table 1.** *Cont.*

| Paper No | First Author | Year | Reported Country of Study | Study Design | Degree of Hearing Loss | No of Dyads | PCI Behaviours Assessed | PCI Measure (Method) | Child Lang Assessed? | Risk of Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | Tasker, S. et al. [52] | 2010 | Canada | Between-groups, observational study | Sev–Prof | 53 | Attention-Getting Strategies and Joint Engagement | Coding | Y | Low |
| 15 | Barker, D. H et al. [9] | 2009 | USA | Between-groups, observational study | Sev–Prof | 185 | Joint Engagement | Coding | Y | Low |
| 16 | Cejas, I. et al. [10] | 2014 | USA | Between-groups, observational study | Sev–Prof | 276 | Joint Engagement | Coding | Y | Moderate |
| 17 | Roos, C. et al. [53] | 2016 | Sweden | Within-group, observational study | Sev–Prof | 12 | Joint Engagement | Coding | N | Moderate |
| 18 | Spencer, P. E. [54] | 2000 | USA | Between-groups, observational study | Mod–Prof | 80 | Joint Engagement | Coding | N | Serious |
| 19 | Dirks, E. et al. [20] | 2019 | The Netherlands | Between-groups, observational study | Mod | 51 | Joint Engagement and Parental Sensitivity | Existing Scale + Coding | Y | Low |
| 20 | Gale, E. et al. [55] | 2009 | USA | Between-groups, observational study | Sev–Prof | 15 | Joint Engagement and Parental Sensitivity | Coding | Y | Moderate |
| 21 | Janjua, F. et al. [56] | 2002 | UK | Within-group, observational study | Sev–Prof | 13 | Joint Engagement and Parental Sensitivity | Coding | Y | Serious |
| 22 | Lederberg, A. R. et al. [57] | 1990 | USA | Between-groups, observational study | Mild–Prof | 82 | Joint Engagement and Parental Sensitivity | Novel Scale + Coding | Y | Moderate |
| 23 | Meadow-Orlans, K. P. et al. [58] | 1993 | USA | Between-groups, observational study | Mod–Prof | 80 | Joint Engagement and Parental Sensitivity | Novel Scale + Coding | N | Moderate |
| 24 | Meadow-Orlans, K. P. et al. [18] | 1996 | USA | Between-groups, observational study | Mod–Prof | 80 | Joint Engagement and Parental Sensitivity | Novel Scale + Coding | N | Moderate |
| 25 | Abu Bakar, Z. et al. [59] | 2010 | Not reported | Between-groups, observational study | Sev–Prof | 18 | Parental Sensitivity | Novel Scale | N | Serious |
| 26 | Meadow-Orlans, K. P. et al. [60] | 1995 | USA | Within-group, observational study | Mild–Prof | 43 | Parental Sensitivity | Novel Scales | N | Moderate |
| 27 | Lam-Cassettari, C. et al. [61] | 2015 | UK | Between-groups, intervention study | Mod–Prof | 14 | Parental Sensitivity | Existing Scale | N | Moderate |
| 28 | Meadow-Orlans, K. P. [62] | 1997 | USA | Between-groups, observational study | Mod–Prof | 40 | Parental Sensitivity | Novel Scales | N | Moderate |
| 29 | Pressman, L. J. et al. [63] | 1998 | USA | Between-groups, observational study | Mild–Prof | 42 | Parental Sensitivity | Existing Scale | Y | Moderate |
| 30 | Pressman, L. J. et al. [64] | 1999 | USA | Between-groups, observational study | Mild–Prof | 24 | Parental Sensitivity | Existing Scale | Y | Low |

**Table 1.** *Cont.*

| Paper No | First Author | Year | Reported Country of Study | Study Design | Degree of Hearing Loss | No of Dyads | PCI Behaviours Assessed | PCI Measure (Method) | Child Lang Assessed? | Risk of Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| 31 | Spencer, P.E. [65] | 1996 | USA | Between-groups, observational study | Mod–Prof | 43 | Parental Sensitivity | Novel Scale | Y | Low |
| 32 | Vohr, B. et al. [66] | 2010 | USA | Between-groups, observational study | Mild–Prof | 58 | Parental Sensitivity | Existing Scale | Y | Low |
| 33 | Waxman, R. et al. [67] | 1996 | USA | Between-groups, observational study | Mod–Prof | 30 | Parental Sensitivity | Coding | N | Moderate |
| 34 | Ambrose, S. E. [68] | 2016 | USA | Between-groups, observational study | Mild–Prof | 48 | Parental Sensitivity | Coding | Y | Low |
| 35 | Caissie, R. et al. [69] | 1993 | Not reported. | Between-groups, observational study | Sev–Prof | 11 | Parental Sensitivity | Coding | Y | Serious |
| 36 | Eddy, J. R. [70] | 1997 | Australia | Between-groups, observational study | Sev–Prof | 18 | Parental Sensitivity | Coding | Y | Serious |
| 37 | Glanemann, R. et al. [33] | 2013 | Germany | Between-groups, intervention study | Mod–Prof | 29 | Parental Sensitivity | Coding | Y | Moderate |
| 38 | Wedell-Monnig, J.; et al. [71] | 1980 | USA | Between-groups, observational study | Sev–Prof | 12 | Parental Sensitivity | Coding | N | Serious |
| 39 | MacTurk, R. H. et al. [72] | 1993 | USA | Between-groups, observational study | Mod–Prof | 40 | Parental Sensitivity and Child Eye Gaze | Novel Scales | N | Serious |
| 40 | Choo, D. et al. [73] | 2016 | Australia | Within-group, observational study | Sev–Prof | 12 | Parental Sensitivity and Parental Communication (Comm.) | Novel Scale | N | Moderate |
| 41 | James, D. et al. [74] | 2013 | UK | Within-group, intervention study | Profound | 3 | Parental Sensitivity and Parental Comm. | Existing Scale + Coding | Y | Serious |
| 42 | Nicastri, M. et al. [13] | 2020 | Italy | Between-groups, intervention study | Profound | Not reported: 22 parents of 14 children | Parental Sensitivity and Parental Comm. | Existing Scale | Y | Moderate |
| 43 | Preisler, G. M. [75] | 1995 | Sweden | Within-group, observational study | No Report | 14 | Parental Sensitivity and Parental Comm. | Coding | N | Serious |
| 44 | Quittner, A. L. et al. [14] | 2013 | USA | Between-groups, intervention study | Sev–Prof | 285 | Parental Sensitivity and Parental Comm. | Scales (×2 existing, ×1 novel) | Y | Low |
| 45 | Quittner, A. L. et al. [76] | 2016 | USA | Between-groups, observational study | Profound | 285 | Parental Sensitivity and Parental Comm. | Scales (×1 existing/ ×1 novel) | Y | Low |

**Table 1.** *Cont.*

| Paper No | First Author | Year | Reported Country of Study | Study Design | Degree of Hearing Loss | No of Dyads | PCI Behaviours Assessed | PCI Measure (Method) | Child Lang Assessed? | Risk of Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| 46 | Ahmad, A. et al. [77] | 2016 | Australia | Between-groups, observational study | Mild–Prof | 16 | Parental Communication | Coding | N | Moderate |
| 47 | Brown, P. M. et al. [78] | 2004 | Australia | Between-groups, observational study | Profound | 20 | Play and Parental Communication | Coding | Y | Moderate |
| 48 | Chen, D. [79] | 1996 | USA | Between-groups, observational study | Mod–Prof | 12 | Parental Communication | Coding | Y | Serious |
| 49 | DeVilliers, J. et al. [80] | 1993 | USA | Within-group, observational study | Profound | 2 | Parental Communication | Coding | N | Critical |
| 50 | Morelock, M. et al. [81] | 2003 | USA/Australia | Between-groups, observational study | Profound | 9 | Parental Communication | Coding | N | Serious |
| 51 | Roberts, M. [34] | 2019 | USA | Randomised controlled trial | Mod–Prof | 19 | Parental Communication | Coding | Y | Moderate |
| 52 | Koester, L. S. et al. [82] | 2010 | USA | Between-groups, observational study | Mod–Prof | 61 | Parental Communication | Coding | N | Serious |
| 53 | Paradis, G. et al. [83] | 2015 | USA | Between-groups, observational study | No Report | 60 | Touch and Parental Sensitivity | Existing Scale + Coding | N | Moderate |
| 54 | Pipp-Siegel, S. et al. [84] | 1998 | USA | Between-groups, observational study | Mild–Prof | 48 | Touch and Parental Sensitivity | Existing Scale + Coding | N | Moderate |
| 55 | Abu-Zhaya, R. et al. [85] | 2019 | USA. | Between-groups, observational study | Mild–Prof | 24 | Touch | Coding | N | Moderate |
| 56 | Gabouer, A. et al. [86] | 2020 | USA | Between-groups, intervention study | Sev–Prof | 18 | Touch | Coding | N | Serious |
| 57 | Spencer, P.E. [87] | 1993a | USA | Between-groups, observational study | Mod–Prof | 36 | Other: Maternal Comm. Modality | Coding | Y | Low |
| 58 | Spencer, P.E. [88] | 1993b | USA | Between-groups, observational study | Mod–Prof | 7 | Other: Maternal Comm. Modality | Coding | Y | Moderate |
| 59 | Lederberg, A. R. et al. [89] | 2000 | USA | Between-groups, observational study | Sev–Prof | 40 | Other: Maternal Comm. Modality | Coding | Y | Moderate |
| 60 | Depowski, N. et al. [90] | 2015 | USA | Between-groups, observational study | Sev–Prof | 8 | Other: Type and Use of Gesture | Coding | N | Serious |
| 61 | Lieberman, A. et al. [91] | 2014 | USA | Between-groups, observational study | Mod–Prof | 8 | Other: Maternal and Child Eye Gaze | Coding | Y | Moderate |

## 3. Results

### 3.1. Study Characteristics

In total, 3140 papers were identified and included in the selection process. Following title and abstract screening, 226 papers were retrieved for the full-text review. After in-depth reading, 61 papers were included in this review. See PRISMA [37] flowchart (Figure 1) for more details.

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3.1. Study Characteristics
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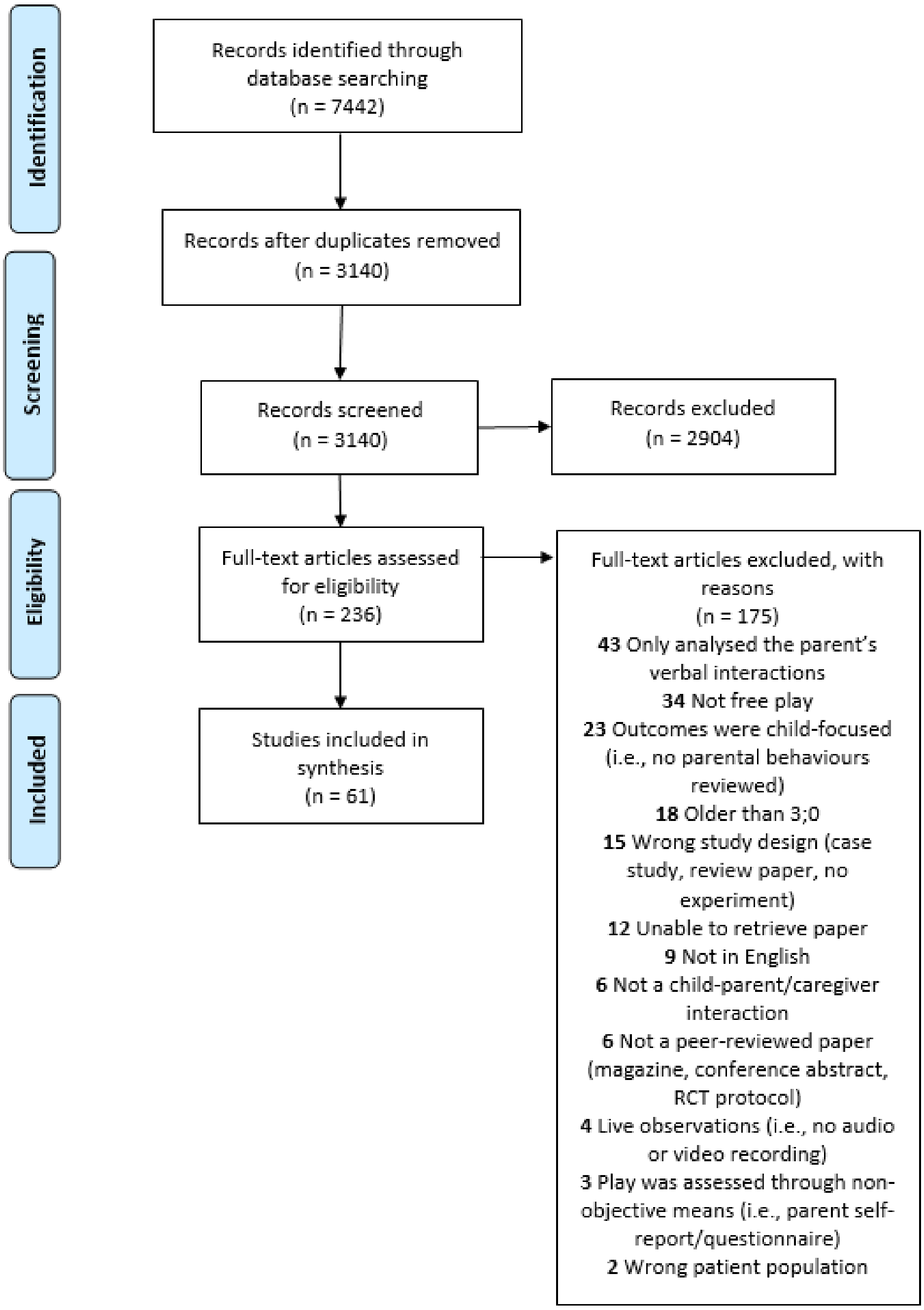

**Figure 1. PRISMA systematic** review flow diagram.

Included papers spanned 40 years of research (1980–2020). Most studies were from the USA (63%), followed by Europe (21%), Australia (10%), Canada (3%) or unreported (3%). The most common research design was between-groups, observational studies (75%), followed by within-group, observational studies (11%), between-groups intervention studies (8%) and one randomised control trial (2%), one case series (2%) and one within-group intervention study (2%).

Ten papers (16%) observed hearing parents of deaf children exclusively and three papers (5%) observed deaf parents of deaf children exclusively. The remaining 48 papers (79%) recruited two or more of the following groups for comparisons: hearing parents of deaf children (compared alongside other groups in 46 of 61 papers), deaf parents of deaf children (compared alongside other groups in 19 of 61), deaf parents of hearing children (compared alongside other groups in 7 of 61) and hearing parents of hearing children (compared alongside other groups in 40 of 61).

Many papers did not report key demographic information relating to the children in the studies: child communication mode (signing, speaking, etc.) was not reported in 28% of papers; presence of additional needs was not reported in 27% of papers; ethnicity was not reported in 53% and social economic status was not reported in 73% of papers. Insufficient descriptions of the samples were thus considered as potential bias. When this demographic information was reported, included studies indicated that children used a mix of speech and sign in their productive language (33% of papers), were either typically developing or no known additional needs were present (56%), and were Caucasian (42%). Research studies were mainly focussed on mother-child interaction (75% of papers); a small number of papers also included fathers (8%) and the remaining papers did not explicitly state which parent was involved.

### 3.2. Quality Assessment

Seventy percent of the papers in this review achieved a low ($n$ = 12) or moderate ($n$ = 31) level of bias rating. Thirty percent of papers were rated as having a serious ($n$ = 16) or critical risk of bias ($n$ = 2). Papers were generally evaluated with higher levels of bias for not providing enough detail in the description of participants, the assessment procedures, reliability checks, and not using statistical tests for comparisons. Whilst we removed these papers from our analysis to answer research question 3 (correlations between PCI and language outcomes), we felt that it was appropriate to leave these papers in the analysis for the methodology-based research questions 1 and 2 and present each paper's risk of bias in Table 1.

Sample size differed across the papers but was low in comparison to PCI studies with hearing populations. The average sample size of parent–child dyads was 45, with a range of 2–285 and a mode of 18. Sarant and colleagues state: "Large numbers of participants must be included in order to draw valid conclusions. However, this is difficult to accomplish in the case of children with hearing loss because hearing loss is a relatively rare condition and many research centers do not have the resources to conduct large population studies [92] (p. 206)."

### 3.3. Research Question 1: Which Parent Behaviours Are Being Assessed in PCI Studies in Deaf Infants Aged 0–3 Years?

We found that research studies assessed parents on gaining their deaf child's attention, maintaining joint engagement, levels of parental sensitivity, and parental communication behaviours. Each of these will now be explored in greater detail.

#### 3.3.1. Attention-Getting Behaviours

Attention-getting behaviours can be defined as explicit bids, made by the parent, with the intent of gaining or directing their deaf child's attention. The bid for attention can use one or more modalities. Fourteen (14) of the 61 studies (papers 1 to 14 in Table 1) observed this aspect of parent behaviour. Data from these papers have been synthesised into four modalities: visual, auditory, tactile, and multi-modal.

##### Visual Strategies

Using any of the following within the child's visual field with the intention to gain or direct the child's attention: waving, gesturing, reaching, pointing, making eye contact, switching gaze between an object and the child, holding or moving an object or toy directly into the child's visual field, offering an object, manipulating an object, demonstrating play with toys, making faces, displacing the location of a sign into the child's vision or signing space, and changing affect.

#### Auditory Strategies

Using any of the following sounds to gain a child's attention: using voice to call the child's name, using a word such as 'look!' or non-words (e.g., 'whee' or 'pssst!'), humming or singing; use of the body to make sounds (outside of the child's visual field) such as clapping or clicking; and/or the use of toys or objects to make sounds.

#### Tactile Strategies

Using any of the following to gain or direct a child's attention: making gestures or signs on the body of the child; tapping, touching, hugging, or holding the child; grabbing on to the child's clothing; moving the child's limbs; and touching the child with a toy (out of their visual field). This category also includes tapping the ground to create vibrations, and physically adjusting the child's position to direct their attention.

#### Multi-Modal Cues

Combinations of the above—multi-modal cues—were also coded. For auditory-visual combinations, a parent might say 'uh oh!' and gesture as a toy rolls under the table. For visual-tactile, a parent may turn a child sat on their lap and then point to a new toy out of their current visual field. Other combinations may be auditory-visual-tactile, e.g., holding a child while talking to them and pointing to a toy.

Coding in papers that included deaf parents of deaf children also featured 'waiting' as an attention-getting strategy [1,3,12,17], e.g., it was noted when parents did not initiate the interaction or any expression but actively waited until their child was looking at them before communicating. This could be seen as an attention-getting strategy, as a paused action may warrant the child to look towards the parent. These papers also put greater focus on parents' visual-tactile attention-getting strategies (ibid).

Related to interaction, six studies (papers 5–10 in Table 1) reported on the success of parental attention-getting behaviours in relation to child gaze and noted gaze could be either elicited, responsive, spontaneous, and failed.

Papers 11 to 14 in Table 1 combined attention-getting behaviours with joint engagement between parent and child. This phenomenon was the focus for many more papers included in this review and is defined and described in the next section.

### 3.3.2. Joint Engagement

Joint engagement is a state of mutual focus and shared involvement between a parent and child, where both participate in reciprocal, contingent, socially directed behaviours. Authors use the following terms interchangeably: joint engagement, joint attention, and intersubjectivity, with frequent references to the coding systems of Bakeman and Adamson [93], Prezbindowski and colleagues [94], and Tasker and Schmidt [95]. Twelve of the studies observed this phenomenon (papers 11 to 24 in Table 1).

#### When Engagement Is Established and When It Is Terminated

Marking joint engagement as 'established' varied from three seconds of mutual focus to a five-second rule of engagement (where the child had to respond to a parent's act within five seconds). It was also categorised as three or four sequential, on-topic, connected turns where both the parent and child's attention and/or language are focussed on the same event or object. Physical acts were also included (such as tickling or laughing). Similarly, how to class a state of joint engagement as finished also varied across papers. Joint engagement was 'terminated' when one social partner stopped responding and their attention was lost after a set time period which varied between papers from 3 to 15 s.

#### Levels of Joint Engagement

Some authors differentiated between ‘supported/passive’ joint engagement, with the parent joining the child in an activity and helping to support the joint engagement, without the child acknowledging the parent, and ‘coordinated’, wherein both parent and child exclusively engaged with each other and the activity. Interactions may be physical and/or visual (body movements, facial expressions, tickles) or may be ‘symbol-infused’, which refers to the use of language (signed, spoken or referential gesture) within a period of joint engagement.

The authors of the current review use ‘joint engagement’ as the term suggests parent and child are active participants, doing more than simply attending to the same thing.

### 3.3.3. Parental Sensitivity

Parental sensitivity refers to a set of skills that enables a parent to be emotionally connected, in tune and responsive to their child’s needs, goals, and communicative attempts. A parent with a high level of sensitivity will be positive and accepting of their child and will strive for interactive congruence. Twenty-five (25) studies within the review assessed this aspect of parent behaviour (papers 19 to 45 in Table 1) and therefore it is the most frequently assessed aspect of PCI. Across papers parental sensitivity was described as a group of sub-skills. Parents were often assessed on each of these sub-skills using Likert-scales. These behaviours consisted:

#### Positive Regard

A parent showing enthusiasm, warmth, pleasure, love, and respect for their child, regularly using positive body language, praise and comforting and playful physical touch. Opposite: Covert or overt hostility, negative affect, physical harshness.

#### Availability

A parent who is genuinely interested and actively involved in participating in accessible interactions with their child. Opposite: Passive, bored, and disengaged.

#### Contingent and Responsive

A parent that follows their child’s lead and pace and responds with contingent, on-topic behaviours or language. Opposite: Directive, intrusive, dominant, and regularly initiating new topics.

#### Emotionally Sensitive

A parent who is emotionally attuned and adaptive. Able to recognise and respond to distress and disinterest, and repair or resolve misunderstandings or conflict. Opposite: Lacking or unhelpful emotional responses, unwillingness to soothe or resolve incidents causing discomfort.

#### Structure and Stimulation

A parent who is able to support a child’s interest by guiding and developing the interaction with appropriate play and language. The parent will be flexible and accept a change in play or routine put forward by the child. Opposite: Overpowering, structuring the play, inappropriate pace or activity, highly authoritative, inflexible, or formally teaching the child.

#### Consistency

A parent who can absorb a range of child emotions and behaviours, whilst remaining mostly constant in their behaviours, predominantly striving for a positive interaction. Opposite: Unpredictable behaviour that changes regularly in the interactions from positive to negative.

Most of the papers also included a rating of the child's levels of responsiveness (also termed compliance or eagerness to respond) and involvement (initiations made, willingness to share). Some codes and scales rated the dyads for overall synchronicity, reciprocity, enjoyment, and communicative competence (understanding of one another). Papers 39 to 44 assessed parental sensitivity along with parental communication behaviours.

### 3.3.4. Parental Communication Behaviours

Parental communication behaviours are language-focused strategies used by parents during moments of interaction with their deaf child. Though most are explicitly linked to exposing the child to signed or spoken language, some behaviours are centred around increasing the child's *access* to spoken or signed language. Papers that *only* recorded and analysed parent's verbal interactions were excluded ($n$ = 43) and are listed in Appendix C. Thirteen papers assessed parents on a range of communicative behaviours (papers 40–52 in Table 1) and these are summarised below:

**Increased access to language:** Some papers assessed parents on their ability to communicate within the child's line of sight or whilst being face to face; others observed parents' use of timing, i.e., waiting for the child to look before communicating. Others observed parents' use of child-directed speech or child-directed sign, i.e., where parents modify their speech or sign to be more child orientated. For example, a parent may adapt the palm orientation of a sign so the child can see more of the hand; they may increase the size and range of movement of signs, they may exaggerate the non-manual features of accompanying signs (facial expressions), use exaggerated vocal pitch or acoustic/sign highlighting, where the parent adapts their amplification of words or signs closer to the child.

**Language input:** This category refers to signed or spoken languages. Similar to parental sensitivity, parents were assessed on their contingent talk and number of connected turns, as well as their off-topic initiations (i.e., directives, requests and questions). Parents' use of language stimulation was coded and assessed on how they: labelled items or feelings; commented; described; made accompanying sounds; interpreted their child's behaviour with language; repeated their child's utterance; expanded their child's language by adding 1 or 2 new words, or rephrased it with correct grammar. Parents' mean length of utterance (MLU) was assessed in one paper. Parents' use of praise, affirmation and encouragement was assessed through language use, intonation, their gesture, and facial expressions. Assessment of less frequent behaviours included the parent modelling play, and the parent opposing the child, either by rejecting their communication, correcting their communication, or prohibiting their child's behaviour.

### 3.3.5. Use of Touch

The frequency and function of parents' use of touch when interacting with their child was also assessed in a small set of studies (Papers 53–56 in Table 1). The authors of these papers were interested in the type, location, and duration of parent-initiated touch. One paper looked at the temporal alignment between touch and parents' utterances [85]. Two papers also measured parental sensitivity [83,84] with Paradis and Koester [83] creating a coding system to analyse the function of parental touch, e.g., affectionate, attention-getting and instructive.

### 3.3.6. Other

Five papers included in the review sit within this category (papers 57–61 in Table 1). Three papers [87–89] focused on the communication mode of parents (i.e., how often they signed, used gesture or spoke). One paper looked in detail into the type and function of gesture used [90] and another transcribed American Sign Language and documented eye gaze between mother and child [91].

### 3.4. Research Question 2: How Are Parent Behaviours Assessed?

Most papers (66%, $n$ = 40) used a coding system to assess PCI, often watching and coding films frame by frame, using software such as INTERACT (Mangold) and ELAN (Max Planck Institute). This method allowed an in-depth analysis of the behaviours focused on in RQ1. Thirteen (13) papers (22%) used Likert scales instead of coding and some scales were well-known and validated, while others were developed for the specific research study with little mention of pilot testing prior to their use. The Emotional Availability Scales [96] were used in 7 of the 11 papers that used validated scales (see Appendix D for a full list). Nine papers (12%) used a combination of coding and scales. See Table 2.

**Table 2.** Methods of assessing PCI between included papers.

| Method of Assessing PCI | *n* Papers (%) |
|---|---|
| Coding | 40 (66%) |
| An existing, validated scale | 7 (12%) |
| A novel scale | 4 (7%) |
| A mix of validated and novel scales | 2 (3%) |
| Coding and a validated scale | 4 (6%) |
| Coding and a novel scale | 4 (6%) |

Fifty-one percent (31) of the papers used a one-off recording of PCI, whereas the remaining papers repeated filming as the child matured. Most videos were filmed in a lab (30%, $n$ = 18), at home (26%, $n$= 16) or in a clinic (8%, $n$ = 5). Some research studies used a mixture of the three settings (22%, $n$ = 13). The remaining studies did not report the location of filming (6%, $n$ = 4) or used a vague description (8%, $n$ = 5), e.g., ‘a playroom’. The average length of film data made was 18.9 min, with recording length ranging from 3 to 60 min. Notably, 15% (9) of papers did not report on the length of the video made. In further detail, the average length of film used for analysis was 8.7 min, with a range of 1–20 min. Some papers specified that the whole recording was used for the scale data but only the central ten minutes was used for coding. In addition, other papers gave more general information related to how they selected the section of video for coding analysis, e.g., ‘five minutes into the recording’, ‘not the first few minutes’ or ‘the central five minutes’. However, some papers (26%, $n$ = 16) did not report on the length of the video used for analysis.

Eighty (80) percent of papers (48/61) reported on reliability testing of the PCI assessment. On average, authors had 33% of their video tapes independently re-assessed by a second coder, with a range of 10–100% re-assessed. Thirty-nine papers (64%) used statistical reporting: 30% (18 papers) used Cohen’s kappa; 27% (16) used percentage of agreement; and 8% (5) used both calculations.

### 3.5. Research Question 3: Which Parent Behaviours Are Associated with Higher Child Language Scores?

In total, 46% (28) of papers assessed children’s language skills. To answer research question 3, the authors discounted nine papers (32% of 28 papers) that used informal measures of child language, such as coding of vocalisations and number of signs. We felt this increased the risk of bias and a valid measure could have been used. Therefore, 31% (19) of the 61 papers included at least one formal measure of child language skill. Four (21% of the 19 included) papers were removed due to serious or critical risk of bias due to a lack of demographic information and minimal reporting on reliability. One paper (5% of 19) was removed as the formal child language measure was used as a baseline characteristic rather than an outcome, and another paper (5% of 19) was removed due to the reporting of confounders in the results. From the remaining 13 papers (papers 2, 15, 16, 19, 20, 29, 30, 32, 34, 42, 44, 45 and 51 in Table 1) the MacArthur–Bates Communicative Development Inventory [97] was the most common formal language measure (used in 9 papers, 69% of 13), followed by the Reynell Developmental Language Scales [98] (used in 4 papers, 31%

of 13). Across the papers, 1364 dyads were included initially but after removing repeated samples, the figure reduced to 803 dyads.

Before we explore the correlations between deaf children's language and parent behaviours, it is worth noting that child hearing status or hearing level is one of the most significant predictors of language gain. Pressman and team [63] found that the hearing status of a child accounted for 34% of the variance in child language skill. The 13 papers (21% of 61) included in this section of the review covered a wide range of deafness; four papers (46% of 13) included mild to profoundly deaf children, five included severely to profoundly deaf children only (38% of 13), with other combinations and single levels of deafness (i.e., moderately deaf only) also included (*n*= 4, 15%).

Looking at the papers it is evident that capturing the impact of parent interaction on child language development is difficult within research with limited time. Seven of the 13 papers (54%) assessed PCI cross-sectionally at one time point (average child age 28.5 months). The remaining six longitudinal papers (46%) regularly assessed PCI with some studies following the child from 5 months through to 5 years of age.

From the 13 papers (21% of 61 papers) that included formal language assessments, the following parental behaviours were positively correlated with deaf children's language.

### 3.5.1. Joint Engagement

Higher child language scores were related to more time in higher level engagement states with a parent (i.e., coordinated joint engagement and symbol-infused joint engagement) [10]. Deaf children spent significantly less time in these states when compared to their hearing peers and therefore used less language [9,55].

Dirks and Rieffe [20] add further evidence to this finding: deaf children and their hearing parents are less successful in establishing joint engagement and have briefer episodes when they do. These authors found positive correlations between total duration of joint engagement and receptive and expressive language skills. Interestingly, Gale and Schick [55] and Dirks and Rieffe [20] found correlations between non-intrusiveness and joint engagement in mothers who followed their toddler's interests, rather than directing, and this was also linked to more instances of joint engagement.

### 3.5.2. Parental Sensitivity

Maternal sensitivity was positively correlated with expressive language and predicted language growth over time [14,76]. In their study of 285 deaf children with cochlear implants, Quittner and team found parents with above-average skills in maternal sensitivity and language stimulation had children with 1.52 years less of a language delay [14]. Dirks and Rieffe [20] also found positive relationships between parental sensitivity and receptive and expressive child language *and* total duration of joint engagement. Children with better language experienced longer interactions with their parents and this was linked to parents with higher levels of emotional sensitivity (ibid).

In their 1999 study, Pressman and colleagues found that maternal sensitivity was not correlated with children's initial expressive language scores, but was positively correlated in their follow up assessments 12 months later [64]. In their regression analyses, maternal sensitivity positively predicted expressive language scores and accounted for 10% of the variance. In their 1998 study, they uncovered that maternal sensitivity had a larger positive effect on language in the sample of deaf children compared to their hearing sample [63].

Ambrose [68] focused on the responsiveness of mothers. She found that hearing mothers of deaf children were significantly less likely to respond to their child's gestures, compared to mothers of hearing children. Despite having a similar number of gestures to their hearing peers, the deaf children used fewer words (ibid). This decrease in responsiveness may be associated with greater levels of maternal stress, as was found by Vohr et al. [66] where greater stress was related to decreases in positive regard, availability, enjoyment, and number of words produced by the child at 18–24 months.

### 3.5.3. Parental Communication Behaviours

We remind the reader of our inclusion/exclusion criteria for this review: we included papers that explored correlations between parents' verbal and visual behaviours and child language outcomes.

As such, for this section, we will not report on correlations found in DesJardin [42] (2006) or Quittner et al. [14,76], as parents' communication was solely analysed in terms of their verbal input, despite other outcomes in their papers looking at features beyond spoken language (attention-getting behaviours and parental sensitivity, respectively). Therefore, only two papers [13,34] were included in this subsection. Both studies involved parents receiving training in PCI and both assessed deaf children's pre-linguistic skills (i.e., pointing, co-ordinated joint engagement and gestures using the MacArthur Bates CDI Words and Gestures Form [97] or the Communication and Symbolic Behaviour Scale Behaviour Sample [99]

In the study from Nicastri et al. [13], parents received nine whole-group sessions and three individual sessions of training over 10.5 months. The intervention was based on the 'It Takes Two to Talk' Hanen program [100] and involved video modelling, where parents had opportunities to put their training into practice at home. Strategies within the program included waiting and observing the child, following the child's lead, interpreting the child's behaviour, parallel talk, and expanding and recasting the child's language. The authors reported significant gains in parent communication behaviours and parental sensitivity post-intervention and noted that parents in the treatment group had children with significantly better language skills, when formally assessed three years post treatment.

A pilot RCT [34] involved parents receiving weekly, hour-long sessions for six months, where they were explicitly taught to use strategies to promote early communication. The authors referred to methods such as enhanced milieu teaching [101], prelinguistic milieu teaching [102], and The Hanen Program It Takes Two to Talk [100]. Examples of strategies include sitting face to face, using gestures, imitating/mirroring the child's actions, and turn taking. The study reported that parents in the treatment group increased their use of communication support strategies by 17% compared to 2% in the control group., There was a large effect size of 1.09 ($p = 0.03$) for the difference in gains in deaf children's prelinguistic speech skills between the treatment and control groups.

## 4. Discussion

This is the first systematic review focusing on research on the assessment of communicative parent behaviours within the context of parent–deaf child interaction. PCI is positively associated with improved child language in many at-risk hearing populations and in particular, within deafness [15]. The quality and quantity of interaction is an important predictor of a deaf child's future language abilities [22,103]. However, it is not clear how to administer a good clinical assessment of PCI in deafness. Most of the included papers assess one or two aspects of PCI in isolation. This review condenses 40 years of research to provide us with details on the full range of parent behaviours that are assessed across the field of PCI in deafness and whether these behaviours correlate to higher levels of language in deaf children. We included a range of children's hearing levels, a range of children's communication mode, as well as hearing and deaf parents to capture a wider view of the interaction behaviours assessed between parents and their deaf children aged 0–3. This enabled us to avoid binary perspectives on parental interaction that is solely focused on oral-only or visual-only input, but instead we report on a combination of these alongside other important features such as joint engagement, emotional availability, warmth, and touch. In addition, this is also the first review of its kind to specifically detail the methods used in the assessment of PCI, with a view to develop the content of a future clinical assessment tool for PCI in deafness.

### *4.1. RQ1: What Parent Behaviours Are Being Assessed in Parent–Deaf Child Interaction?*

Investigations have looked at a wide range of parent behaviours, including how a parent gains a child's attention; the maintenance of attention in engagement; the emotional availability and responsivity of a parent during the interaction; and their strategies in providing accessible and stimulating linguistic input. These behaviours were purposely presented in the order they appear, with gaining a deaf child's attention an important initial basis for subsequent successful interaction.

The four main areas of PCI uncovered in our review have some parallels with the review on children with language difficulties by Roberts and Kaiser [30], where the three most measured parent strategies were: parent responsiveness, use of language models and rate of communication. Similarly, a review by Holzinger and colleagues [104] on children with cochlear implants uncovered family involvement and parental linguistic input as key themes in their results. Additionally, within PCI research in the hearing population, the same set of behaviours are commonly measured [35].

Fourteen (14) of the papers (23%) identified in this review measured attention-getting behaviours and a further ten (16%) measured joint engagement. Joint attention skills predict receptive language [105] and are important to establish early. Whilst many papers in the hearing population assess how much a parent *re-directs* a child's attention (as part of their parental directiveness) and how much time is spent in joint engagement, few researchers assess how a parent *gains* a child's attention, except in the field of Autism [106]. It appears that the reduction or absence of hearing in deaf infants means the gaining of attention is a more prominent feature within PCI. This is presumably to increase access to parental signed or spoken language.

Within each theme highlighted in the review, there was much overlap between the parent behaviours identified across papers, despite differences in terminology. For example, 'joint engagement' and 'joint attention' were often used interchangeably in papers. We provided clear definitions of each parent behaviour within this review to facilitate collaborative working and a shared language between parents, Teachers of the Deaf, Speech and Language Therapists and academic researchers.

### *4.2. RQ2: How Are These Parent Behaviours Being Assessed?*

The most prominent way of assessing PCI was with coding systems to analyse interactions. However, coding methods differed depending on the authors' research focus. Some of the coding systems referred to well-known frameworks such as those from Waxman and Spencer [44], where attention-getting behaviours are well described and the coding scheme from Adamson, Bakeman, and Deckner [93], which includes 11 states of joint engagement. Other coding systems were created for the purposes of the particular study and papers did not report on the piloting of coding prior to their use.

Behavioural observation is the ideal method for assessing the quality of interactions and reduces the risk of bias that may arise from the use of self-reporting tools [107]. Lotzin et al. [35] also limited their review of PCI assessments to objective instruments, with all 24 of their included measures being validated rating scales. After coding, scales were the next and only other objective measure included within our review but only 11 papers (18%) used a validated scale.

### *4.3. RQ3: Which Parent Behaviours Are Correlated with Improved Child Language Outcomes?*

Longer periods of joint engagement, increased parental sensitivity and a range of facilitative language techniques were all correlated with higher levels of language in deaf children. Parents with higher rates of maternal sensitivity and language stimulation have a greater effect on their child's expressive language scores over time [13,64]. This finding is echoed in a systematic review by Holzinger et al. [104] where a meta-analysis of four longitudinal studies found that parental linguistic input explained 31.7% of the variance in deaf children's expressive language scores. Their review included papers that also analysed parents' verbal communication, whereas our review would have excluded these single modality studies. The findings in our review mirror not only those in deafness, but in the wider literature within the hearing population which reports that the quality and the quantity of parental talk is related to growth in children's language [108].

Though attention-getting behaviours were assessed frequently within free-play PCI, no formal measure of child communication was administered within the 14 studies. We were therefore unable to uncover any relationships between formal language outcomes and getting a child's attention. An exception is Tasker et al. [52], who monitored the success rates of maternal initiations for attention (i.e., how many bids resulted in the establishment of joint engagement) and found similar success amongst all three groups in their study (deaf children of hearing parents with CI, without CI, and hearing children of hearing parents). They did not include and compare deaf parents of deaf children.

An important correlation highlighted by Vohr et al. [66] was that parents with more support and higher SES had decreased intrusiveness, directiveness and negative regard. The better supported a parent is, the more sensitive, responsive, and positive they will be in their interactions. Hintermair [109] mirrored this finding in his study with parents of deaf children showing that child development profits from parents accessing 'personal and social resources' that influence their coping process and significantly lower stress. Furthermore, Zaidman-Zait et al. [110] found that higher levels of child acceptance were associated with lower levels of parenting stress in parents of deaf children.

### *4.4. Limitations of the Review Process*

As described, we excluded papers that only analysed parents' verbal interactions, that were not published in peer-reviewed journals, and were written in languages other than English. This may have led to some parent behaviours and/or methods of assessment being overlooked. However, when we compared our findings with those of the Holzinger et al. [104] systematic review, which used a different approach for their inclusion criteria, there were similar findings between the two papers.

For consistency and in order to compare data between studies, we only selected studies of PCI in the context of free-play. However, Mahoney, Spiker and Boyce [111] recommend that observations of PCI take place in a range of interactive contexts. It is also advised that interactions are assessed by an observer known to the dyad [112] and so, with many of our dyads being assessed cross-sectionally in play, by an unknown researcher, we must remain cautious when interpreting their findings.

The development of this research field and subsequent support and policy is driven by countries with more resources. In addition to being from countries of higher wealth, all the papers included in this review are from Western countries who share similar views on language acquisition. Further research on early language experiences in deafness and early language acquisition in diverse communities and plurilingual contexts is needed.

Though not a limitation as such, the majority of papers had a between-groups, observational design, where PCI was assessed at the same time as the child's language. In these correlational studies we cannot attribute PCI as causing change in child language development. In order to identify causation and the predictive factors of PCI that benefit deaf children's language outcomes, more RCTs, that extend the work of Roberts [34], are required.

## **5. Recommendations**

Following this systematic review, we make the following recommendations for future research on PCI and deafness:

1. Provide full details with regard to participant information, for both the child and their parents including level of deafness, amplification use, child communication profile and parent-to-child communication profile (see 'Language Access Profiles' from Hall [113]).

2. Report all methodological details of parent–child interaction assessment including who filmed the PCI, location of the assessment, instructions given to parents, length of the recording and length of film analysed.
3. Use validated scales to assess PCI. We refer readers to Lotzin et al. [35] for their comprehensive list of psychometrically tested measures, where Biringen's Emotional Availability Scales [96] are listed. This was the most commonly used validated scale in this review. In addition, reliability statistics should be reported.
4. Use frame-by-frame coding as a detailed method of analysis. Coding schemes should be explained in detail and their development and pilot testing described. Reliability statistics should be reported.
5. Recruit more representative samples of families with diverse socio-economic status and ethnicity.
6. Recruit and/or include deaf children with additional needs for similar reasons. The proportion of deaf children with additional needs is 22% [114].
7. Carry out more RCTs to explore causation between parental interaction and deaf children's language growth.

### *Clinical Implications*

We recommend the following for professionals working in deafness:

1. Though frame-by-frame coding and testing reliability may not be appropriate activities for busy practitioners, knowing that eight minutes of interaction may provide enough data to use in discussion with parents is helpful and can reduce the need to film families for longer than this.
2. Scale measures may be a time-effective and efficient way of clinically measuring PCI, providing the scales are evidence based, valid and reliable.
3. Assessments of PCI should address attention-getting behaviours, states of joint engagement, parental sensitivity, and language input.
4. Assessments of PCI will assist in the planning of appropriately set, family-centred targets for intervention.
5. Practitioners should support parental stress and access to social resources following findings reporting the association between low levels of stress and higher quality PCI.

## 6. Conclusions

Good-quality PCI is widely acknowledged to be significant for child language development in deaf and hearing children. The outcomes within this review indicate that good-quality interaction requires the parent to: wait for or gain the child's attention; maintain a shared, mutual focus with their child; follow their child's lead; provide contingent and attuned responses to the child's interests and needs; and use multi-modal methods to interpret, enrich and expand their child's communicative attempts. Several of these behaviours have been associated with child language development outcomes. Yet, there are no specific clinical assessments for professionals to use in PCI with parents of deaf children. In order to inform the content of such an assessment, we carried out a systematic review of the PCI literature. This identified 61 papers that looked at interactions between hearing and deaf parents and their deaf children. These papers indicate that, over the past 40 years, there has been extensive attempts to document PCI with deaf children aged 0–3 years. However, many omissions in methodological reporting were noted, with the majority of studies lacking sufficient participant characteristics, details on setting, and data (video-recoding) length. Evaluations of PCI were conducted largely through detailed coding methods and the use of software—methods that are not typically available in routine clinical practice. A minority of studies assessed PCI via scales, although few of these were validated. This review provides the basis for the future development of an assessment tool for professionals to use in clinical contexts. Such a tool will facilitate the identification of targets for intervention and the monitoring of progress in parental communicative skills to maximise language learning opportunities for deaf children.

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## Appendix A. Search Strategy

All eight databases were searched like this:

deaf OR deaf* OR 'hearing impair*' OR 'hearing loss' OR 'hard of hearing' OR d/hh OR dhh OR 'cochlear implant' OR 'hearing aids' OR 'hearing disorders'

**AND**

child OR child* OR infant* OR baby or babies OR preschool OR kindergarten OR nursery OR toddler

**AND**

parent OR parent* OR caregiver OR 'care giver' OR mother OR father

**AND**

'involvement' OR 'interaction' OR 'engagement' OR 'parent communication' OR 'parent engagement' OR 'child-directed interaction' OR 'facilitative communication' OR 'parent interaction characteristics' OR 'sensitivity' OR 'responsiv*' OR 'linguistic input' OR 'language input' OR 'relationship' OR 'communication support strategies' OR 'dyad' OR 'availability' OR 'intersubjectiv*' OR 'attention' OR 'attend'

Then, all data bases were searched again using the strategy below, except Scopus (unable to perform this function):

deaf OR deaf* OR 'hearing impair*' OR 'hearing loss' OR 'hard of hearing' OR d/hh OR dhh OR 'cochlear implant' OR 'hearing aids' OR 'hearing disorders'

**AND**

child OR child* OR infant* OR baby or babies OR preschool OR kindergarten OR nursery OR toddler

**AND**

parent N5 (involvement OR interaction OR engagement OR communication OR 'child-directed interaction' OR 'facilitative communication' OR sensitivity OR responsiv* OR 'linguistic input' OR 'language input' OR 'relationship' OR 'support strategies' OR 'dyad' OR 'availability' OR 'intersubjectiv*' OR 'attention' OR 'attend'

## Appendix B. Data Extraction Variables

### General

Title
Publication year
Country of study
Conflicts of interest
Aims/Objectives

Study design

**Participants**

Total sample size—parents (*n*)
Sample size of hearing parents of deaf children
Sample size of hearing parents of hearing children
Sample size of deaf parents of deaf children
Sample size of deaf parents of hearing children
Total sample size (children)
Sample size of d/hh children
Sample size of hearing children
No. of dyads assessed
Participating groups (only CI, only HA, mix of HA/CI, mix of deaf/and NH)
Inclusion criteria
Exclusion criteria

**The child**

Age ranges of children in months
% of males
Unilateral or bilateral
Level of deafness (mild, moderate, severe, profound, not reported)
When deafness identified (months)
Aetiology of hearing loss
Amplification in use
Amplification provided (at age)
Additional needs (included, not included, unclear if children are included)
Language(s) used by child
Child exposed to sign lang?

**The adult**

Age of adult
Adult hearing status
Adult relationship to child
% females
Ethnicity (majority group, minority group, mixed group, other (state ethnicity), not stated, unclear)
Adult education level
Socio-economic status (mixed group, low SES, middle SES, high SES, not stated, unclear)
Language(s) used by adult
Language(s) used by adult to the child
Adult's prev. experience of deafness

**The methods and procedure of the study:**

Multiple measured used? Y/N
Child measures/outcomes (i.e., communication, cognition, behaviour)

- Validated measures?
- Novel measures/devised for study?

Parent measures/outcomes (i.e., parental stress, self-efficacy)

- Validated measures?
- Novel measures/devised for study?

Measure used to assess parent–child interaction

- Coding
- Validated scale
- Novel measure/devised for study
- Other

If a tool/scale, number of items in the measure.
If a tool/scale, list the items in the measure.
Definitions of skills/constructs
Video—singular or a series (i.e., 'one-off' video or a collection of videos over time points?)
Software used for coding/analysis (i.e., ELAN, CLAN, INTERACT)
Length of interaction
Length of analysed section
Context of interaction (home, clinic, lab)
Coding method explicitly shared?
Reliability procedures
Blinding procedures

**If intervention study:**

Named intervention
Delivery of intervention (group, 1:1, modelling, coaching, other?)
Dose of intervention (no. of sessions, no. of weeks, length of individual session)
'Control' or alternative intervention?

**Results:**

Stats analysis used
Results on parent outcomes (T1/T2, means, median, range, scaled score, pre/post, change data)
Results on child outcomes (T1/T2, means, median, range, scaled score, pre/post, change data)
Results on PCI outcomes

**Discussion**

General summary
Confounding factors (identified by authors)
Limitations (identified by authors)
This paper was about (select all that apply: Touch, Sensitivity, Eye gaze, Emotional availability, Pointing, Linguistic input, Other—please type).

## Appendix C. List of Papers (*n* = 43) Excluded Based on Only Analysing Parent's Verbal Interactions

Allen, S., Crawford, P., & Mulla, I. (2017). Exploring the acceptability of innovative technology: A pilot study using LENA with parents of young deaf children in the UK. *Child Language Teaching & Therapy*, *33*(2), 117–128, doi:10.1177/0265659016671168
Ambrose, S. E., Vandam, M., & Moeller, M. P. (2014). Linguistic input, electronic media, and communication outcomes of toddlers with hearing loss. *Ear & Hearing (01960202)*, *35*(2), 139–147, doi:10.1097/AUD.0b013e3182a76768
Benítez-Barrera, C. R., Angley, G. P., & Tharpe, A. M. (2018). Remote microphone system use at home: Impact on caregiver talk. *Journal of Speech, Language & Hearing Research*, *61*(2), 399–409, doi:10.1044/2017_JSLHR-H-17-0168
Benítez-Barrera, C. R., Thompson, E. C., Angley, G. P., Woynaroski, T., & Tharpe, A. M. (2019). Remote microphone system use at home: Impact on child-directed speech. *Journal of Speech, Language & Hearing Research*, *62*(6), 2002–2008, doi:10.1044/2019_JSLHR-H-18-0325
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Carey-Sargeant, C. L., & Brown, P. M. (2003). Pausing during interactions between deaf toddlers and their hearing mothers. *Deafness & Education International*, *5*(1), 39–58.
Carey-Sargeant, C. L., & Brown, P. M. (2005). Reciprocal utterances during interactions between deaf toddlers and their hearing mothers. *Deafness & Education International*, *7*(2), 77–97, doi:10.1179/146431505790560437

Caskey, M., & Vohr, B. (2013). Assessing language and language environment of high-risk infants and children: a new approach. *Acta Paediatr*, *102*(5), 451–461, doi:10.1111/apa.12195

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DesJardin, J. L., & Eisenberg, L. S. (2007). Maternal contributions: supporting language development in young children with cochlear implants. *Ear & Hearing (01960202)*, *28*(4), 456–469.

Dirks, E., Stevens, A., Kok, S., Frijns, J., & Rieffe, C. (2020). Talk with me! Parental linguistic input to toddlers with moderate hearing loss. *Journal of Child Language*, *47*(1), 186–204, doi:10.1017/S0305000919000667

Fagan, M. K., Bergeson, T. R., & Morris, K. J. (2014). Synchrony, complexity and directiveness in mothers' interactions with infants pre- and post-cochlear implantation. *Infant Behavior & Development*, *37*(3), 249–257, doi:10.1016/j.infbeh.2014.04.001

Ganek, H., Nixon, S., Smyth, R., & Eriks-Brophy, A. (2019). A Cross-cultural mixed methods investigation of language socialization practices. *Journal of Deaf Studies & Deaf Education*, *24*(2), 128–141, doi:10.1093/deafed/eny037

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## Appendix D. List of Validated Scales Used for the Assessment of PCI

| Name of Validated Scale | Authors | Skills Assessed | Papers |
|---|---|---|---|
| Emotional Availability Scales (4th ed.) (2008) [96] | Biringen, Z. | Parental Sensitivity | Used in 7/11 papers:<br>Dirks et al. (2018);<br>Lam-Cassettari et al. (2015);<br>Pressman et al. (1998);<br>Pressman et al. (1999); James et al. (2013); Paradis et al. (2015) and Pipp-Siegel et al. (1998). |
| Early Childcare Study Codes (Maternal Sensitivity and Cognitive Stimulation) (2000) [115] | National Institute of Child Health and Human Development Early Child Care Research Network. | Parental Sensitivity | Used in 2/11 papers:<br>Quittner et al. (2013; 2016) |
| Parent Caregiver Involvement Scale (1986) [116] | Farran et al. | Parental Sensitivity | Used in 1/11 papers:<br>Vohr et al., 2010 |
| Communication-Promoting Behaviors Checklist for Caregivers (1992) [117] | Cole, E. | Parental Sensitivity and Parental Communication | Used in 1/11 papers:<br>Nicastri, M. et al. (2020) |

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RESEARCH REPORT

# Assessing parent interaction with deaf infants: A quantitative survey of UK professional practice

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**Abstract**

**Background:** Between 90% and 95% of deaf children are born to hearing parents who often need support with how to adapt their communication. Parent–child interaction (PCI) is an important predictor of deaf children's future language development. It is therefore necessary for professionals to assess parents' strengths and needs to identify areas for intervention. Qualified teachers of the deaf (QToDs), speech and language therapists (SLTs), psychologists, and national deaf child and adolescent mental health (NDCAMHS) professionals regularly support families with deaf children. With no current evidence-based tool available to assist with the assessment of PCI in deafness, it is important to gather information on current professional practice as this may differ from known practices within research.

**Aims:** To survey the practices of UK-based professionals in the assessment of PCI where the deaf infant is aged 0–3 years. Professionals were QToDs, SLTs, psychologists or psychiatrists and professionals working at NDCAMHS services.

**Methods & Procedures:** After a pilot phase, an 85-item survey was distributed electronically through a range of professional and social media networks. Survey items were based on a systematic review of PCI with deaf infants. Survey questions were focused on parent behaviours that were assessed, methods of assessment, goal planning and service provision. Analysis was conducted using descriptive and inferential statistics.

**Outcomes & Results:** A total of 190 professionals from across the UK completed part 1 of the survey; this decreased to 148 in part 4. Respondents were primarily female, hearing, used spoken English and had 16 years or more experience. Results indicate that PCI is routinely assessed by a large proportion of professionals and there is a substantial overlap in which parent behaviours are assessed. Some parent behaviours are assessed that do not feature in the research. Methods of assessment are informal and predominantly consist of observation and note making, with professionals using their own skills and experience to

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analyse interaction. Goal setting practices were largely similar between professionals, with many jointly deciding goals with parents.

**Conclusions & Implications:** This survey highlights the range of parent behaviours assessed by UK professionals in PCI with deaf children aged 0–3. This survey provides valuable information about and for professionals who assess PCI and set intervention goals with parents. Information from research and professional practice is important to consider in the design of a future PCI assessment. Implications are included for future research in this area.

**KEYWORDS**
assessment, deaf, infant, parent–child interaction, practice, survey

## What This Paper Adds

*What is already known on this subject*

Parental involvement is one of the greatest predictors of deaf children's language outcomes. With many deaf children born to hearing parents, parents often need guidance with how to facilitate effective communication. A recent systematic review identified the range of parent behaviours and methods used to analyse PCI in international research studies, but little evidence or guidance exists on how professionals assess this phenomenon in practice.

*What this study adds*

This is the first survey to generate large, valuable practice-based evidence for the assessment of parents' communication behaviours as they interact with their deaf infants aged 0–3. The survey recruited a range of multidisciplinary professionals working on interaction within this field: SLTs, qualified teachers of the deaf, psychologists or psychiatrists, and professionals working within deaf child and adolescent mental health services. The study reports on which behaviours these professionals assess and how, and includes information on the goal setting behaviours of practitioners. Most respondents were highly experienced; the survey, therefore, reveals expert practice within the field.

*What are the potential or actual clinical implications of this work?*

We recommend the following practice: (1) incorporate a range of parent-based behaviours in PCI assessments, including establishing joint engagement and parental sensitivity, as well as communication-focused behaviours; (2) video record PCI assessments where possible to enable professionals and parents to watch and reflect together; (3) following assessment, set parent-focused goals in collaboration with families, ensuring parents' skills, particularly their strengths, are considered. All primary caregivers should be included in the process where possible; and (4) reassess PCI regularly (at least termly) to monitor and encourage families' progress. The timing of reviews should be discussed between parent and professional.

# INTRODUCTION

Parent–child interaction (PCI) is an umbrella term that focuses on the reciprocal, face-to-face, dyadic relationship between caregiver and child during communicative exchanges. Good PCI is defined as contingent, responsive and expanded input, and is positively associated with language learning in hearing children (Roberts & Kaiser, 2011). Children build the foundations of language through the 'serve and return' of interactions with their parent. Responses can be visual (eye contact, facial expressions, gestures) and/or language based (Tomasello, 2010). Parents are seen as the main provider of the social and linguistic stimulation required for successful communication development (Peacock-Chambers et al., 2017). Parents provide scaffolds to this development through prompts and contingent reactions to their child's behaviour (Bornstein et al., 2008). This in turn encourages and reinforces a child's communicative intentions (Tomasello & Todd, 1983).

Although in the wider population there is considerable variability in the quality of PCI any one child experiences (Bergelson et al., 2019; McGillion et al., 2017), parents' engagement, responsiveness and linguistic input may be particularly important for deaf children for whom language and socio-emotional development are more at risk than their hearing peers (Stevenson et al., 2015). This may be due to differences in hearing status between parent and child, difficulties in gaining and maintaining the deaf child's visual and/or aural attention and the deaf child's reduced access to incidental language learning. In this paper, we use the term 'deaf' to refer to all levels of deafness, from mild to profound. We follow the recommendation from the British Association of Teachers of the Deaf and use the positive terms 'deafness' and 'deaf' rather than 'hearing loss' and 'hearing impairment' (BATOD, 2020).

A total of 90–95% of deaf children are born to hearing families (Mitchell & Karchmer, 2004) who often have little experience of deafness and the impact it can have on the child's ability to access spoken language. Hearing parents who have not yet developed effective skills in communicating with their deaf children may provide PCI that has fewer contingent responses and reduced language input (Barker et al., 2009; Meadow-Orlans & Spencer, 1996; Vaccari & Marschark, 1997). This in turn affects how a child develops their own understanding and use of language (Levine et al., 2016). Most hearing parents of deaf children need to be supported to adapt their communication to attain successful interactions with their deaf child (Dirks & Rieffe, 2019; Moeller et al., 2013). In the early years, this may include greater focus on gaining and/or establishing joint attention between parent and child, to ensure parental interaction and language is accessible/perceivable by the deaf child. It may also include the introduction of a signed language.

According to the most recent UK-wide summary from the Consortium for Research in Deaf Education (2021), there are 51,612 deaf children (i.e., children and young people up to the age of 19 years 11 months) in the UK: 22% of these are unilaterally deaf, 26% are mildly deaf, 31% are moderately deaf, 9% are severely deaf and 12% are profoundly deaf. CRIDE reports on languages used by deaf children and young people in educational settings: 88% of children use spoken language, 7% use a spoken language (English or Welsh) with signed support, 2% use British or Irish Sign Language, and 3% use an alternative combination (CRIDE, 2021). Cochlear implantation is provided to families for free in the UK after thorough assessment as part of the country's free national healthcare provision. The proportion of eligible deaf children in the UK with at least one cochlear implant is approximately 44% (CRIDE, 2021) and approximately 74% of eligible deaf children receive CIs by the age of 3 years (Raine, 2013).

Upon identification, generally following new born hearing screening shortly after birth, every deaf child regardless of their level of deafness is allocated a qualified teacher of the deaf (QToD).[1] Other professionals may include a speech and language therapist (SLT),[2] a deaf instructor, professionals from national deaf child and adolescent mental health services (NDCAMHS), and/or other professionals from cochlear implant teams (additional QToDs, SLTs, audiologists and psychologists). It is these professionals who deliver PCI interventions to deaf children and their families (Rees et al., 2015). Dependent on local provisions and pathways, PCI interventions can begin at any time from referral to these services, that is, from 3 months of age following deafness identification onwards.

Much research has documented that the quality of PCI offered is linked to better language development in deaf children (Curtin et al., 2021; Ambrose et al., 2014; Desjardin, 2003; Yoshinaga-Itano, 2003). In a recent systematic review and meta-analysis, parents' linguistic input was found to be a substantive predictor of deaf children's expressive language and explained 31.7% of the variance in deaf children's language scores (Holzinger et al., 2020). Another recent systematic review of 26 studies from six countries uncovered the strategies used by hearing and deaf parents to gain their deaf children's attention, as well as the strong positive associations between the length of joint engagement between parent and child and child language scores (Lammertink et al., 2021). Other international studies have uncovered additional parental features in PCI associated with higher language scores for deaf children, such as higher skills in maternal responsiveness and non-intrusiveness (Niparko et al., 2010), a higher number of conversational turns between the parent and child (Ambrose et al., 2014), a wider range of word types and language structures used by the parent (DesJardin & Eisenberg, 2007), as well as parents' recasts and the use of open-ended questions (Cruz et al., 2013).

There is some evidence that providing parents with the knowledge, skills and practice they need to adapt their communication leads to improved child communication, for example, improvements in pre-linguistic skills (an American RCT from Roberts, 2019) and in receptive and expressive language (an Italian between-groups intervention study from Nicastri et al., 2021). An important stage prior to providing support or intervention is assessment. However, a validated assessment tool to appraise a parent's strengths and needs, and assist with targeted goal planning or with continued monitoring via reassessment does not yet exist within PCI work with deaf infants. A systematic review of 61 papers by Curtin et al. (2021) found the most assessed parent behaviours when communicating with a deaf child aged 0–3 to be: how a parent gains a child's attention; the maintenance of joint engagement; the emotional availability and responsivity of a parent during the interaction and strategies in providing accessible and stimulating linguistic input.

Regarding methods of assessment, Curtin et al. (2021) found researchers predominately used frame-by-frame coding of videos, scales or both. Dyads (predominately mother–child) were filmed in either a lab, at home or in a clinic. While Curtin et al. (2021) described how PCI is evaluated in research, it is also important to investigate PCI assessment within professional practice, to explore the extent to which practice and research are aligned. The focus of the current paper was therefore to investigate how parent behaviours within interactions are assessed in current UK professional practice.

Assessment and goal setting are well-established activities in health and education. There are some validated tools available to professionals to track a deaf child's early expressive and receptive language development, such as the Ski-Hi Language Development Scale (Watkins, 2004). However, there are no published, parent-focused PCI assessments in the English language for practitioners to use. This has implications for how goals are set and reviewed. In a UK-based survey (Rees et al., 2015) investigating early interventions used by professionals working in deafness (SLTs, QToDs and auditory–verbal therapists), participants reported that they frequently selected and combined principles from approaches developed for hearing children (e.g., Hanen: Manolson, 1992, and parent–child interaction therapy: Eyberg, 1988). Many participants also reported relying on guidance from the Early Monitoring Protocol (Early Support, 2004), now relaunched as 'Success from the Start' (National Deaf Children's Society, 2020). This is a developmental tracker that allows parents and professionals to monitor a deaf child's language, cognition, play, social and physical development. However, none of the aforementioned are (or include) validated assessments of PCI.

Methods to assess interaction in research are less appropriate for practitioners to use in the family home as they have a narrow focus on a single or a few specific behaviours and take considerable time to complete. Some PCI research studies do use validated scales, which could be deemed as quicker to use, such as the Emotional Availability Scales (Biringen, 2008) as used by Dirks and Rieffe (2019) and Pressman et al. (1999), but these scales are not yet recommended in any SLT or QToD professional guidance in the UK. In addition, practice-based PCI assessments will be influenced by the real-life circumstances of each family and their individual social, emotional and environmental factors. For example, assessments may be administered more informally to be sensitive to parents' emotional well-being, they may be administered at home, with/without siblings, with/without additional caregivers or with interpreters; these factors are rarely discussed in research.

In their detailed clinical guidelines on deafness, the Royal College of Speech and Language Therapists (RCSLT) (2021) recommends that practitioners make informal observations of how the deaf child communicates with their key communication partners but does not provide any specific information on how to observe parents supporting or facilitating communication. The RCSLT also suggests careful monitoring and outcome measurement but does not suggest any tools to use for this. While the National Deaf Children's Society (2019) resource 'Assessments of Deaf Children and Young People' is comprehensive, there are no assessments included that can be used to monitor parents and their interactions in the early years. The absence of a reliable, evidence-based assessment tool may mean that professionals are not in agreement on which parent behaviours are important to appraise in the home. It also increases the likelihood of disparity between professionals on how to identify parents' strengths, needs and targets for intervention, which could impinge on the child's development if therapy goals are not appropriate. It is therefore important to consult with practitioners working in the field to ascertain current practices of PCI assessment. Further, by involving and gathering insights from professionals, we propose to fuse practice-based clinical findings with the research evidence from Curtin et al. (2021) to develop the content of a future assessment tool for PCI for young deaf infants.

## PATIENT AND PUBLIC INVOLVEMENT (PPI)

Patient and public involvement is well-established in UK-based health research and is an area of growing interest in Europe (Biddle et al., 2021). Involving patients, caregivers and the public in the entire research process can lead to higher quality, relatable work that meets the needs of the target population (Cook et al., 2019). This project has 10 hearing parents of deaf children and eight hearing and deaf professionals involved, working with the first author as research partners. In preparation for this project, parents were asked about their key lines of enquiry and what they might want to ask a wider group of professionals in relation to PCI practice. Parents shared many negative experiences of appointments where they were told their child was deaf, reporting that the language used, and the flippancy of some professionals had caused great upset and distress in the first few months of their child's life. Parents also collectively shared a severe lack of counselling support at this time. When planning this survey, parents were keen to ask whether other professionals involved in the child's journey after identification were alert to parental well-being and checked whether parents felt supported, as this may affect when a parent is ready for a PCI assessment and should influence the approach taken by the assessing professional.

While we wanted to acknowledge the research drives of our parent partners, a clear evidence based for considering the well-being of parents also exists. The range of negative emotions felt by parents after learning of their child's deafness is well documented internationally. Henderson et al.'s (2014) review uncovered a list of emotional concerns found by authors ascribed to parents: 'emotional distress, low self-esteem, grief, unpredictability, loneliness, incompetence, vulnerability, lack of fulfilment, and perceived stigma. Many of these negative emotions arose after the child's diagnosis with hearing loss and/or at periods of transition' (p. 442). Parents who feel supported in the period after identification report significantly lower negative feelings of well-being and stress, which in turn has a positive effect on the socioemotional development of the deaf child (Hintermair, 2006). We have included a research objective below that refers to parent well-being by professionals assessing PCI.

This paper reports the results of a quantitative survey which focused on UK-based professionals' practice in assessing PCI where the child is deaf, aged 0–3 years, and the parent is hearing. To our knowledge, this is the first paper of its kind within the international research field of deafness. The research question addressed by the study is: What is the reported practice of UK professionals assessing PCI with deaf infants aged 0–3? The specific research objectives were:

1. To understand whether assessing early PCI is routine practice for professionals working with deaf infants aged 0–3.

For professionals who do routinely assess PCI:

2.1 to identify which parent behaviours are and are not assessed

2.2 to distinguish which parent behaviours are considered the most important to assess in PCI

2to determine how assessments are conducted in practice

2.4 to ascertain how assessment results influence goal setting and intervention planning

2.5 to determine whether parental well-being is considered

3. To examine any differences in PCI assessment that exist in the UK dependent on professional background, hearing status of assessor, languages used at work and/or years of experience.

## METHODS

Ethical approval was granted from City, University of London's Health Sciences Research committee (ETH2021-0335). The study is funded by National Institute for Health Research, as part of a fellowship (NIHR300558). The Checklist for Reporting Results of Internet E-Surveys (CHERRIES, Eysenbach, 2004) has been used for this paper.

### Development and testing

The data reported in this paper was collected via an online, open quantitative survey. As mentioned, some questions were co-designed by a group of hearing and deaf professionals and parents of deaf children, but most were based on the findings from a systematic review of PCI research (Curtin et al., 2021). Narrative synthesis of the 61 papers included in this review (Curtin et al., 2021) generated definitions of each PCI concept, as well as skills measured for each concept, for example, a definition of joint engagement was provided along with ways to assess the skill, that is, by the number of connected turns within an episode of joint engagement, total length of time engaged, and whether engagement was mutual or more supported by the parent. The first author compiled all co-produced and evidence-based questions for the authorship team and PPI group's final review and agreement.

Questions were then refined through five, individual, 'think-aloud' cognitive interviews with professionals (SLTs and QTODs) working in the field, using the methods outlined by Willis (2005). Cognitive interviewing is 'a qualitative method specifically designed to investigate whether a survey question satisfies its intended purpose' (Willis & Artino, 2013, p. 354). The interviews involved pilot testers reading the survey questions aloud and then vocalizing their thoughts to the first author while answering the question. Probing questions were also used by the first author such as 'What does [concept] mean to you?' or 'Can you put that question into your own words?' to ensure the questions were comprehended as intended. This pilot work also considered the usability and technical functionality of the survey. The adaptation of wording from second-person questions (e.g., 'Do you assess …?') to first person statements (e.g., 'I assess …') is an example of a change made from the cognitive interview process. Another addition included frequent reminders that the term 'assessment' could also mean 'observe', 'evaluate' or 'look at,' and that the activity could be formal or informal. This was because those involved in the pilot cognitive interviews commented that 'assessment' suggested a formal, standardized tool and that other terms may be preferred by professionals.

## Recruitment and inclusion criteria

The survey was open for 15 weeks to all hearing and deaf, currently registered UK QToDs, SLTs, psychologists or psychiatrists and professionals working in NDCAMHS. The latter two groups were included in the recruitment strategy as psychologists (working in NDCAMHS or in cochlear implant centres) are often involved in appraising PCI as part of a larger assessment. Any professional working in NDCAMHS was welcome to participate as there is often a range of professionals responsible for carrying out PCI assessments when referrals are received. All these professional groups are highly skilled, highly trained and acknowledge the important role parents play in a deaf child's language acquisition.

Professionals had to have experience of working with deaf infants aged 0–3. Professionals of any age, gender, hearing status, ethnicity and years of experience were eligible. The survey link was anonymous and shared through professional network mailing lists, social media, and professionally relevant magazines and newsletters (see Appendix A in the additional supporting information). Completion was voluntary, and no incentives were offered.

## Consent process

An information sheet (downloadable from the first page of the survey) explained the study's purpose, the name and contact details of the investigator, the approximated completion time of the survey, where data were stored and for how long. On the second page, participants gave their consent. The survey was presented through Qualtrics, and responses were anonymous and GDPR compliant.

## Survey administration

Questions were not randomized or alternated, but were adaptive (i.e., certain items were conditionally displayed based on responses to previous questions) to reduce the number of items. There were 85 questions with a range of 1–19 questions per page (see Appendix B in the additional supporting information). The questionnaire was distributed over 11 pages but again this depended on the responses given. Each item required a mandatory response, except the four optional open text boxes provided for participants who wanted to share their opinions on the COVID-19 pandemic's impact on PCI, add their own suggestions of the parent behaviours they observe (beyond those presented), or provide more detail to some of the questions. Participants were able to change their answers using a 'back' button. Most questions were designed for respondents to select a single response or multiple responses from the range offered.

## Survey content

Following consent, the survey began with a screening question to check participant eligibility. The remaining 81 questions were split into four sections to collect information on the following: anonymous participant demographics; parent behaviours assessed in PCI; methods used to assess PCI; and goal setting and service provision (see Appendix B in the additional supporting information). Definitions of parent behaviours described in a review from Curtin et al. (2021) were displayed to ensure shared understanding of the concepts explored.

## Response and participation rates

Qualtrics identified each participant as a unique visitor through their IP address. There were 228 unique visitors to the survey's first information page. A total of 228 people agreed to participate by clicking the consent box; the recruitment rate was therefore 100% (consent ticked/first page). Ten participants left after giving their consent, 20 participants left after ticking 'I meet the criteria' and eight participants selected 'I do not meet the criteria'. In total, there were 153 complete and 37 partially complete responses (completion rate ranged from 28% to 81%). This study reports on all complete and partially complete responses, as the partially complete responses also contained much useful information. Duplicate entries were avoided by preventing users with the same IP address access to the survey twice, that is, the survey was not displayed a second time if the user had completed it.

## Data analysis

Data were exported from Qualtrics into Microsoft Excel and reviewed by the lead author. Both partial and fully complete questionnaire responses were analysed, with the sample size noted for each main research question. Descriptive statistics summarized the data, further analysis used *t*-tests via SPSS to compare groups.

# RESULTS

## Participant demographics

Most participants were SLTs and QToDs (Table 1). Participants were mostly female, hearing, aged between 50 and 59 and used spoken English as their preferred language. Most professionals' highest qualification was a master's-level degree, followed by an undergraduate degree. The majority of professionals (55%, $n = 104$) had over 16 years of experience in their profession. Participants mainly worked in England, with London and the south-east of England featuring prominently. A total of 97% ($n = 184$) reported they had specialist knowledge and skill in the field of deafness and almost half (48%, $n = 91$) reported they used both English and British Sign Language (BSL) at work.

## Participant responses according to research objectives

**1. *Where the deaf child is aged 0–3, is the assessment of PCI routine practice? Respondents (n) = 185***

The term 'assess' refers to all formal and informal observations and evaluations. Most professionals (92%, $n = 171$) assessed PCI as part of their routine practice. Split by profession, this was 95% ($n = 82$) of SLTs, 89% ($n = 76$) of QToDs, 100% ($n = 6$) of psychologists or psychiatrists and 88% ($n = 7$) of NDCAMHS professionals. Those who did not routinely assess PCI (8%, $n = 14$) explained another professional was responsible for doing this. These professionals were taken directly to the end of the survey.

**2.1. *Which parent behaviours are assessed by practitioners? Respondents (n) = 155***

A breakdown of all responses to this question, per profession is provided in Appendix C in the additional supporting information.

*Attention getting behaviours (Q22–26; see Appendix B in the additional supporting information)*

The most frequently assessed attention getting behaviours selected were parents making eye contact with their child (97%, $n = 150$); parents using gesture (95%, $n = 147$), parents using words such as 'look' (94%, $n = 146$), parents using pointing (93%, $n = 144$), and parents using their voice to call their child's name (92%, $n = 153$). Waiting was also considered an attention getting strategy, as a paused action, voice, sign or gesture can initiate a look from the child. Most professionals (97%, $n = 151$) assessed whether the parent actively waits for their child to look before communicating and most (96%, $n = 149$) reported they watched to see if parents used combinations of visual, auditory and tactile strategies, that is, multimodal strategies, to gain their child's attention. Parents grabbing onto their child's clothing (27%, $n = 41$) and using humming to gain their child's attention (27%, $n = 41$) were the least assessed.

All professional groups assessed parents' visual-based attention-getting strategies the most (each professional group selected between nine and 12 of the 12 visual strategies). SLTs and QToDs then assessed auditory-based attention getting strategies (a range of five to six of the seven listed strategies were selected), whereas psychologists or psychiatrists and NDCAMHS professionals selected more tactile-based strategies (eight of the 10 skills selected). Fewer tactile-based strategies to gain a child's attention were selected by QToDs and SLTs (six of the 10 skills). Some caution is required here as only three psychologists or psychiatrists and six NDCAMHS professionals completed this section.

*Joint engagement (Q27–31)*

Many professionals noted the length of joint engagement (71%, $n = 110$), counted the number of connected turns between the parent and the child live, as they observed (68%, $n = 105$), and noted whether joint engagement was 'supported by the parent' or 'coordinated between parent and child' (79%, $n = 123$). By this, we mean the difference between a parent working hard to support joint engagement by waiting, watching and responding to the child, versus coordinated, mutual, joint engagement where parent and child focus on each other.

*Parental sensitivity (Q32)*

Many professionals assessed all six features, with 'availability' (92%, $n = 143$) and 'contingent and responsive' (92%, $n = 142$) being the most frequent. 'Availability' refers to a parent who is genuinely interested and actively involved in participating in accessible interactions with their child. 'Contingent and responsive' refers to a parent that follows their child's lead and pace and responds with on-topic behaviour or language. Fewer professionals assessed a parent's consistency of interaction (70%, $n = 108$), that is, a parent who can absorb and regulate a range of their child's emotions and behaviours, while remaining mostly constant and positive in their own behaviours.

*Assisting the child's access to language (Q33)*

Most professionals assessed to see if the parent and child were face to face (96%, $n = 149$) and whether the parent

**TABLE 1** Survey participants ($n = 190$)

| Professions | SLT<br>46% ($n = 88$) | QToD<br>46% ($n = 87$) | NDCAMHS<br>5% ($n = 9$) | Psych<br>3% ($n = 6$) | Total<br>100% ($n = 190$) |
|---|---|---|---|---|---|
| Female % ($n$) | 98% (86) | 94% (82) | 100% (9) | 67% (4) | 95% (181) |
| *Hearing status % (n)* | | | | | |
| Deaf or hard of hearing | 4% (3) | 16% (14) | 67% (6) | 0 | 12% (23) |
| Hearing | 95% (84) | 82% (71) | 33% (3) | 100% (6) | 86% (164) |
| Other/prefer not to say | 1% (1) | 2% (2) | 0 | 0 | 2% (3) |
| *Age (years) % (n)* | | | | | |
| 20–29 | 7% (6) | 2% (2) | 11% (1) | 0 | 5% (9) |
| 30–39 | 31% (26) | 10% (9) | 45% (4) | 17% (1) | 21% (40) |
| 40–49 | 28% (25) | 30% (26) | 11% (1) | 33% (2) | 28% (54) |
| 50–59 | 33% (29) | 51% (44) | 11% (1) | 50% (3) | 41% (77) |
| 60–69 | 1% (2) | 7% (6) | 22% (2) | 0 | 5% (10) |
| 70+ | 0 | 0% | 0 | 0 | 0 |
| *Preferred language % (n)* | | | | | |
| Spoken English | 98% (86) | 85% (75) | 33% (3) | 83% (5) | 89% (169) |
| BSL | 0 | 2% (2) | 56% (5) | 0 | 4% (7) |
| Spoken English and/or BSL | 2% (2) | 9% (8) | 11% (1) | 17% (1) | 6% (12) |
| Other | 0 | 4% (2; 1 BSL with voice, 1 no detail) | 0 | 0 | 1% (2) |
| *Languages used at work % (n)* | | | | | |
| Spoken English only | 43% (38) | 39% (34) | 11% (1) | 67% (4) | 41% (77) |
| BSL only | 0 | 2% (2) | 33% (3) | 0 | 3% (5) |
| Spoken English and BSL | 51% (45) | 47% (41) | 45% (4) | 16% (1) | 48% (91) |
| Other | 3% (3) (sign supported English—SSE); 2% (2) AAC/Makaton | 7% (6) SSE; 1% (1) Welsh and English; 1% (1) Welsh and BSL | 11% (1) BSL and written English | 16% (1) SSE | 8% (15) |
| *Highest qualification % (n)* | | | | | |
| Undergraduate degree | 58% (51) | 9% (8) | 56% (5) | 0 | 34% (64) |
| Postgraduate diploma, e.g., PGCE | 1% (1) | 16% (14) | 0 | 0 | 8% (15) |
| Master's | 32% (28) | 46% (40) | 33% (3) | 16% (1) | 38% (72) |
| Doctorate | 1% (1) | 0 | 0 | 84% (5) | 3% (6) |
| Other | 8% (7) | 29% (25) | 11% (1) | 0 | 17% (33) |

(Continues)

**TABLE 1** (Continued)

| Professions | SLT<br>46% (*n* = 88) | QToD<br>46% (*n* = 87) | NDCAMHS<br>5% (*n* = 9) | Psych<br>3% (*n* = 6) | Total<br>100% (*n* = 190) |
|---|---|---|---|---|---|
| *Years working in profession % (n)* | | | | | |
| < 3 | 3% (3) | 5% (4) | 34% (3) | 0 | 5% (10) |
| 4–10 | 22% (19) | 21% (18) | 11% (1) | 17% (1) | 21% (39) |
| 11–15 | 21% (18) | 20% (17) | 11% (1) | 17% (1) | 19% (37) |
| 16–20 | 23% (20) | 16% (15) | 22% (2) | 49% (3) | 21% (40) |
| +21 | 31% (28) | 38% (33) | 22% (2) | 17% (1) | 34% (64) |
| *Geographical location % (n)* | | | | | |
| Wales | 6% (5) | 8% (7) | 0 | 0 | 6% (12) |
| Scotland | 3% (3) | 6% (5) | 0 | 0 | 4% (8) |
| Northern Ireland | 2% (2) | 2% (2) | 0 | 0 | 2% (4) |
| *England* | | | | | |
| North West | 7% (6) | 15% (12) | 11% (1) | 17% (1) | 11% (20) |
| North East | 2% (2) | 5% (4) | 11% (1) | 0 | 4% (7) |
| Yorkshire and Humber | 2% (2) | 7% (6) | 11% (1) | 17% (1) | 5% (10) |
| West Midlands | 3% (3) | 3% (3) | 0 | 0 | 3% (6) |
| East Midlands | 3% (3) | 3% (3) | 0 | 17% (1) | 4% (7) |
| East of England | 3% (3) | 8% (7) | 11% (1) | 0 | 6% (11) |
| London | 33% (28) | 17% (15) | 22.5% (2) | 17% (1) | 24% (46) |
| South East | 31% (26) | 20% (17) | 11% (1) | 32% (2) | 34% (46) |
| South West | 3% (3) | 3% (3) | 22.5% (2) | 0 | 4% (8) |
| Prefer not to say | 2% (2) | 3% (3) | 0 | 0 | 3% (5) |

used child-directed speech or 'parentese' (95%, $n$ = 147), where a parent modifies their speech to be more child orientated, for example, exaggerated pitch/acoustic highlighting or stress. Fewer professionals assessed whether parents used child-directed sign (64%, $n$ = 99), where a parent modifies their signing to be more child orientated, for example, palm orientation so the child can see more, exaggerated non-manual features, larger sign space and range of motion.

*Enriching the child's language (Q34–36)*

The most assessed behaviours were parents labelling items or feelings (96%, $n$ = 148), commenting on the child's actions (96%, $n$ = 148), adding one to two words or signs to a child's utterance (96%, $n$ = 148), use of praise (95%, $n$ = 147) and modelling play (95%, $n$ = 147). Fewer professionals assessed parents' recasting of their child's utterance into a question (65%, $n$ = 100) and whether a parent reprimanded or disciplined their child (60%, $n$ = 92).

Most professionals often (44%, $n$ = 68) or always (31%, $n$ = 48) noted the number of signs/words used by parents in interactions with their children. When asked about assessing parents' signing proficiency, some professionals said they either always do this (31%, $n$ = 48) and the other large group said they did not have the skills (29%, $n$ = 45).

*Use of touch (Q37–38)*

For the frequency of parental touch, 30% ($n$ = 46) of professionals said they 'sometimes' assessed this and 28% ($n$ = 44) said they 'rarely' assessed this. For the purpose of touch, an equal proportion of professionals said they 'often', 'sometimes' or 'rarely' assess this phenomenon (all 27%, $n$ = 41).

*Behaviours assessed by professionals that were not mentioned in the survey (Q39)*

Professionals could report any parent-focused behaviours in a free text box, that they felt were missing from the survey. After qualitative analysis, there were 18 additional behaviours listed by 72 different professionals. Some of these focused on the listening environment or environmental sounds; others considered parental awareness of their skills, or specific techniques adopted while speaking. These are listed in full in Appendix C in the additional supporting information. Respondents also suggested observing how parents include siblings within the interaction, use books, use language in everyday routines, and use music, singing and rhymes.

### 2.2. *Which parent behaviours are considered most important to assess in PCI?*

Professionals selected the 10 most important behaviours they assess (Table 2). The behaviour most frequently selected by the 155 participants was 'waiting', that is, a parent actively waiting or pausing until their child looks at them. This was selected as a 'top 10 skill' by three of the four professional groups (QToDs, SLTs and NDCAMHS professionals). All four professional groups agreed that the second most frequently selected parent behaviour to assess was 'contingency/ responsivity'.

There were four parent behaviours selected by all four professional groups: being contingent/responsive (see Parental Sensitivity above); being face to face; being emotionally available and genuinely interested and providing appropriate stimulation and pace in play and language. QToDs and SLTs selected eight of the same behaviours in their respective top 10, with the first two parent behaviours in the same position. The three least selected for assessment were: parents prohibiting their child (3.9%, $n$ = 6), parents recasting their child's utterance into a question (3.2%, $n$ = 5) and parent correcting their child's communication (2.6%, n = 4). Appendices D and E in the additional supporting information provide details on all behaviours and each professional group's top 10.

### 2.3. *How are PCI assessments conducted in practice? Respondents (n) = 145–148*

Findings were combined due to all professionals answering Q42–56 similarly (Table 3). Just over half of professionals (55%) let parents know that they are observing their interactions with their deaf child and 37% assessed PCI covertly. The remaining 8% selected 'other' and using open text responses, explained it was family and context dependent, that is, they would not explicitly say 'I am observing you' but would offer some positive feedback if they noticed behaviours that were supportive of the child's development.

Professionals usually observed PCI during play in the family home. A total of 17% selected 'other' for the activity they observe, adding that they often asked parents to choose whatever they are most comfortable with or whatever the family most enjoys. Mostly, professionals conducted these assessments alone with the family rather than with other colleagues. As well as those professionals listed in Table 3 (Q50), respondents used the 'Other' option to report that PCI assessments were also conducted with teaching assistants, audiologists, multisensory impairment colleagues and cochlear implant team members, for example, listening therapists.

Professionals usually assessed PCI live and made either mental or written notes of their observations. Most commonly, the mother was assessed, followed by the father and then older siblings and grandparents. The most popular method used to form judgments on the interaction was by professionals using their own skills, knowledge and expertise, followed by intervention checklists such as those from Hanen (Manolson, 1992), Palin PCI (Kelman & Nicholas, 2008), VERVE Child Interaction (Cummins, 2021) and the Early Monitoring Protocol (Early Support, 2004). A total of 14% reported using formal, scientifically validated checklists for PCI and named the Autism Diagnostic Observation

**TABLE 2** Top 10 parent behaviours assessed in PCI ($n = 155$)

| Parent behaviour assessed | % | ($n$) |
|---|---|---|
| Parent waits for the child to look | 82.6% | 128 |
| Parent is contingent and responsive, follows their child's lead and responds with on-topic behaviours or language | 69.0% | 107 |
| Parent uses multimodal strategies to gain the child's attention | 59.4% | 92 |
| Parent ensures they are face to face with their child | 58.1% | 90 |
| Parent is stimulating and can provide appropriate pace, play, and language structures | 54.2% | 84 |
| Parent is available to the child, genuinely interested and involved | 53.5% | 83 |
| Parent expands their child's language by adding 1 or 2 new words/signs | 50.3% | 78 |
| Parent uses child-directed language (spoken or signed) to raise child's interest | 49.7% | 77 |
| Parent interprets their child's behaviour with language (spoken or signed) | 45.2% | 70 |
| Parent comments on, or describes the child's action | 41.9% | 65 |

Schedule (ADOS) (Lord et al., 2012), the Nottingham Auditory Milestones (Datta et al., 2011), the Rossetti Infant Toddler Language Scale (Rossetti, 2006), the Infant Monitor of Vocal Production (Cantle-Moore & Colyvas, 2018) and the Pre-school Language Scales (Zimmerman et al., 2011).

Many professionals reassess PCI once every few months (38%, $n = 44$) which would suggest a termly review. The next largest interval selected was 'other' (35%, $n = 40$) with many professionals using the open-text box to say reassessment would be dependent on the family's progress, or the frequency of visits. For those professionals who used filmed recordings of PCI (22%, $n = 33$), film recording length was generally between 3 and 5 min with the same length of time watched in analysis. Professionals generally watched back the videos in the same appointment, with the parent. Finally, on a sliding scale from 0 to 100 where '100' signified 'extremely confident', professionals averaged at '80' for their confidence in assessing children in PCI and slightly lower at '75' for their confidence in assessing parents' skills.

### 2.4. What is the goal-setting practice of professionals? Respondents ($n$) = 145–148

Most professionals (76%; $n = 111$) stated that their assessments always lead to goal planning. As well as setting child-focused goals, professionals reported setting parent-focused goals either all the time (42%, $n = 61$), often (33%, $n = 48$) or sometimes (25%, $n = 36$). Many professionals discussed and jointly set goals with parents (61%, $n = 89$) but others chose the target themselves (22%, $n = 32$), or asked the parent to choose (15%, $n = 22$). Just over half of professionals (52%, $n = 76$) had a timeframe in mind for when the goal might be expected to be achieved, whereas 43% ($n = 62$) reported this was sometimes the case. The majority (71%, $n = 98$) shared this time frame with parents, with a high proportion (77%, $n = 111$) reporting that they revisited and reviewed goals.

The two most frequently selected time frame categories to review PCI goals were 'once a term', that is, every 10–12 weeks (23%, $n = 34$) and 'every 6–8 weeks' (23%, $n = 33$). For this question, the category of 'other' was also frequently selected (24%, $n = 35$). Within the free text box, many professionals reported that reviewing goals depended on two things: the individual family's progress with their goals and the visit schedule to that family, with many reporting they may review the goals at the start of every visit (which could be weekly, bi-weekly, monthly or termly). Finally, 61% ($n = 88$) of professionals shared their goals with other members of the families' multidisciplinary team and 37% ($n = 54$) reported they 'sometimes' shared their goals.

Only 24% of professionals ($n = 35$) said their assessments sometimes lead to goal planning. This group contained a similar number of SLTs ($n = 17$) and QToDs ($n = 15$), as well as two psychologists, and one NDCAMHS professional. Most professionals in this group (68%, $n = 24$) had a small proportion of their work (0–25%) allocated to working with deaf 0–3-year-olds. Only one professional from this group received supervision every six weeks from a more knowledgeable colleague, whereas others either had access to peer-to-peer support (31%, $n = 11$), never received supervision (20%, $n = 7$) or received supervision one to two times a year (20%, $n = 7$).

### 2.5. *Do professionals consider parental well-being during assessment sessions and visits? Respondents (n) = 141*

A relatively even number of professionals 'sometimes' (34%, $n = 48$), 'often' (28%, $n = 40$) or regularly asked (26%, $n = 37$) about parents' feelings towards their child's

**TABLE 3** Survey responses for methods of PCI assessment

| **Q 42 When I assess PCI, I:** | **100% ($n = 148$)** |
|---|---|
| let parents know | 55% (81) |
| do not let parents know I am observing them | 37% (55) |
| other | 8% (12) |
| Q 43 When I assess PCI, I: | 100% ($n = 148$) |
| observe play | 78% (116) |
| observe book reading | 3% (5) |
| meal time | 1% (2) |
| other | 17% (25) |
| Q 44 When I assess PCI, I: | 100% ($n = 148$) |
| observe live and make written notes | 38% (56) |
| observe live and make a mental note | 26% (38) |
| make a video recording | 22% (33) |
| ask parents to send me a video | 5% (8) |
| other | 9% (13) |
| Q 49 When I assess PCI, I: | 100% ($n = 145$) |
| carry out the assessment alone | 74% (108) |
| with another professional | 16% (24) |
| other | 10% (15) |
| Q 50 When I assess PCI, I: | 100% ($n = 145$) |
| Joint-PCI assessments have been with QToDs | 64% (99) |
| with SLTs | 48% (75) |
| with spoken language interpreters | 16% (25) |
| with portage workers | 15% (23) |
| with deaf instructors | 8% (13) |
| with BSL interpreters | 6% (9) |
| with psychology colleagues | 5% (8) |
| Other | 18% (28) |
| Q51 When I assess PCI, I: | 100% ($n = 148$) |
| assess the family at home | 72% (107) |
| assess the family in a community clinic | 10% (15) |
| assess at a specialist centre | 7% (11) |
| assess at a hospital appointment | 5% (8) |
| assess a nursery | 5% (7) |
| Q52 When I assess PCI, I: | 100% ($n = 148$) |
| assess mum and child | 76% |
| assess dad and child | 16% |
| assess older siblings and child | 3% |
| assess grandparents and child | 3% |
| assess nanny/au pair and child | 1% |
| assess others interacting with the child | <1% |
| Q48 When I assess PCI, I: | 100% ($n = 146$) |
| observe and make judgements using my own skills, expertise, training and knowledge | 88% (128) |
| use a formal checklist from a therapy | 21% (31) |
| carry out a descriptive analysis / written transcript | 18% (27) |
| use a service-developed tool | 17% (25) |
| use a formal, validated assessment | 14% (21) |
| make a tally of behaviours observed | 7% (10) |
| other | 9% (13) |
| Q55 When I assess PCI, I: | 100% ($n = 148$) |
| reassess PCI | 79% (117) |
| do not reassess PCI | 21% (31) |
| Q56 When I assess PCI, I: | 100% ($n = 115$) |
| reassess PCI once a week | 10% (11) |
| reassess PCI once a month | 16% (18) |
| reassess PCI every few months | 38% (44) |
| reassess PCI yearly | 2% (2) |
| other | 35% (40) |

*Note*: See Appendix B for the survey questions.

deafness. Similarly, professionals reported 'regularly' (32%, $n = 45$), 'sometimes' (32%, $n = 45$) and 'often' (28%, $n = 39$) asking about parental stress. Finally, 43% ($n = 60$) of professionals regularly ask parents about access to external sources of support, such as friends and family or members of the local community. A proportion of professionals often (31%, $n = 44$) or sometimes ask (21%, $n = 29$). Significantly more QToDs (36%, $n = 23$) regularly ask about external pressures, compared with SLTs (23%, $n = 17$, $t(7.25) = -1.99$, $p = 0.008$). No other significant differences were found.

**3. What are the differences in PCI assessment practices between practitioners who differ in profession, hearing status, languages used at work and years of experience?**

*Differences in PCI assessment practice between professional groups*

Psychologists ($n = 3$) and NDCAMHS professionals ($n = 6$) were removed from these *t*-test analyses due to small numbers. To explore differences in skills selected, a '1' was given for each of the 52 parent-focused behaviours that respondents selected throughout the survey and a '0' was given where the professional had not selected that behaviour. Behaviours were categorized as in section 2.1 above, that is, 12 visual, seven auditory and 10 tactile attention-getting strategies; six parental sensitivity behaviours; five behaviours focused on access to communication and 12 on language enrichment. When QToDs and SLTs were compared across the six categories above, there were no significant differences in the number of behaviours selected, except for the five parent behaviours around providing good access to language. On average, SLTs assessed four of these five skills and QToDs assessed all five ($t(144) = 4.06$, $p < 0.001$). Looking back to the descriptive data within this category, we can see fewer SLTs (52%) assessed whether the parent checks the child can hear all six Ling sounds compared with QToDs (86%) and fewer SLTs (56%) assessed child-directed sign, compared with 73% of QToDs.

The methods used in PCI assessment were very similar and no significant differences were found between groups, except for the location of assessments. Mostly, QToDs assessed mothers in the home (92%) with less assessed in community clinics (2%), nurseries (3%) and specialist centres (3%). The distribution for SLTs was more spread: 59% of assessments happened at home, but some took place in community clinics (16%), specialist centres (11%), hospitals (9%) and nurseries (5%), $t(128) = -4.36$, $p > 0.001$. There were no significant differences in the goal setting practices of both professions, nor were there any differences in their confidence ratings in assessing parents' skills during interaction.

*Differences in PCI assessment practices between professionals with differing hearing status*

The survey recruited 23 deaf professionals and 164 hearing professionals. Inferential statistics were not run due to an imbalance in sample size. However, some subtle differences in behaviours valued as most important to assess were noted. When professionals selected the most important behaviours to assess, six parent behaviours were the same across deaf and hearing professionals but were ranked differently. These were being face to face, waiting/pausing, structure and stimulation, child-directed language, emotional availability and expanding on the child's language. For the other four skills, deaf practitioners assessed visual-based attention getting strategies, joint attention, positive regard, and the parent using praise; whereas hearing practitioners assessed multimodal attention-getting strategies, contingency/responsiveness, commenting/describing and interpreting the child's action with language.

There were no differences in the PCI assessment methods or goal setting behaviours. Both hearing and deaf practitioners ranked themselves highly in terms of their confidence with assessing deaf children in PCI, but in terms of assessing parents' skills in PCI, deaf practitioners rated their confidence lower (64/100) compared with hearing practitioners (75/100). Again, caution is required with this finding due to stark differences in group sizes.

*Differences in PCI assessment practices between professionals who use English only at work and those who use English and BSL*

These two groups of professionals were compared on how many of the 52 parent-focus behaviours they assessed across the six categories. There were no significant differences found between the two groups. The top 10 parent behaviours to assess were also very similar, with eight of the 10 being the same. Professionals who only use English at work (referred to here as monolingual-focused professionals) prioritized assessing whether the parent uses child-directed language and whether they interpret the child's behaviour with language. Professionals who can use English and BSL at work (bilingual bimodal-focused professionals) prioritized assessing the parents' use of comment/describing the play and whether the parent is within 1–2 m of their child's amplification device(s). There was a significant difference in how professionals assess joint engagement. Significantly fewer monolingual-focused professionals count the number of connected turns (57%, $n = 38$) compared with bilingual bimodal-focused professionals (73%, $n = 53$, $t(133) = 1.97$, $p = 0.5$). Similarly, significantly fewer monolingual-focused professionals note the length of time a parent and child remain engaged (64%, $n = 43$) compared with bilingual bimodal-focused professionals (75%, $n = 55$, $t(138) = 1.44$, $p = 0.01$). Both groups rated their confidence in assessing parent's skills the same (76/100).

*Differences in PCI assessment practices between professionals with different levels of experience*

Professionals with under and over 10 years' experience were compared on how many of the 52 parent-focus behaviours they assessed across the six categories. Significant but marginal differences were observed in the number of auditory-based attention getting strategies assessed; those with less experience assessed five of the six skills on average, whereas those with more experience assessed all six skills on average ($t(51) = -1.994$, $p = 0.05$). Similarly those with less experience assessed fewer language-based parent behaviours (nine out of 12) compared with more experienced professionals, who assessed 10 of the 12 behaviours ($t(153) = -1.929$, $p = 0.05$). Regarding their most selected parent behaviours to assess, eight of the 10 chosen were the same. Less experienced professionals prioritized joint attention and positive regard, whereas more experienced professionals prioritized stimulation and structure, and interpreting the child's behaviour with language. Methods of assessment and goal setting behaviours were very similar. Finally, less experienced practitioners rated their confidence in assessing parents' skills significantly lower (66/100) when compared with those with more experience (78/100), $t(144) = 3.75$, $p < 0.001$.

## DISCUSSION

This is the first study of its kind to report on professionals' practice of PCI assessments of hearing parents and deaf infants. The total sample size was 190 for part 1 of the survey, reducing to 148 in the final section, part 4. This exceeded the sample size reported by Rees et al.'s (2015) intervention-focused survey of professionals working in pre-school deafness ($n = 158$ for part 1 and $n = 117$ for part 2). We were successful in recruiting widely across England and within Northern Ireland, Scotland and Wales.

Almost all our sample self-reported specialist skills in working with deaf children and over half had more than 16 years of experience. These professionals are well established, well-practised experts in the field of PCI assessment in deafness, therefore enhancing the validity of our findings. As described, the survey's content was based on a systematic review of 61 papers that assessed PCI between parents and their deaf children aged 0–3 (Curtin et al., 2021). The value of consulting this group of professionals has uncovered the differences in clinical and research PCI assessment practice, including which parent behaviours are prioritized in practice, how assessments are conducted, and how goals are made. The survey also extends the knowledge base on clinical PCI assessment in this field by uncovering 18 more parent-focused behaviours.

## Parent behaviours

PCI assessment is routine practice for almost all professionals in our survey. By far the most frequently assessed parent behaviour was 'waiting', that is, observing whether the parent waits for the child to look before they communicate. The next most frequently assessed parent behaviour (agreed upon by all four professional groups) was responsivity and contingency, that is, ascertaining whether the parent follows the child's lead and responds with on-topic cues or language. Within the top 10 of most assessed skills, there were three more language-focused behaviours: adding one or two new words/signs to the child's utterance; interpreting the child's behaviour with language; and commenting or describing the child's action. These language skills echo the parent behaviour of responsivity and contingency, as they are all based on the parent observing, receiving and then responding to the child's language or behaviour. These findings align with the parent behaviours taught in PCI intervention studies carried out by Glanemann et al. (2013), Roberts (2019) and Nicastri et al. (2021). Each of these intervention studies involved parents of deaf children aged 0–3 learning these behaviours. With all three studies highlighting the value of these particular parent behaviours in promoting good language development, it is encouraging to see that professionals observe whether they are present in PCI.

Almost two thirds of participants prioritize assessing parents' methods of gaining their child's attention and whether the parent is face to face with their child. Almost half of professionals assess whether the parent used child-directed language, that is, adapting their speech or sign to raise the child's interest. Despite not being within the top 10 in Table 2, high numbers of professionals measure joint attention in some way. Assessing these skills within interaction is important as gaining and maintaining joint attention is positively associated with deaf children's language development (Barker et al., 2009; Cejas et al, 2014; Chen et al., 2020; Dirks & Rieffe, 2019). There is also evidence to suggest deaf children will attend to, and their language learning benefits from, child-directed speech (Dilley et al., 2020; Wang et al., 2017) and/or child-directed sign (Koester & Lahti-Harper, 2010; Perniss et al., 2018).

The majority of professionals assess two more features of parental sensitivity; whether the parent is stimulating and can provide appropriate pace and structure in play and language, and whether the parent shows genuine interest, involvement, and availability to the child. These features link to the parents' willingness to engage with, attune to, and enhance interaction with their deaf child. They are important to observe within PCI, as higher rates of parental sensitivity correlate with greater language scores in deaf children (Dirks & Rieffe, 2019; Pressman et al., 1999; Pressman et al., 1998; Quittner et al., 2016; Quittner et al., 2013).

Most professionals noted the number of words or signs used by the parent to the child within their PCI assessments. As discussed above, professionals also assess parents on their abilities to gain their deaf child's attention, remain face to face and provide language that is child directed. We could infer professionals noting the number of words used by a parent are also assessing whether the number of words used is appropriate for the child's age and stage of language development, whether the number of words used (and the way they are used) are perceptually and cognitively accessible by the child. This aligns directly to the research work of Hall (2020), where parental input (signed or spoken) matters: 'it is not enough to simply consider what kinds of linguistic signals are being sent to a child. Instead, it is necessary to think about the linguistic signals that that child is receiving' (p. 3).

Differences, though small, did exist between some professional groups. For example, psychologists and NDCAMHS professionals assessed visual and tactile based attention-getting strategies the most, whereas QToDs and SLTs assessed primarily visual and auditory strategies. Furthermore, psychologists and NDCAMHS professionals prioritized far more parental sensitivity skills within their top 10s than SLTs and QToDs. This is likely due to their professional focus on positive mental health and well-being for the families, parents, and deaf children they see within their service. However, caution must be taken with this finding, due to a large contrast in sample size between groups.

A similar difference was also seen between SLTs and QToDs. In comparison to SLTs, QToDs were more likely to assess parents using the Ling sound checks and child-directed sign, as many QToDs have advanced audiology training as part of their master's-level degrees and are also expected to know/learn BSL. Finally, more QToDs check in on parental wellbeing than SLTs. This may be because generally in the UK, QToDs are the first professionals in the home with families following a child's identified deafness and may therefore have a closer connection to parents.

One behaviour that does not align between research and practice is 'restating the child's utterance into a question format'. This was one of the least selected parent behaviours to assess in practice but was highlighted by DesJardin and Eisenberg (2007) as a higher level facilitation language technique and positively associated with deaf children's language skills. DesJardin and Eisenberg's paper has since been cited many times, with other established authors using their coding system to analyse PCI (Ambrose et al., 2014; Chen et al., 2019; Dirks & Rieffe, 2019). Based on our survey, professionals seem wary of parents asking or relaying questions, whereas research suggest this may be supportive in developing language.

## Methods

Our study uncovers the routine practice of UK professionals assessing PCI. Assessments were reported to take place mainly with mothers in the family home. Professionals mostly watched play-based interactions live and made mental or written notes, with only a fifth of professionals using video recordings. Professionals made sense of their observations through using their own skills, knowledge and expertise.

When compared with the Curtin et al. (2021) review, similarities and differences were found between researchers and practice-based professionals. For example, both researchers and professionals tend to assess mothers most. The importance of the mother–child bond has long been the focus of research and practice, but fathers are known to have positive impact on the deaf child's academic, language and social–emotional development too (Calderon & Low, 1998; Hintermair, 2006). Gender differences have been found between hearing parents use of spoken language with deaf children (Löfkvist et al., 2022), and there are also differences between hearing and deaf fathers in the amount of visual–tactile interaction strategies and wait-time they use to gain their child's attention (Loots & Devisé, 2003) and between the number of turns taken by deaf mothers and deaf fathers when interacting with their deaf children (Wille et al., 2019). As recommended by Szarkowski and Dirks (2021), future work should focus on both parents, the mother–father–child triad, or indeed other parent–parent–child dynamics.

We identified that over three quarters of professionals assess parents in free play with their deaf infants (free play was also an inclusion criterion for Curtin et al.'s, 2021, review). Play involves the integration of cognitive, social and emotional processes (Cohen, 2018). It has been called 'the child's work' by Montessori (2004), more than just fun, but the driving force behind the development of a child's ability to think, plan, sequence, develop motor pathways, take turns, share enjoyment, express emotion, communicate, imagine and pretend. It, therefore, seems apt that UK professionals focus on this concept within interaction. Play opportunities certainly exist in a wide range of cultures but vary in frequency, mode and partner (Roopnarine, 2010).

While researchers mainly preferred a more controllable context (i.e., clinics and labs), assessing PCI in homes only 26% of the time (Curtin et al., 2021), families in our survey were mostly assessed at home by professionals (72% of the time). Home is seen as an advantageous place in terms of the 'ecological validity' of the observation (Smith, 2010, p. 6), is more representative of real life, and remains key to providing family-centred care, as the families' toys and favourite interactive activities are in easy reach.

Another difference between practice-based professionals and researchers is in the methods used to analyse PCI. For example, the majority of researchers use video recordings and either detailed frame by frame coding, validated scales, or a mixture of coding and validated scales. Conversely, professionals mainly observe PCI live and make mental or written notes, with 88% relying on their own skills and knowledge to decipher the PCI. Video recording was used by less than a quarter of professionals. When observing play and play-based interactions, video recording is recommended by Smith (2010) as it does not lose any information, increases accuracy in interpretation, can be played over and over, moments can be observed that were not apparent at first viewing, videos can be freeze-framed, precise measurements can be made, and the practice is less intrusive for infants if cameras are inconspicuous. There is a risk that professionals are missing information or making errors in interpretation if they are not using video at least some of the time.

Lastly, the formal, validated assessments reported to be used by 14% of professionals (the ADOS, the Nottingham Auditory Milestones, the Rossetti Infant Toddler Language Scale, the Infant Monitor of Vocal Production, and Pre-school Language Scales) are not in fact designed for the assessment of PCI in deafness but mainly assess skills *within the child*. Most professionals who completed the survey were very experienced and in the absence of a deaf-specific, evidence-based tool, it could be considered that relying on one's skills, knowledge, qualifications and experience is a legitimate way to observe and analyse PCI. Many disciplines, including health, depend on expert judgement where time, resource and adequate data are limited (Burgman et al., 2011; Morgan & Henrion, 1990). However, for less experienced professionals, very little guidance exists on how to observe a parent's skills in interactions with their deaf child. Our survey found that less experienced professionals assessed PCI less regularly and felt significantly less confident in assessing parents' skills compared with those with more experience. The development of an assessment for PCI in deafness is likely to benefit all practitioners (with goal setting, measuring progress) but perhaps provide particular support to early career practitioners with which skills to look for.

## Goals

For most professionals, assessments of PCI lead to the development of family-orientated goals and these are targeted in subsequent visits. This conduct is aligned with Moeller et al.'s (2013) 'best principles' paper, where family-centred assessments are recommended within play and everyday routines to determine the need for change or enhancement to communication, and parents are encouraged to reflect on outcomes and evaluate successes (Moeller et al., 2013). Our findings suggest that many UK professionals are doing this, either jointly setting targets with parents or asking parents to choose a target themselves. Goals drive progress and change and help to steer the course of intervention. Goals that incorporate the parent as the expert and align with parental priorities and preferences as well as the acknowledgement of family routines have been found to lead to progress in a range of parent-implemented programmes with children with additional needs (Lucyshyn et al., 2002; Rodger et al., 2004). Our survey also highlighted that nearly a quarter of respondents only set goals 'sometimes'. This may be explained by two overlapping characteristics among individuals within this group: a smaller proportion of their work was spent with children with this age group and the lack of regular supervision from a more knowledgeable colleague.

## Limitations

The structure and topics in the quantitative survey were driven by a systematic review from Curtin et al.'s (2021) review of PCI assessments in research. Researchers often choose topics in order to test theory, not to support intervention in practice. Therefore, the closed question, tick-box style of the e-survey may have narrowed responses for practitioners. To address this, open text boxes were provided enabling participants to add further parent behaviours that were not drawn from research.

Professional bodies such as BATOD and RCSLT do not have detailed figures for the number of professionals working with deaf infants 0–3, therefore the representativeness and generalizability of these findings are unclear. It was also unfortunate that we were unable to recruit more psychologists, more NDCAMHS professionals, more male professionals, more deaf professionals, and more with under 3 years of work experience. With respect to deaf professionals, efforts were made to subtitle recruitment videos, create videos explicitly for BSL users, and share within professional deaf networks such as the UK Deaf QToD group. Providing professionals with a longer window to respond and more reminders to complete the survey may have increased participation. Similarly, UK-based higher education institutes that offered SLTs and QToD courses were asked to share the survey with their alumni to recruit recent graduates and early career professionals. Low numbers of early career professionals may be explained because few work with the 0–3 age group; the recruitment strategy was not robust enough; potential recruits were not confident enough to complete the survey, and/or were too busy with settling into their roles.

As is a risk for all questionnaires, participants may not have been completely truthful in reporting practices (aligning with social desirability bias). The anonymity of the survey will have assisted with this as well as the reassurance provided at the start of the survey that guidelines in PCI assessment in deafness do not currently exist, and wrong answers are therefore not possible.

# IMPLICATIONS FOR PRACTICE

Based on our survey of well-established experts working in the field of PCI with young deaf children aged 0–3, we recommend the following in future practice:

- Assessments of PCI incorporate a range of parent-based behaviours, including the 10 listed in Table 3.
- Despite survey findings, assessments of PCI should be video recorded where possible. Professionals could suggest using parents' own devices to record the PCI. Professionals and parents can then replay and reflect on the video together during the session and leave the recording with parents to share with other family members.
- Following assessment, parent-focused goals should be set in collaboration with families, ensuring parents'

skills, particularly their strengths, are considered. Mothers, fathers and other primary care givers are to be included in the process where possible.

- Reassessment should take place regularly (at least termly) to monitor and encourage families' progress. The timing of reviews should be discussed between parent and professional.

## FUTURE RESEARCH

Though this survey paper describes routine PCI assessment practice with deaf infants in the UK, it does not provide information on the professional reasoning behind the decisions they make. For instance, we do not know how a PCI assessment may change where the child has additional needs, where the child is implanted, or where the family use a language other than English. In addition, though we know professionals check in on parental well-being, we do not know how this is done and how a parent's well-being might influence the approach a professional takes for a PCI assessment. We explore these aspects of professional practice in a follow-up study using explanatory focus groups.

Further, the outcomes of our systematic review, this survey data and the follow-up focus groups will provide the basis for an international e-Delphi, where a range of expert skill, knowledge and experience will be consolidated towards the development of an assessment tool. The tool will be for experienced and novice professionals to use, with the aim of standardizing and formalizing the assessment, identification of targets, and monitoring of progress in parent–deaf child interaction.

## CONCLUSION

This study has demonstrated that experienced professionals in the UK report routinely assessing parent-focused behaviours when observing PCI. Many of the parent behaviours reported to be included in practitioner assessments have also been associated with, or found to be drivers of, improvements in deaf children's language development. Survey respondents also included 18 skills that were not initially suggested in our survey or uncovered by our preceding large-scale systematic review.

Professionals typically observe mothers, in the home environment, during play. Professionals typically use their own skills and experience to decipher observations made in the home, and rarely use video recordings or a deaf-specific, evidence-based framework to support either their PCI analysis or goal setting processes. As mentioned above, it is our aim to address these gaps in practice through the development of a new tool in PCI for deaf infants.

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

## DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

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## ENDNOTES

[1] QTODs are trained teachers with an additional 2-year master's-level qualification that covers topics in deaf education, communication and audiology. QToDs are also expected to have a basic level (minimum level 1, from the Council for the Advancement of Communication with Deaf People—CACDP) in British Sign Language (BSL). A QToD may refer a deaf child to an SLT automatically, or only if there is a concern about a child's communication development. This referral pathway varies across the UK as local trusts within the UK health service and education departments operate differently. The RCSLTs and the British Association of ToDs recommend approaches for working collaboratively (2019).

[2] SLTs gain either undergraduate or master's-level qualifications in speech, language and communication development and disorders. They then develop a specialism in deafness post-qualification through working in deaf settings and attending post-qualification courses in deafness. They must also receive regular supervision with a more knowledgeable clinician in deafness, in order to work through clinical cases and develop competency with the client group.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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# "It doesn't matter if we're the most amazing professionals in the world…" A qualitative study of professionals' perspectives on parent-child interaction assessment with deaf infants

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**Introduction:** Parent child interaction (PCI) is positively associated with deaf children's language development. However, there are no known, deaf-specific tools to observe how a parent interacts with their deaf child aged 0–3 years. Without a framework for professionals to use with families, it is unknown how professionals assess PCI, what they assess, why they assess, and how the assessment results relate to case management.

**Methods:** Eighteen hearing and deaf professionals, who work with deaf and hard of hearing infants aged 0–3 years and their families, attended online focus groups. The aim of the study was to gain insight into the professional assessment of PCI. Data were analyzed using thematic analysis.

**Findings:** Six themes were generated from the dataset. Professionals discussed how central parents were in the support offered to families in the home, the importance of knowing and understanding the individual family, and accounting for and supporting parental wellbeing. Descriptions on how to administer a best practice PCI assessment included which parent behaviors to assess and how to make adaptations for different populations. Professionals shared how the assessment and review process could be used to inform and upskill parents through video reflection and goal setting.

**Discussion:** This study provides insight into the mechanisms and motivations for professionals assessing the interactive behaviors of parents who have deaf children aged 0–3. Professionals acknowledged that family life is multi-faceted, and that support is most meaningful to families when professionals worked with these differences and incorporated them into assessment, goal setting, and intervention plans.

KEYWORDS

**parent-child interaction, deaf, assessment, professional practice, focus groups, infant, caregiver**

## Introduction

Deafness is a low incidence condition with estimated prevalence of 1 per 1000 live births (Morton and Nance, 2006). According to the most recent UK-wide summary from the Consortium for Research in Deaf Education (The Consortium for Research in Deaf Education [CRIDE], 2022), there are 52,798 deaf children and young people in the UK (aged 0–19 years). In this paper, we use the term 'deaf' to refer to all levels of deafness, from mild to profound. Although deafness is low incidence, it is a high need, long-term condition. Further, this population is highly diverse due to differences in levels of deafness, audiological equipment provision, age of fitting and levels of consistent use (hearing aids, implants, or none), language choices (monolingual spoken language users, multilingual spoken language users, sign language users, bimodal/bilingual language users), a high incidence of comorbid difficulties (40% according to Cejas et al., 2015), and other more universal differences such as maternal education, socio-economic status and levels of family involvement.

Most deaf children are born to hearing families (Mitchell and Karchmer, 2004) who have not yet developed effective skills in communicating with their deaf children. Reduced or disrupted input affects how a child develops language (Levine et al., 2016). Indeed, deaf and hard of hearing children's language is reported to be 1–1.5 standard deviations lower than hearing peers (expressive and receptive spoken language in Ching and Dillon, 2013; expressive spoken language vocabulary in Yoshinaga-Itano et al., 2017). A recent systematic review found that parents' linguistic input explained 31.7% of the variance in deaf children's expressive language (Holzinger et al., 2020). Parents of deaf children therefore need to be supported to adapt their communication style to attain successful interactions (Dirks and Rieffe, 2019). Early interventions that coach parents to use supportive interaction strategies help to improve deaf children's communication skills (Roberts, 2019; Nicastri et al., 2021). An important early step in providing targeted support and intervention is parent-child interaction (PCI) assessment. However, to date, a deaf-specific, validated tool of PCI does not exist.

A recent systematic review summarized 61 papers (Curtin et al., 2021) and identified which PCI behaviors are assessed in research with deaf children. These were: attention-getting, joint engagement, emotional availability, and responsivity of a parent and strategies for providing accessible and stimulating linguistic input. Most researchers focus on the mother-child dyad in PCI and these interactions are often filmed in labs, for 20 min on average. Researchers mostly used frame by frame analysis with coding systems. The review found that the length of joint engagement between parent and child, the level of parental sensitivity and the use of parental communication behaviors were significantly correlated with greater gains in deaf children's language. Whilst it is beneficial to consider how PCI is assessed in research, the highly rigorous methods used are time consuming and unlikely to have application in real-life clinical settings. Professional practice therefore needs consideration.

In the United Kingdom, the first professionals to support families of deaf children at home are Qualified Teachers of Deaf Children and Young People (QToDs) and Speech and Language Therapists (SLTs). Tools such as the Ski-Hi Language Development Scale (Watkins, 2004), the MacArthur Communicative Development Inventory (Fenson et al., 1993), the Visual Communication and Sign Language (VCSL) Checklist for Signing Children (Simms et al., 2013), and Success from the Start (National Deaf Children's Society, 2020) assist professionals with monitoring a deaf child's communication development. Similarly, the Tait video analysis method (Tait et al., 2007) focuses on the deaf child's eye gaze, and vocal and auditory pre-verbal skills, even though it is recommended to keep the adult's face/profile within the camera's shot. These tools observe and monitor one interactant and do not explicitly observe parents' *interaction skills* when they are communicating with their deaf child. There are no known, deaf-specific assessment tools for observing parent interaction, despite this being a known predictor for language development. The lack of a reliable, evidence-based assessment tool may mean that professionals are not in agreement on which parental behaviors are important to appraise in the home, do not have a shared technical language when discussing assessment findings, and/or do not offer standardized care. This lack of consensus can increase the chances of disparity between professionals on how to identify parent and child strengths, needs, and areas to address in intervention. In turn, this can impinge on the child's language development if therapy goals are not appropriate.

A survey of 190 UK-based professionals working with deaf 0–3-year-old children (Curtin et al., 2023) found that PCI was routinely assessed by the majority of professionals, and that there was substantial overlap between professional groups in which parent behaviors are assessed. Many professionals observed parent behaviors identified in Curtin et al. (2021). Survey participants (Curtin et al., 2023) reported an additional 18 novel parent behaviors they felt were missing from the survey, e.g., parent using appropriate voice volume, using a range of different word types, offering and labeling choices. Furthermore, professionals' methods of assessment were informal and predominantly consisted of observation and note making. The vast majority of professionals used their own skills and experience to analyze interactions rather than any adapting any existing tools from the hearing population. Goal setting is a regular part of parent-implemented and/or parent-focused intervention (Barnett et al., 2023) and many of the professionals in the survey reported deciding upon goals with parents. What was not clear from the survey was why professionals assess PCI, how they introduce the concept to families, and how they work with or include aspects of everyday life that might impact a family's interactions, such as a parents' wellbeing or a deaf-plus child (i.e., a deaf child with additional needs). Finally, the survey did not explore goal setting practices in depth, and how these might differ across families.

In practice, considerable expertise and knowledge are required to observe and make sense of PCI. Despite professional bodies recommending that PCI be monitored (Royal College of Speech and Language Therapists [RCSLT], 2019), there is little evidence or guidance of how to do this in practice. The current study is third in a series of five that aim to develop an evidence-based assessment tool for PCI with deaf children aged 0–3 years. Combined with the earlier professionals' survey (Curtin et al., 2023), this work seeks to gain insight into the motivations and mechanisms for the professional assessment of PCI (i.e., the why and the how). Specifically, it focuses on why PCI assessment is important, features of best practice, how to assess, what to assess, and how assessment relates to case management. Findings generated from the focus groups aim to enhance the knowledge and skills of professionals more widely.

## Research questions

1. Why is assessing parent behaviors in early PCI important, when the deaf infant is aged 0–3?
2. How do professionals conduct a best-practice PCI assessment when the infant is deaf aged 0–3?
3. Which parent behaviors are most important to assess?
4. How do PCI assessments influence professionals' practice?

## Materials and methods

This study formed part of a large, explanatory, sequential mixed-methods project lead by the first author. First, data were collected via an open quantitative survey of 190 UK-based professionals (Curtin et al., 2023). The analysis of the survey guided the planning of the follow-up qualitative focus groups. In this paper, we report the qualitative findings using reflective thematic analysis. The reporting guideline for qualitative research was used [i.e., COREQ from Tong et al. (2007)].

### Research team

The focus groups were conducted by the first author, a white, female, hearing, specialist SLT and clinical doctorate fellow with 12 years of experience with working with deaf children and their families, and the second author, a white, deaf, female, QToD and consultant in deaf education with 34 years of experience with working with deaf children and their families. The first author was the lead facilitator and the second supported the facilitation. Both attended training in conducting online focus groups from the Social Research Association in the UK.

Though the first and second authors were perhaps known to the professionals (working in the same field), no close personal relationships were established. This meant that professionals did not assume the authors knew anything of their work or their experiences. The importance of the moderators knowing the topic, the culture and traditions is essential (Litosseliti, 2007), nonetheless professionals were encouraged to be explicit with their reasoning, as though the moderators were new to the field, to avoid the researchers inferring meaning. Professionals were aware of the short-term aims of the research: to explore and explain findings in the e-survey, and the long-term aim: to develop an evidence-based clinical assessment tool.

### Recruitment

The following professionals with any level of experience in working with deaf 0 to 3-year-olds and their families were invited to fill in the e-survey: SLTs, QToDs, Auditory Verbal Therapists (AVTs),[1] Psychologists/Psychiatrists, and professionals working in Deaf Child and Adolescent Mental Health Services (DCAMHS). In the e-survey information sheet, participants were informed of the follow-up focus groups and invited, using a separate link, to register their interest in participating in the focus groups. Participants shared their contact details and some demographic information (profession, geographical location, hearing status, years of experience, gender, and ethnicity). The separate link ensured that e-survey responses remained anonymous. Forty-two professionals registered their interest in participating in the focus groups.

### Sampling

Sampling was initially intended to be informed by survey findings, however survey analysis found no differences in PCI assessment practices between professionals' roles, hearing status, languages used at work, or years of experience (Curtin et al., 2023). Therefore, registered professionals were purposively sampled based on the demographic identifiers listed above to ensure diversity, inclusion, and a range of perspectives. Twenty-three professionals were emailed an invitation to the focus group, and the information sheet and consent form.

### Sample size

Nineteen professionals originally agreed to participate, with one drop out. As focus groups were online and involved 14 hearing and four deaf professionals using their preferred languages, i.e., English or British Sign Language, the group size was slightly smaller than usual. Carlsen and Glenton (2011) found the average sample size is eight participants There were two groups of four professionals, and two groups of five.

### Professional demographics

Professionals from each of the four focus groups are shown in **Table 1**. Most professionals were white, hearing, female, and QTODs. Whilst there was a range of years of experience and geographical location, most professionals had over 20 years' experience and were working within the south of England. There were two SLTs practicing as AVTs.

### Setting

Due to the Coronavirus-19 pandemic, all four focus groups were conducted online via Zoom software. Professionals joined the meeting from work/home in a private room. Due to a range of hearing and deaf professionals attending these groups, there were between one and four non-participants in each meeting (technical

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[1] In the UK, AVTs were Teachers of the Deaf, Speech and Language Therapists and/or Audiologists before they qualified as Listening and Spoken Language Specialist Certified Auditory Verbal Therapists.

TABLE 1 Whole group characteristics (*n* = 18).

| | | |
|---|---|---|
| Sex | Female | 94% (17) |
| | Male | 6% (1) |
| Profession | QTOD | 55% (10) |
| | SLT | 39% (7) |
| | DCAMHS Professional | 6% (1) |
| Hearing Status | Hearing | 78% (14) |
| | Hard of Hearing / Deaf | 22% (4) |
| Years of Experience | 0–3 | 11% (2) |
| of 0–3 year olds | 4–10 | 28% (5) |
| | 11–15 | 17% (3) |
| | 16–20 | 11% (2) |
| | +20 | 33% (6) |
| Geographical Location | England South | 38% (7) |
| | England NE | 17% (3) |
| | England NW | 17% (3) |
| | Scotland | 11% (2) |
| | Wales | 11% (2) |
| | Northern Ireland | 6% (1) |
| Ethnicity | | |
| | East Asian | 6% (1) |
| | White African | 6% (1) |
| | White English/ Welsh/ Scottish/ Irish | 82% (15) |
| | White European | 6% (1) |

support, closed captioners, and qualified British Sign Language (BSL)/English interpreters).

## Topic guide development

This project is supported by a patient and public involvement (PPI) group of nine hearing parents of deaf children and eight hearing and deaf professionals, who collaborate with the first author as research partners and experts by experience. For the current study, the quantitative survey results (Curtin et al., 2023) were shared with the PPI group who co-created a topic guide (**Supplementary Appendix A**). The PPI group wanted to understand the motivations for assessing PCI, gain clarity on how professionals perceive the importance of the top ten skills identified in the survey (**Supplementary Appendix B**), and see if relationships existed across the parent behaviors. The PPI group raised the lack of an evidence base for families who use a home language other than English and families with children with additional needs. Questions were therefore created to probe best practices in relation to these two populations. Half of the professionals in Curtin et al. (2023) reported they regularly asked parents about their wellbeing. However, the PPI group experiences suggested this was not common and therefore it was pursued in the focus groups. Lastly, Curtin et al. (2023) reported that a quarter of professionals did not always set goals after PCI assessments, so the PPI group wanted to explore goal setting in more depth. Parents in the PPI group were particularly keen to hear what professionals do with assessment data as not all parents had experienced receiving feedback or goals following a PCI assessment.

## Data collection

Professionals were sent the topic guide a week before attending their focus group. Each focus group lasted 90 min. All focus groups were recorded and then transcribed. Field notes were made during the sessions by first and second authors, to clarify understanding and note non-verbal expressions (e.g., head nodding, clapping).

## Ethical considerations

Ethical approval was granted from City, University of London's School of Health and Psychological Sciences Research Ethics Committee (ETH2021-0335). Professionals were not asked high-risk or controversial questions and questions remained focused on PCI assessment practice. Professionals gave their consent for direct quotes to be used in publications with real names redacted to protect confidentiality. All attendees (including non-participants) committed to a promise of confidentiality. To acknowledge their commitment, professionals were sent a £25 'thank you' voucher.

## Data analysis

All responses (spoken English and interpreted BSL) were transcribed into written English by either a live closed captioner or automatic transcription (i.e., OtterAI). The first author listened to each recording and made corrections to ensure accuracy. For initial coding, software NVivo 12 was used by the first author.

A seven-phase approach to reflexive thematic analysis was used to analyze the data (Braun and Clarke, 2022). Transcribed data were listened to during accuracy corrections, read and re-read, and then features of the data set coded. The first author clustered codes together into initial themes and presented these themes in a series of 'case by code' matrices, i.e., each participant was a case, not each focus group. These matrices (along with the transcripts) were then shared with the authorship team for review and refinement. Many of the smaller themes were pooled to create richer exploration of overarching topics. Themes were defined and named, and illustrative quotes were decided upon before producing a final report and coding tree (see **Supplementary Appendix B**). Participants names were replaced by labels linked to their profession and hearing status, e.g., "hearing SLT 1," "deaf QToD 1." Codes and themes were independently verified to ensure reliability of results between the first, second, and last author.

## Reflexivity

We remind the reader this study aimed to provide further explanation to our quantitative survey results. The authorship team's thematic analysis therefore had an inductive, semantic, and experiential orientation to the data. This means that coding and themes were organically driven by data, stayed close to the participants' language, and had an essentialist approach, i.e., the analysis aimed to capture truth and reality from within the participants' contributions - 'a hermeneutics of empathy' (Braun and Clarke, 2022, p.160). That said, the authors had a critical realism ontology that postulates a reality that exists beyond the researcher's ideas, but also recognizes that the researcher is part of the world they are aiming to analyze, and that 'human practices always shape how we experience and know' (Braun and Clarke, 2022, p.168).

The first author and main contributor to data analysis acknowledges her own 'situatedness' as an insider researcher, a member of the group being studied. She is hearing, uses spoken English as her preferred language and is proficient in using British Sign Language (certified to level 6). She has much experience of working collaboratively with deaf QToDs and sign language instructors. She has also attended a foundation course in listening and spoken language (at Auditory Verbal UK). These experiences and courses mean that she values spoken and signed languages and for many children aged 0–3, recommends a bilingual / bimodal communicative approach for a multitude of cognitive, socio-emotional and language reasons. This perspective will have influenced interpretation of the findings below. In addition, the first author will have also been influenced by the aforementioned PPI group when the findings were shared with them. There was strong support for family-centered (not child-centered or mother-centered) assessment, with opportunities for sensitively given, direct feedback on PCI, provided at a pace that considered family readiness. Some of the PPI members' experiences were different to the findings in the paper; they reported both a lack of PCI assessment feedback and information sharing between professionals.

## Findings

Six themes were generated from the data and illustrated in **Figure 1**. A coding tree (**Supplementary Appendix C**) presents the journey toward each theme in relation to the research questions. Unless specifically stated, all professions shared similar views; due to manuscript length, this cannot be illustrated using dual or multiple quotes, therefore single profession quotes have been featured.

### Parents are key players in child language development

This theme speaks to how central parents are to a deaf child's language development and why parents are important to assess. As their child's most frequent and influential interlocutors, parents have the greatest impact on their child's developmental outcomes. Parental use of helpful communicative behaviors leads to successful language learning. Observing a positive attachment between caregiver and child and how this can support positive social and emotional development was also regularly discussed.

> 'So much research has shown the importance of parental involvement and how that leads to better outcomes for deaf children... That's why we observe parents in the home 0–3, because that's an important age and when they get most from the language input' – **deaf QTOD 2**

> 'When those important people use good interaction strategies around children then the outcomes are generally better' – **hearing SLT 1**

For many parents, interacting with a deaf child is a new experience and requires a shift in how they might typically engage with their child. Professionals therefore deemed it is necessary to assess (or observe) parents' skills to get a full picture of interaction at home, to 'know what you're working with' (hearing, AVT 1), to ensure that language learning is at optimal, and to know where or how to provide support.

> 'For me it's connected with language. A lot of why I am observing is to see how this parent is interacting: Are they using visual strategies? Are they getting their child's attention?... It's important that they are learning to interact in that new way, in a visual way with their child, so [the child] can learn that language and have access to language' – **hearing QTOD 1**

Efficiency in the use of professionals' limited time and resources was a key driver in why assessing parents' behaviors was considered important. Professionals described educating and upskilling parents as an 'investment' as they were potentially preventing further professional support later in the child's life.

> 'It doesn't matter if we are the most amazing professionals in the world, and even if we have the luxury of having quite high input. If we see a child once or twice a week for an hour, it's a drop in the ocean in that child's life... If we can promote and build on strategies for good parent child interaction, that is what is going to make the difference' – **hearing QTOD 2**

Assessing PCI had the added benefit of showcasing progress, both with the parent, but also with colleagues and line managers, where demonstrating accountability to had importance.

> 'I think it's also to qualify your time and the interventions, certainly in our area, they love a bit of data that shows progress and evidence of development' - **hearing TOD 3**

Two QToDs shared historical resistance from managers for centralizing parents in their work rather than working directly with the child during the early years. One said 'as far as they are concerned, we are teachers and we work with children' (hearing, QTOD 3). They had spent considerable amounts of their time highlighting the evidence and financial gains of working with parents to legitimize working in a family-centered way. By contrast, SLTs did not report having that same barrier; PCI was quite a common feature to assess for many communication conditions in the early years.

### Family first, then assessment

This theme represents four important factors that must be known, discussed, and established before embarking on a PCI assessment with a parent. These prerequisites were: culture and

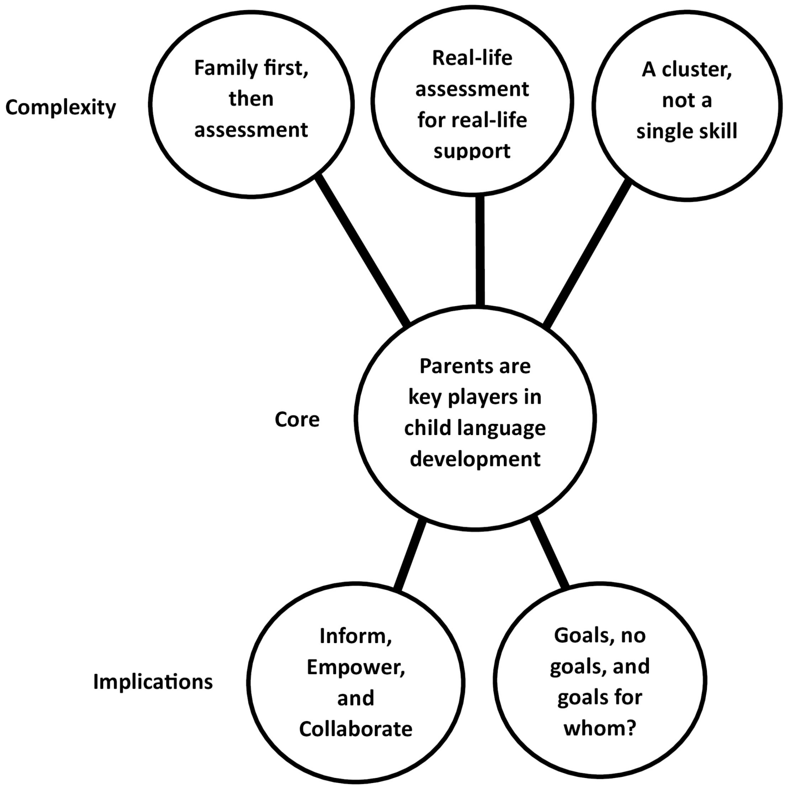

FIGURE 1
Key themes illustrated.

language of the home; general knowledge of child development and specific knowledge of each deaf child; parental wellbeing; and the parent-professional partnership.

## Culture and language

Knowing which languages were used between the family, and which languages (if different) were used with the deaf child was important information. Heterogeneity exists across families as interaction behaviors will be influenced by their culture and context.

> 'Eye contact and looking at people's faces is culturally dependent... I think it's important to acknowledge that you might need to change things because the child is deaf... but you need not assume something is wrong because you're not seeing it. Actually, the child could be behaving completely appropriately within the bounds of what they see in their family' - **hearing, SLT 3**

Working with interpreters and bilingual support workers was discussed, with a preference for the latter. Benefits included smooth communication between the professional and the family and increased skill in working effectively with a range of families due to the professionals' improved cultural competence.

> 'You don't know what everybody's culture is like, you can't have that basis of knowledge for every single culture. So I'm very much trying to work with my colleagues, bilingual support workers. Interpreters sometimes even can give you an idea but you might not base your clinical judgments on it' - **hearing SLT 3**

It was important that families used their home languages with their deaf child, so that parents felt comfortable, but also so that the deaf child was exposed to a rich, grammatically correct first language. Professionals acknowledged parental anxiety about doing this due to fears their deaf child would be unable to learn two spoken languages.

> 'We do encourage parents who have English as an additional language to use the home language because they [the child] will be able to learn other languages more easily... I have parents saying to us "we don't want to teach them our home language, we want them to learn English because that's what they'll be learning at school," and it's trying to kind of turn that on its head and say "well actually, it is important to learn your home language as well as English, if they learn the home language first, English will happen." But sometimes it's convincing the parents of that.' - **hearing QTOD 7**

A diverse case was encountered within these discussions where one professional shared great concern with the blanket approach that all deaf children from non-English speaking families should learn the spoken language of the home. This professional felt that success in one or two spoken languages was dependent on hearing level and that severe to profoundly deaf children could struggle with this. They stressed the importance of access to a visual language for deaf children, especially for severe-profoundly deaf hearing aid users, or for deaf children who do not use any audiological devices, and raised the risk of language delay if the above was not considered.

When assessing PCI with families who use spoken languages other than English in the home, professionals encouraged parents to use songs, books, games, and other customs from their languages and culture. During these PCI observations, professionals described 'stepping back' and observing more; they looked at how the parent was using the home language and how they were engaging with their deaf child. Observations could still be made of the parents' interaction skills and whether the child was responding with babble or imitations of the parent's facial expression, gesture, tone, rhythm, or speech sounds.

## Knowing the child

Knowing the ages and stages of child development and early communication enabled professionals to be more focused in their observations, e.g., noticing milestones as well as missing skills, or knowing the next step in development the child may be working toward. Learning about *each* child referred was discussed, i.e., their medical needs, emotional needs, additional diagnoses, level of deafness, use of technology, and whether any other professionals were involved.

> 'For the child to achieve their linguistic and educational milestones. . .we need to look at the whole picture, their wellbeing, not just solely at their deafness and seeing them as someone who can't hear. We need to think of them holistically' – **deaf DCAMHS professional 1**

For deaf-plus children, knowing about their use of technology allowed for a better understanding of the child's access to, or perception of, language and interaction.

> 'For those children [with complex needs] you need to get as clear audiological information as you can. . . audiology and fitting of hearing aids is often left later than it should be, or it's not pushed quite as well. . . For many of those children, that might be the sense that they are dependent upon' - **hearing QTOD 4**

One professional shared her experiences of working with a deaf, partially-sighted child and how dual sensory needs impacted on both attention getting and on maintaining joint engagement. Deeper knowledge of the child allowed for a more context-specific, family-focused assessment of the deaf child and their family.

PCI assessments including deaf-plus children tended to be more child-focused where the child's stage of development was sensitively considered using developmental trackers such as 'Success from the Start' (National Deaf Children's Society, 2020). Professionals observed the methods used by the child to signal communicative intent, as these might differ from a typical trajectory. Parent interaction behaviors assessed would be the same, but the rate and pace at which new skills were expected or encouraged would be set by the child.

> 'It's looking at the child rather than the parents' interaction. . . and I think that can come down to very, very small, fleeting moments. . . Being able to assess the interaction and pick up on those points, and then highlight those for parents to build on. . . It is more complex, it's about breaking those stages down into very, very small parts depending on the child's needs. . . I think it is about working through the same sort of stages, the same skills, but just at a different pace. . . at the child's pace' - **hearing SLT 5**

## Parental wellbeing

If concerns about acceptance, early bonding, or self-efficacy existed, professionals would prioritize support around these areas. A confirmation of childhood deafness can be difficult for parents and spark additional emotions such as guilt, of not being good enough, and of not feeling skilled in how to communicate. For some, how they were told about their child's deafness influenced acceptance, as it was negatively framed from the beginning.

> 'The very most important thing to talk about is the parents' feelings about their child. . . rather than the hearing aids or how they work. . . to make sure they've got that initial bonding and they're enjoying their experience with their baby. . .. I do experience a few tears within the first visits and I'm okay with that. I think it's a relief you know, parents sometimes need to express their emotions and bring out how they feel before they can move on' - **hearing QTOD 6**

Consideration of parent readiness, and of the parent's emotions should always be in the foreground and set the pace for any assessment and/or intervention plans. Providing unbiased information, that may need to be repeated, was important.

> 'Some parents want to understand what does the audiogram say? Do the hearing aids make a difference? Will they always be deaf? Or was it my fault? Or, you can also have where they don't want to know anything about the genetics or whatever, and they'll say 'We are happy to accept our child. We love him as he is'. . . You really have to read it, go at the family's pace. . . be in tune with them' - **hearing QTOD 4**

> 'I think we try and make sure that our families are happy to ask us the same questions again and again. . . So you're the gateway into this world, but I think we really have to be very careful not to be the gatekeeper into the world, we just need to make sure everybody has all the information' - **hearing SLT 5**

Ways to check-in on, and support parental wellbeing included informally observing the bond between the parent and child, asking direct open questions such as "How are you feeling about your child's audiology results?," being willing to stop and listen to a parent's struggles if they opened up or shared an experience, and being available to answer questions in-depth. Professionals acknowledged the need for boundaries and stressed the importance of supporting parental wellbeing within the capabilities of their role and skillset. Others felt a need to enhance their own skill development in having supportive conversations, and many mentioned the lack of counseling support services for parents of deaf children.

> 'It's not easy at all I don't think. . . because some parents keep it altogether, altogether on the outside but actually when you have left, they are not dealing with it. . . their mental health is suffering. It's always really difficult. . .' - **hearing, QTOD 5.**

Deaf professionals did not share many experiences of *explicitly* asking parents how they felt about their child's deafness, but instead three out of four noted that parents seemed to open up and ask them questions about their lived experiences as a deaf child and adult.

> 'When I go out to their homes, I feel like, in their environment, the parents are quite relaxed. . . I do find they like to off load. I don't know if it's because I am deaf myself, they feel they can confide in me. I talk about my own experiences, and they really like that'– **deaf QTOD 2**

Professionals recognized that within teams, parents may confide in some professionals and not others and so the sharing of information across teams was important and helpful. This was particularly noted by some SLTs in the group, who felt that QTODs may have better connections with families as they have known the family longer and have more contact time with them.

Providing parent-to-parent support was reported to be another helpful way of supporting parental wellbeing. This ranged from establishing formal parent groups to connecting parents with one another that shared the same culture, language, or case history. Not all parents were 'group people' and so professionals' sensitivity toward parents' personalities and preferences was required, i.e., a parent who may not be ready for a parent-to-parent meet immediately should be offered another invite later in the support journey.

> 'I think sharing experiences with each other is very helpful. I think parents like speaking to other parents rather than the professionals . . . speaking to another parent is much more relaxing. And you know, there's always other parents that have been through the same thing and I think they quite like that' - **hearing QTOD 7**

### Parent/professional relationship

Establishing a partnership based in support and trust and shared responsibility was important for two identified purposes. Firstly, by getting to know a parent and building a genuine, open and honest relationship, parents began to develop trust in professionals and this could lead to them sharing their worries and concerns. Secondly, a parent who felt safe, supported, and seen as an equal partner was more likely to receive the assessment and ongoing support well and build their own efficacy.

> 'Through talking to them, getting to know them and building their trust. . . the more you get to know a parent, the more you notice if they seem a little off, like they are struggling or stressed. . . But I think you have got to build that relationship with them so they are comfortable answering those [wellbeing focused] questions as well'- **hearing QTOD 1**

## Real-life assessments for real-life support

This theme describes professionals' reflections on working with families effectively, suggesting that a 'real-life' assessment of PCI enabled 'real-life' support that made sense for each family. Observing others, being in the home, observing daily routines, and using video were helpful in accurately capturing the child's real communication experiences. Joint-working was also discussed in this theme.

### Not just the mother and deaf child

Many professionals described very busy family homes where there were multiple children present with the parent. Professionals acknowledged the value of observing interaction between only the parent and the deaf child, but also highlighted how unlike real family life this was, as the parent would rarely have one child with them at one time. Instead, real-life dynamics and interactions should be observed at home, so that advice or support following the assessment was relevant, family-centered, and applicable to the family's situation. The value of observing fathers, other partners, and grandparents was also shared especially if they are one of the deaf child's regular communication partners.

> 'I am working with a family with two profoundly deaf twin babies. . . and a [hearing] sibling that is a little bit older. . . From my perspective, it would be 'how are the interactions'? Because that is what happens all day every day.' – **hearing QTOD 2**

### Home is most natural

Observing interaction in the home was incredibly valuable and yielded 'a gift of information' (*hearing QTOD 3*). Home provided the most 'normal circumstances' for the family to be observed in, representative of everyday life.

> 'The home environment is better; it's a very good environment to observe parents because that's where they are most of the time. And. . . for the children, it's their natural environment' – **deaf QTOD 2**

Whilst home was the most popular setting for a PCI assessment, many observations also happened at nurseries, clinics, and toddler groups. Each setting provided challenges and benefits with regards to the environment and therefore further insights into the family's PCI. Some QToDs queried the differences in assessment results generated by SLTs versus QToDs, as QToDs observed parental interaction primarily in homes and SLTs observed interactions primarily in clinical settings. Although, some SLTs had the flexibility to observe the deaf child in a range of settings.

## Looking at play, and daily routines too

Professionals valued the 'to and fro' opportunities between a parent and child that play provided, the range of parental skill that could be observed, as well as the fun, joy, and connection experienced by parent and child. Some professionals warned about arriving and then leaving with a box of toys for the assessment because appraising parents' interaction behaviors with unfamiliar items demanded even more improvisation and creativity.

Daily care routines such as nappy changing, dressing, mealtimes, bath times, were acknowledged as equally useful to observe. These activities happened with such frequency, particularly with infants aged 0–3, and so provided good opportunities for optimizing parents' everyday communication skills. When deciding which part of home life to assess, professionals take the parent's lead.

> 'Sometimes you have to be guided by the parents, because... one of the most important things is that parents feel comfortable and that they have their own sense of ability to do this' – **hearing SLT 5**

For a small number of families with deaf-plus infants, play could be seen as a luxury, particularly if there are multiple medical-based routines to get through in a day. As above, observations with these families might be context bound and family-led, to reduce any burden associated with setting up the assessment.

> 'A lot of the parent child interaction occurs around fulfilling those medical needs... I have got lots of these children... A wonderful parent said to me 'once I make sure I have kept him alive, there is not much time left for play'... For those parents, if you don't assess it [interaction] within that context, then you could put a lot of extra pressure on them.' – **hearing SLT 3**

Assessing parent-child interaction was informal. An unstructured, often incidental, observational approach was used either in the home or at parent groups, where the parent might not be aware they were being observed.

> 'Obviously we're working and we're professional, but at the same time, I'm keeping it in that sort of manner that feels informal and relaxed. I almost observe people without them realizing that are being observed because you naturally just see stuff and think 'that was brilliant" – **deaf QTOD 1**

## Video as a window to real life

Using video to capture a PCI assessment had many benefits: greater accuracy; easier to reflect with parents on the skills observed in play-back; opportunities to watch segments repeatedly; the ability to spot things they missed live; the possibility of leaving the parent and child alone so the interaction could be more natural; video provided a measure or baseline for progress; and lastly with permission, professionals could share clips with other members of the child's Multi-Disciplinary Team (MDT).

> 'The benefit was to be able to look back on it and pick it apart. I think it is invaluable, it's like having that second person there isn't it? When you can sit back and re watch it, you can look from a removed point of view a bit more' - **hearing QTOD 3**

Some professionals routinely filmed every session or visit, reporting that parents got used to being filmed and were not aware of the camera after a few sessions. Some services allowed parents to upload or send in their own videos for professionals to view. This flexible provision worked better for some families and children; these videos were often in alternative settings – at the park or at the shops, and at alternative times, e.g., mealtime. These videos offered a more effective or efficient way of capturing multiple aspects of family life and provided professionals with more opportunities to give parents advice and praise.

> 'I've had some really lovely clips sent to me, interaction clips that have been with grandparents, or with dad to visit his sister... clips without any tension. They're just what they would do themselves and keep on their phone or show to a friend' – **hearing QToD 4**

With focus groups held online because of Coronavirus-19, many professionals mentioned the pandemic and the benefits that video use/telehealth brought. For example, other MDT professionals (i.e., from NDCAMHS or cochlear implant centers) joined the call as 'silent observers' and then participated in discussions nearer the end of the session. Those who held a more dispersed national or regional caseload, found being able to remotely 'enter' a range of family homes in 1 day incredibly enlightening, providing 'closer to real life' (hearing AVT 2) observations than seen at their center or hospital setting. Lastly, remote sessions provided a reality check in terms of each individual family's set up. During the pandemic, parents were mostly seen at home with all other family members present, therefore a better depiction of weekend or evening life was presented. These 'real deal' observations led to a more real or aligned offering of support.

> 'It's been different over lockdown and COVID... I see one child with ANSD [Auditory Neuropathy Spectrum Disorder] that is in a home of 10 children. Seven live at home and it's only by looking online when we do the Zoom, that you realize how busy, particularly if they say "yes, I'll see you at six pm," and there's literally, people floating you know, pass the whole [uses sign to show people walking passed the camera, uses sign to show busyness] which you don't get when you go on a home visit because you tend to go to at 11 a.m. or 9 a.m. or whatever, and everybody's gone to school and it's definitely given me a totally different insight into what you can also realistically expect when you give advice, because sometimes I think we can be a little unrealistic' – **hearing QToD 4**

Whilst the consensus was that video was helpful, concerns around the acceptability, practicalities, and implications of video or remote working were raised. For example, some services do not have filming equipment or do not allow its use. Others felt there were legal or safeguarding issues with both the secure sending and receiving of child-based videos, as well as how and where to safely store the videos (both in terms of security and in the practical sense of storage/capacity of servers). Others noted the hindrances of travelling with cameras, tripods, and chargers, but also how arriving with, and setting up, this equipment roused the interest of other children and pets whilst family members were trying to focus. Others remarked that, during the pandemic, seeing family life through a static lens was limiting and they sometimes missed important moments off camera. Further, the pandemic created a barrier to accessing low-income families where the digital divide was most prevalent. Professionals also acknowledged the self-consciousness of some parents and how setting up a camera could be problematic as the activity seemed more formal and parents felt under pressure.

Professionals felt that including video use as part of the proposed assessment's protocol might help drive change for more resistant local authorities or trusts to allow more filming and encourage discussions about the transfer and storage of videos. Another recommendation to help alleviate these difficulties was to use the family's recording devices in the home.

> 'If they are up for it, use the parent's phone... I know that means, you then you can't go away and look at it and think about it, but it's certainly a way to look at it together. It means you're very much thinking on your feet but then you bypass the thing about storing video' – **hearing QTOD 2**

### Optimal PCI assessment requires joint working

Professionals spoke of effective and less effective joint working in relation to a range of contexts and disciplines. Many QToDs and SLTs discussed working jointly. This included attending child progress meetings, attending home visits to the family together, jointly running a parent group, attending hospital-based appointments with families or hospital-based professionals joining a home-based session. Many professionals acknowledged there was huge overlap in the areas of focus for SLTs and QToDs, i.e., parent wellbeing, audiology, language, and listening, therefore clearly outlining who was doing what was important for joint-working and for families. Key benefits of joint working highlighted by professionals were the opportunity to sound board and 'bounce ideas off one another' (deaf QToD 1), deepen clinical discussions, and develop better understanding around the child and family. The benefits of joint working for families included fewer appointments, fewer assessments, less of a burden for the family to repeat information, broader expertise involved with each child's care, and joined-up, holistic care.

> 'Some skills can be very fleeting. I've asked other colleagues to look at something and I'll say, "I think I've seen X," particularly profoundly deaf children with complex needs. And if somebody else can look at it, you know, with a different eye, a speech and language therapist, whoever you happen to work with, that's really helpful' – **hearing QToD 4**

Joint working between QTODs and SLTs was less successful when professionals had very stretched caseloads, when there was less deafness expertise, and when teams were geographically spread out. For example, language and communication was a common need for many children living in areas of greater poverty. This impacted QToDs' and SLTs' capacity for joint working and joint visits as both were stretched in terms of caseload capacity.

Hearing and deaf professionals regularly discussed the importance and value of working with deaf colleagues. Deaf professionals who were native signers shared a complete fluency of communication with the deaf children they worked with, and self-reported as having deaf identity at the center of their work. They helped to build rapport with the child, to identify the needs of the child and family, and to model successful ways of interacting. It was important that families had access to successful deaf adults both as role models for the deaf child, and in offering the family the possibility to envisage what their deaf child may achieve in the future. Families also learnt and appreciated the value of sign language as an alternative way to communicate.

> 'What is important is that the parents have access to both hearing and deaf people. Usually, parents gravitate toward hearing professionals and follow the advice that they get from them, sorry for the terminology, but the idea of 'curing deafness'... but actually what they need to learn is that language is what is the most important of all. It's about the child being able to express themselves... Deaf people have the lived experience. They have grown up deaf in this world and so **we** need to talk to them about the journey of language acquisition' **– deaf DCAMHS professional 1**

A lack of deaf professionals who work with deaf children could impact families and professionals' learning and development, and families' hopes for their child as they grow up.

> 'I think a weakness around the UK and generally, is that at these initial points of contact, these people are not deaf. And personally, I think that that's wrong. I think it is vitally important to have deaf professionals involved in this whole journey, so that a child and their family can see what kind of person they can grow up to be when they're older... it's so important to have role models, to have people being professional, particularly deaf people, because there aren't enough out there generally working at this level. I think that that should be a basic within services' - **deaf QToD 3**

## A cluster, not a single skill

This theme describes which parent behaviors professional prioritize in their PCI assessments. Professionals were presented with the top 10 parent behaviors most assessed by professionals during PCI assessments [**Supplementary Appendix B**: survey data from Curtin et al. (2023)]. Professionals agreed these parent behaviors were beneficial for the development of all languages, signed and spoken, and would therefore be relevant to assess within *any* parent-child dyad, providing the cultural diversity of the family was considered.

> 'I think it doesn't matter. You should have the same approach, the same method and same way of assessing regardless of language' – **deaf DCAMHS professional 1**

Whilst the behaviors were listed in order of how frequently they were assessed in practice, focus group discussions reflected that these do not necessarily mean they are in order of importance. Two viewpoints surfaced in relation to this. First, that parent behaviors needed to be assessed within a cluster in order to holistically capture the PCI, i.e., observed all at once.

> 'What I was thinking was 'Is there a hierarchy? Are any of those more important than the others?' When I went down the list, I was trying to think what if I had to put them in order which one would I do first and I really struggled with that, which made me think that most of those on there are of equal importance.' - **hearing SLT 3**

In contrast, others felt the list was more of a progression: earlier fundamental skills underpinned later, more sophisticated skills. For example, 'parent is genuinely interested and involved' (number six in the list) was viewed as a foundation behavior, a potential driver of change and, if not present, the first stumbling block in observing and/or supporting PCI.

> 'Without that involvement and interest and emotional availability, I think it's difficult to focus on any skill' – **hearing QTOD 5**

The parent waiting for the child to look before communicating (number one) was also raised as the first behavior professionals looked out for because in their view, if the parent was not practicing that, then not much else would be perceived by the child. Many parents may need this skill explained and modeled as they may be unfamiliar to this way of interacting and could easily forget that a child not looking might mean the child was not listening or receiving language.

> 'That's one of the first things that I look at, the parent to wait for the child to look. Besides I just know from my own experience, if someone talks to me without getting my attention, I would miss half of the information. I haven't got what they said, so I know the importance of eye contact. Parents do sometimes get frustrated because they're very young to maintain eye contact, children are so distracted, but it's important to start young and then hopefully it develops' – **deaf QTOD 2**

Professionals mentioned that the child's age and/or stage would alter the level of 'looking' a parent could or should expect, particularly for younger babies, or infants with additional needs, where head control or neurodiversity could have an impact on successful eye contact. They suggested that 'face watching is enough sometimes' (hearing SLT 5).

Another fundamental skill discussed was parental responsivity, a parent following their child's lead, being attentive to their child's needs and communicative intents and responding appropriately (number two). Professionals felt if this, often innate behavior was not observed, extra support for the parent would be required.

> 'Following the child's lead is one of the most important ones and goes hand in hand with joint attention. . . For me they are the core ones that have to be there from the beginning. . . A lot of the other things kind of follow on from that' – **hearing QToD 2**

Professionals shared their insights on parents who became good observers of their child, they would notice many or every child contribution to the interaction, particularly early initiations such as eye movements or legs tensing. A parent noticed these behaviors would naturally provide more contingent and effective language input.

Rather than a cluster or progression, a minority group shared an alternative view that the mode of language used by the parents, and the child's access to spoken language, would dictate where to begin with PCI. For example, if the child was nearly 3 years old, had been bilaterally implanted successfully at 1 year, and was developing age-appropriate spoken English, then face watching or eye contact would not be prioritized, but instead professionals would progress to joint attention on objects whilst listening. However, if a child of the same age was severely deaf, with or without hearing aids, then the parent waiting for the child to look would be the priority and starting point (if not already established).

Professionals identified parent behaviors missing from the top 10 list of most assessed skills. A popular skill raised by many professionals was the parent waiting or pausing to give the child time and space to make an initiation, take a turn, or join in with the play.

> 'Does the parent wait for a child to actually start some communication so they have a lead to follow? Rather than thinking it's the parent starting an interaction all of the time. Waiting is something that helps the parent become more responsive to their child' - **hearing SLT 2**

Six other skills identified by professionals as missing from the list included: joint attention; the parent engaging in balanced, communicative turn taking with their child; the parent using a range of different word types (nouns, adjectives, verbs) within their interactions; the parent labeling items and offering choices rather than simply giving items; the parent being in an appropriate position to the child; and the parent becoming less intrusive, less directive, and asking fewer questions. Professionals felt these last three skills needed to be explicitly stated as separate skills rather than falling under the category of 'responsiveness' or 'following the child's lead' as they currently appeared in the list.

Some professionals felt that educating parents on the concept of language was important, stating that it was important to notice, accept, and encourage any form of first language as this provided a building block to developing future skills in bilingualism, bi-modalism, and or multilingualism. Professionals shared how their services and professional groups were now more focused on the importance of language, communication, and the whole child, rather than sole-focus on listening, spoken language, and speech sound production. There was acknowledgement that this shift in attitude was not universal.

> 'All the ToDs and SLTs were pushing for oralism. But then the last 10 years, there's been a really good shift of attitude. Now we are all in agreement, we're all focused on language, not just speech, but language, whether it is BSL, or spoken language or bilingualism. We focus on that, and we are all on the same page here' – **deaf QTOD 2**

## Inform, empower, and collaborate

This theme links to the transformative process that between parent and professionals when reviewing the PCI assessment video. The importance of taking the time to share assessment data with parents was discussed. Parents then understood the purpose of the assessment, became informed, and began to share power and responsibility for their child's progress.

> 'Parents need to be informed. Otherwise, they just feel like they don't understand, thinking why is this person seeing me?' – **hearing AVT 2**

> 'It gives the parents a chance to see themselves, see for themselves' - **deaf TOD 3**

Highlighting positive parent behaviors (no matter how prominent initially) and the impact they have on the child's response or turn was regarded as an empowering activity for parents within the assessment review. It raised parents' awareness of the behaviors that were supporting their child's communicative development, and brought suggestion that parents could be the catalyst for change, especially when the importance of the skill was explored in-depth or supported with research.

> 'Just reiterating the importance of those [parent behaviors] can be the indicator of change that is needed in order to support the progress. . . just being conscious that they are doing it is quite key' **hearing SLT 1**

> 'You can pick out some lovely interactions and show evidence to the parent, and show them the difference that it made to their child. . . Video shows you so much that you don't see live in the moment' - **hearing SLT 3**

Gaining feedback from parents was also seen as an important part of the cycle, with many professionals suggesting that parents should lead discussions on their own communicative strengths as well as any improvements they would like to work toward.

> 'We are constantly monitoring, feeding back, getting feedback from the parents. . . that is a really important part of the process. It's a holistic process, involving the parents. . .. We would share all we have with parents, and parents are always aware of the purpose of the assessment . . .we take a very positive approach. We focus on the strengths' - **deaf DCAMHS professional 1**

Positive feedback empowered the parent to continue using the skills identified and discussed in the assessment review. Parents began to capitalize on their innate skills more consciously. It was felt this strengths-based approach was better than 'it might be helpful to try this new behavior' as this was disempowering for the parent and shifted the 'expertise' to the professional.

> 'It [watching back a videoed assessment] shows the parent that they can make progress with their child. You can show the family that they can make the difference. And that's what we want to do. We don't want to be showing that **we** can make the difference, we want to show that **they** can make a difference with their child's progress' - **hearing QTOD 6**

Professionals noted by regularly offering parents the opportunity to video and review their PCI, parental empowerment developed further. Parents became more at ease with seeing themselves in recordings, and became more skilled and observant in noticing their own behaviors and the impact they had.

> 'Just over time, with doing it [videoing interaction] regularly, it becomes much more natural and an ingrained part of early practice. More relaxed conversations of noticing the interactions occur, and it's a good way of noticing progress' - **hearing QTOD 6**

Some professionals felt that the review process (informing and empowering the parent) helped to build a trusting relationship between parent and professional. Deciding on next steps would then be done jointly with the parent taking the lead and the professional scaffolding the discussion. This approach ensured the parent embraced the work and increased their engagement and involvement.

> 'Being collaborative with parents with your goal setting. . .. Saying, 'we've seen this, this, and this today. . . which would you like to do more of?' Opening it to them. What do you think is achievable? Which one can you most readily apply into your daily routine?' – **hearing SLT 1**

One professional mentioned that whilst they might have a preferential target in mind for the parent following the review, a collaborative approach was more effective and therefore required 'being a bit more open minded, sitting back and taking the parent's lead' (hearing QToD 6).

## Goals, no goals, and goals for whom?

Explicitly collaborating with parents to decide on parent-focused goals was not a feature of every professional's practice. This range is explored within this theme. Firstly, most SLTs, both AVTs and the DCAMHS professional described having quite clear parent and child focused aims that were written up, decided upon with parents, shared across the support team, and regularly reviewed. Having goals for the parent would help facilitate change in their young deaf infants.

> 'It's looking at play with purpose. . . . Where do we need to get to? . . . Whether you're a teacher of deaf children or a speech and language therapist, you're there to help the family progress from one stage to the next. . . and explain the purpose of what you're going to be working on next. . . Now, whether it's a child with complex needs, and they need to have micro steps, but they need to be there' - **hearing AVT 2**

Others reported to take a more informal approach, where a goal was considered and noted down by the professional but perhaps not shared with the parent. There was a nuanced belief that perhaps goals were for deaf children, not for their parents.

> 'I develop goals, but not, you know, like we would in school. . . where you have an IEP (individualized educational plan) or a statement or whatever. For me it's something that I just know. I put in my notes "we are working on this." It's not something I am ticking off and assessing in a formal way' - **hearing QTOD 1**

> 'I think a lot of the language type targets are goals and they are written down "this is what we are working towards," but I can honestly say, I don't write down 'these are the targets for the parent in terms of the parent child interaction' and share that with the parent' - **hearing SLT 2**

Professionals explained why goal setting for parents can be problematic. One common reason discussed was in relation to families who had deaf-plus infants. These families can often have multiple objectives to work on, and professionals preferred to reduce parental burden and not add to it.

> 'I've found they often get a lot of targets and goals. Parents may very well decide that they want to focus on one particular area, it might be the physical needs at that particular time. . . I would actually ask them what they feel their priority is at the moment' – **hearing QToD 4**

Another reason provided was that goals could be overwhelming for a new parent who has many appointments to go to and many visits to host. Using the term 'goal' was debated also, with one professional suggesting less pressured phrases such as "how we can help."

> 'Rather than saying 'this is going to be the goal' (because we don't want to **not** achieve the goal either), we want to make sure that it's an achievable, fun thing to do with the child, and a natural thing to do in everyday routine. . . They just can feel overwhelmed, no other parents seem to have goals. You know, I don't want to make it any different from another parent bringing up a child. I want them to do their communication and language in the most natural way, routine way, throughout the day' – **hearing QToD 6**

Professionals felt it difficult, forced and unrealistic to set goals with or for families who were not as engaged or open to professionals' support. Another professional reported difficulty in creating goals with families who struggled to make decisions about their child's future language or educational setting.

> 'They wanted him to be oral, they wanted him to sign. They didn't kind of stick with anything and it was actually hard to create a goal for them because they didn't know what they wanted. And every time I tried to suggest something, it was kind of "no we don't want that," but they didn't have an idea of what they did want' – **hearing QTOD 7**

Some parents liked monitoring their child by using developmental journals such as 'Success from the Start' (National Deaf Children's Society, 2020). After mapping out their child's current stages of development, professionals would engage in informal discussion around the activities the parent could do with the child, but no parent-focused goals would be set. Conversely, some parents disliked developmental trackers as it highlighted skills not yet achieved by their child. Whilst all professionals seemed to be working toward progressing the deaf child and their parents, goal setting was a 'case by case thing, depending on where the parent was at, and what would work well for them' (hearing QToD 1).

## Discussion

This study aimed to explain why and how early interventionists working with deaf infants aged 0–3 assess parents' interaction skills as part of their practice. Hearing and deaf professionals attended focus groups, steered by a topic guide that was influenced by a large UK survey (Curtin et al., 2023) and co-produced by the authors and a patient and public involvement group.

This study set out to understand the importance of assessing parent behaviors. Professionals placed parents at the core of their rationales for assessment; they were well-versed in the evidence base, they acknowledged how central parents are for language development, how expert they are in understanding their own children, and how parent involvement should be a core focus of professional practice. Parents and primary caregivers are known to be important for language learning (Rowe, 2012); children must be exposed to language to learn it. Recent PCI research in hearing dyads reports that levels of language exposure and conversational turns between parent and child impact language processing over and above quantity of words (Romeo et al., 2018). Houston (2022) argues that the association between language input and language outcomes for deaf and hard of hearing children are more complex because of four differences: total language input; accessible language input; attended-to language input; and language co-ordinated with cognitive level. Houston recommends that early interventionists enhance parents' knowledge, self-efficacy, and skill so that each deaf child receives accessible, developmentally appropriate language in their family context. As such, it seems paramount that professionals assess parents' interaction skills to know where in the language input framework to begin providing support.

Informing, empowering, and collaborating with parents was the most important and powerful theme and implication generated from the data, and aligns with the recommendations made in the Family-Centered Early Intervention (FCEI) consensus paper by Moeller et al. (2013). In the present study, professionals said that by educating parents in the assessment process before it begins and then taking time to review the assessment together, an informed, empowered, and conscious parent developed. The parent was more aware of how their interactions could influence their child's language development. Parental self-efficacy (parents' beliefs about their ability to successfully perform in their parenting role) has been shown to lead to improved maternal language input (DesJardin, 2006; DesJardin and Eisenberg, 2007) and child language development (Niparko et al., 2010; Cruz et al., 2013). Further, in the current study professionals said that by both parent and professional focusing on the positives seen in assessment, parents experienced specific positive feedback on skills they already have. This aligns with Szarkowski and Brice's (2016) Positive Psychology Framework, where parents are encouraged to think of the positive, joyous experiences that come with parenting a deaf child. When they did, parents reported a transformative effect, whereby simply spending time in the joy of their child and the parenting process, parents felt positive, grateful, and experienced growth. Davenport et al. (2021) reported that parents need to feel they are competent and capable in their role as language models to fully enhance a deaf child's language growth. This current study suggests this shift can be gained through assessment, shared review, education, coaching, collaboration, and time with deaf professionals.

Another aim of the study was to understand how PCI assessments influence professionals' practice. Professionals said that reviewing the PCI assessment together fostered a balance of power and shared responsibility. This shared focus, shared analysis, and shared drive to make progress led to collaborative decision-making for goal setting and intervention planning. Whilst it was clear most professionals practiced this way, there was some divergence between the professionals in the focus groups. Interestingly, this was also seen within the survey data, where 76% of professionals *always* created goals and 24% *sometimes* did (Curtin et al., 2023). Professionals in our study showed sensitivity to not creating goals where parent readiness, acceptance and engagement was not achieved. In the wider, hearing literature on PCI, parents also report on their needs in terms of readiness (i.e., child and family preparedness, acceptance, and capacity to take part), with a view that their engagement is facilitated through a supportive parent-professional relationship (O'Toole et al., 2021). Prior to setting goals and considering intervening, it is recommended that professionals attune to parental wellbeing, and discuss parent's expectations and involvement (Levickis et al., 2020). Goal setting with parents is a prominent feature across many disciplines, e.g., physiotherapy and occupational therapy (Vroland-Nordstrand et al., 2018; Harniess et al., 2021) and their 'attainment' is often linked to motivation and engagement. In the current study, there were some queries around who goals should be for (i.e., children or parents). Goal-focused conversations are generally accepted as tools used for skill improvement and behavior change (Schenk et al., 2023) and are therefore essential in helping parents (the people within PCI with the greatest capacity to change) to adapt their behaviors in interaction.

Across four of the remaining five themes was the acknowledgement of great complexity when observing PCI within real-life, family life contexts. When investigating how a best-practice assessment of PCI might be conducted, professionals argued for 'true to life' assessments that acknowledged factors often unmentioned (or excluded) in research such as the influence of siblings, multiple caregivers, the home environment, parental wellbeing, deaf-plus children, and / or families who use languages other than English. Further, professionals advocated for PCI assessments of play *and* daily routines, in order to fully capture what happens in the home environment.

Professionals agreed it was impossible to select the single most important skill to assess in PCI and that it was similarly difficult to assess any one skill in isolation from others. They agreed that the top ten most-assessed parent skills generated from the survey (Curtin et al., 2023) were beneficial for all languages and all needs. Parental engagement and sensitivity were given particular mention across the focus groups, perhaps because of their well evidenced importance in PCI with deaf infants (Vohr et al., 2010; Ambrose, 2016). Face watching and eye contact were also picked out from the top ten list. Most SLTs and QToDs included these visual behaviors in their PCI assessments, as they regarded them important for learning sign and or spoken language. A small group of professionals in our study focused less on these. Professionals felt joint attention and balanced turn taking between parent and child were core behaviors missing from the top ten list. This also aligns with multiple studies that have shown the positive relationship between deaf children's language scores and time spent in co-ordinated (or mutual) joint engagement (Gale and Schick, 2008; Cejas et al., 2014; Dirks and Rieffe, 2019).

Because professionals were unable to select the most important parent behavior to assess, they used multi-simultaneous skill observation to analyze PCI. This is in stark contrast to the PCI research base on deaf infants, where mostly one or two features of parental interaction are under the microscope, the context is play, and participants are mostly monolingual, mother-child dyads, observed in labs (Curtin et al., 2021). Whilst this is the majority, there are notable papers that include father-child dyads (Loots and Devisé, 2003; Loots et al., 2005; Wille et al., 2019) and report on a range of language used between parent and child (Vohr et al., 2010). These findings suggest a need for ethnographic research conducted in the home environment, observing *families* (not just mothers and their deaf children) during a range of daily activities, throughout a day, or week, or perhaps longer. Research undertaken with hearing families [see the systematic review by Holme et al. (2022)] increasingly features researchers capturing interactions within daily routines, in homes, using video and audio-based recording equipment. There are some recent studies with deaf infants that seek to capture interactions throughout the whole day (Brock and Bass-Ringdahl, 2021) or during activities such as mealtimes (Smolen et al., 2021) but these embrace audio-only recording software (LENA belts) which therefore limits the perspective on PCI with deaf infants.

For deaf-plus children, another layer of complexity was reflected. Professionals reported a slightly adapted approach where the professional needed to know the child's additional condition(s) and how their development, in association with their deafness, might be impacted. Professionals felt that these families needed to have a more child-focused assessment where parent and professional looked at the child's communicative intent first, rather than the parent's behavior. This shift in assessment focus aligns with research from Turner Dougherty and Day (2022), who also suggest that families with deaf-plus children require an independent lens for assessment and intervention. Professionals in the current study also felt that assessment and support needed to follow the same trajectory as typically developing deaf children, maintaining high expectations, but at a slower pace. Lastly, the goal-setting stage needed strong collaboration with parents as a communication focus may be lower on their priority list, when compared to nutrition or physical needs. Parents of deaf-plus infants can feel less confident in their parenting skills due to the complexity of their child's needs and can also feel as though they have less involvement in their child's daily activities, perhaps due to the high number of services planning and participating in their child's schedule (Turner Dougherty and Day, 2022). The 'inform, empower and collaborate' findings are even more essential with this group, ensuring that parents feel confident, involved, and in control of making informed decisions about their communication behaviors and goals. 'Complex Needs, Complex Challenges' (McCracken and Pettitt, 2011) reported the lived experience of 50 parents of deaf-plus infants and made a series of recommendations for professionals on assessment: provide rigorous and timely assessments; ensure parents are made aware of the purpose and findings; actively include parents in the assessment process as they can help build a picture of needs; value the importance of parental expertise; offer a flexible approach in terms of re-assessment and location; provide effective, coordinated care between all multi-agency teams – sharing information between services as well as parents; and discussions about approach should follow assessment. Many of these recommendations aligned with our professionals' contributions on best practice with this population (and with deaf children more generally).

A final layer of complexity mentioned by professionals was supporting families with deaf infants who do not use English at home. The need for culturally competent and responsive services is necessary in deafness, where respect to each family's cultural and linguistic diversity is given (Yoshinaga-Itano, 2014). Successful ways of working within multilingualism included finding out about the languages used and the culture of the home, involving bilingual co-workers and interpreters in sessions, encouraging the home language be used with the child, and encouraging songs, books, and games from the family's culture to be used during PCI assessments in the home. During PCI assessment, some professionals reported a 'stepped-back' approach. This meant professionals were looking more to the visual parent behaviors within engagement and parental sensitivity (face watching, joint attention, warmth, genuine interest) and then relied on colleagues for language content and cultural brokering. Research into the language outcomes of deaf multilinguals is scarce. A review of 22 studies on this population (Crowe, 2018) produced diverse results due to the range of ages, languages and domains of speech and language development assessed. Studies found deaf multilingual learners had better outcomes (in speech perception, Sininger et al., 2010), similar outcomes (in speech production, Bunta et al., 2016) or worse outcomes (in vocabulary skills, Deriaz et al., 2014) than their comparison groups. With such a limited evidence base and variable outcomes, it is not surprising that, within our study, some tension existed in the advice that professionals give parents, but mostly professionals felt it was important to promote multilingualism.

A way of successfully negotiating these layers of complexity was multi-professional joint working. Professionals were able to list many benefits of joint-working such as being able to sound-board off one another, being able to build a more holistic view of the family and child, building a better suited package of care for families, and reducing the burden on families to repeat assessments and/or repeat information. Holzinger et al. (2022) recommend regular multi-professional assessment and monitoring as a way of ensuring that each early interventionist is offering support that is effective in strengthening the functioning of the family, supporting wellbeing, and building capacity in parent-child interaction strategies. In our data set, many hearing and deaf professionals were able to identify the merits of working with and learning from deaf QToDs, Deaf Language Specialists (Hoskin et al., 2023), and/or deaf CAMHS professionals. Deaf professionals have lived experience, a unique way of perceiving, making sense of, and supporting complexity too. Known benefits for involving a range of deaf adults within family-centered early intervention include reductions in parental stress and increased confidence (Hintermair, 2000), the opportunity for parents to envisage success for their children (Rogers and Young, 2011), parents learning a range of visual strategies to assist with language learning (Humphries et al., 2012), and deaf adults being role models for families and deaf children (Cawthon et al., 2016; Gale, 2021). Our data suggests another benefit; parents seem to have a willingness to open up, 'offload' and confide in deaf professionals, without prompt questions around their wellbeing.

A resource regularly mentioned by professionals to aid with accurately capturing busy, multi-layered, family-child interactions was the use of video. Video, as many professionals shared, offered a chance to capture complexity and shine a light on real life. It also provided the opportunity to freeze-frame multifaceted moments and reflect upon them with parents, accounting for multiple behaviors simultaneously. Playback of short video segments or 'thin slices' of interaction to represent a parent and child's natural pattern of interaction is a well-used, well-evidenced methodology, especially within Video Interaction Guidance Therapy (Landor et al., 2011). Video recordings provide an opportunity for 'micro-analysis' (Trevarthen, 1980) and partnership working with parents (Cummins, 2021). Its use for outcome measurement in parent-implemented interventions is well documented in research with hearing (O'Hara et al., 2019) and deaf populations (James et al., 2012; Lam-Cassettari et al., 2015; Ambrose et al., 2023). Video feedback is often recommended as a tool to use in family-centred early intervention with deaf infants (Mood et al., 2020) and from our data set, it would seem that this is because video allowed a parent to 'see' and seeing led to understanding which then led to empowerment and behavior change. Whilst most of our study's professionals were aware of the benefits of video use, it was clear that not all services use it. Each of the APEASE criteria has relevance here (Michie et al., 2014): Affordability (not all services could afford the equipment and/or resources to record and store video data); Practicability (transporting and setting up the devices brought challenges, and static cameras during telehealth appointments limited access); Effectiveness (queries were raised around representativeness, i.e., parental behavior changed once being videoed); Acceptability (parents, professionals and/or managers avoided or rejected video use, deeming it not useful or important); Side-Effects and Safety (issues around the sharing and storage of videos of young children); and Equity (a mention of the digital divide during the Coronavirus-19 pandemic).

## Limitations

The professionals recruited were self-selected volunteers, and likely passionate about PCI and early years work, therefore a level of bias may be present in our findings. Secondly, focus group data are reported practice, not ethnographic, observational research (which would provide purer insights into practice), so what professionals say they do, may not completely represent actual practice. Thirdly, an attempt was made by the authors to purposively sample professionals on protected characteristics, there was, however, an underrepresentation of male professionals and those from ethnic minority groups.

## Implications

For professionals working with families of deaf children and for educators providing their training, our findings suggest four points to consider when assessing PCI. Firstly, be family-centred in approach, ensure that time is taken to get to know the family context, the child, and check in on parental wellbeing at the beginning of care. Embrace the busyness of family life, of cultural diversity, of daily routines, and of siblings. Secondly, invest time in developing a positive, supportive, non-judgmental relationship with parents. Thirdly, inform and empower parents through the use of video, consider its merits for capturing all the finite details, and providing a source of reflection for parents on playback. Lastly, PCI assessment should lead to jointly discussed and agreed plans for progress. For researchers in the field of deafness, there is a clear need to observe and analyze complexity: encompass activities of daily living beyond the luxuries of play and book reading, include multilingual deaf learners, include deaf-plus infants, observe multiple parent behaviors in homes, and use and analyze video recordings.

## Conclusion

This qualitative study provides insight into the mechanisms and motivations for professionals assessing the interactive behaviors of parents who have deaf children aged 0–3. Professionals considered the parents' role as core for deaf children's language acquisition and a worthy investment of time. Professionals used assessment to understand where to start with a family and to show progress. Before undergoing PCI assessments, professionals recommended providing holistic care where time was taken to understand the family context and support parental wellbeing. Reviewing video-recorded PCI assessments with parents was highlighted as a transformative way to inform, empower, and collaborate with them. Professionals acknowledged that family life is multi-faceted, but support is most meaningful to families when professionals worked with these differences and incorporated them into assessment, goal setting, and intervention plans.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by the City, University of London's Language and Communication Science Proportionate Review Committee (ETH2021-0335). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

MCu: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, Writing—original draft, Writing—review and editing. TW: Data curation, Investigation, Validation, Writing—review and editing. RH: Conceptualization, Methodology, Supervision, Validation, Writing—review and editing. GM: Supervision, Writing—review and editing. MCr: Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing—review and editing, Project administration.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

## Author disclaimer

The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR, NHS or the UK Department of Health and Social Care.

## Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2024.1315220/full#supplementary-material

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PLOS ONE

RESEARCH ARTICLE

# Assessing parent-child interaction with deaf and hard of hearing infants aged 0–3 years: An international multi-professional e-Delphi

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## Abstract

### Introduction

Most deaf babies are born to hearing families who do not yet have the skills to communicate effectively with their child. Adaptations to communication are important because the quality of parent-child interaction (PCI) predicts how a deaf child develops language. Teachers of Deaf children and Speech and Language Therapists support families with communication in the home. Currently, there are no assessments that appraise how a parent interacts with their deaf baby. Previous research has identified which parent behaviours and approaches are used in PCI assessments in research and practice. The current paper forms consensus on the core content and best practices of a new PCI tool for deaf children aged 0–3 years.

### Methods

An international sample of expert academics and practitioners (n = 83) were recruited to take part in a two-round modified electronic Delphi study. Participants were presented with 69 statements focusing on (i) which parent behaviours were important in assessment (ii) the methods to be used in PCI assessment. Participants rated the extent to which they agreed or disagreed with each statement on a five-point Likert scale and gave comments to support their response. Consensus was defined as ≥80% of participants rating the statement as a (4) 'highly important' or a (5) 'essential'. If consensus was not reached, participant comments were used to generate new statements which were rated in the second round. This project involved a patient and public involvement (PPI) group of hearing and deaf parents and professionals to design and guide the study.

### Results

Consensus was achieved on 52 statements and ranged from 80–99%. A further six statements were additionally included. Within the 58 statements included, 36 were parent behaviours which centred on the parent's observation of, and response to, their child's behaviour and/or language. The remaining 22 statements focused on methods used in the assessment

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such as parents having their PCI filmed, parents having the opportunity to review the video and assess themselves alongside a professional, and parents being involved in subsequent goal setting.

## Conclusions

This e-Delphi presented the parent behaviours and methods of assessment to be included in a new PCI tool for deaf children. Future co-production work and acceptability and feasibility testing are discussed.

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## Introduction

Deaf children are most often born to hearing families [1] who have not yet experienced deafness and therefore require support with adapting their communication skills [2]. In the current study, 'parent' refers to the mother, father, or any primary caregiver and 'deaf' refers to all deaf and hard of hearing children, identified with a mild, moderate, severe, and/or profound level of deafness.

The quality of parent-child interaction (PCI) predicts deaf children´s language development [3,4]. A recent systematic review reported that the quality of parents' linguistic input explained 31% of the variance in deaf children's spoken language scores [5]. In many studies, deaf children's spoken language development is 1–1.5 standard deviations lower than hearing peers [6]. Children with severe and profound degrees of deafness are the most delayed [7]. Much research suggests that communication is one of the major sources of stress when parenting a deaf child [8,9]. There is an internationally accepted guideline of working with families of deaf babies, known as '1-3-6 model' where hearing screening occurs before the infant is 1 month old, a deafness diagnosis is complete by 3 months, and intervention is provided by 6 months [10]. Professionals (such as Teachers of Deaf children (ToDs), Speech and Language Therapists (SLTs), and Psychologists) maximise on this early start by offering family-centred support, education, and coaching. Professionals might suggest adaptations to a parent's communication approach that includes greater focus on gaining the attention of the deaf infant, or on maintaining the joint attention between parent and child [11]. A parent may need support with ensuring their interactions are accessible and perceivable by the child; this might include the introduction of a signed language. There is evidence that by providing parents with the knowledge, skills and practice they need to enhance their communicative behaviours, positive changes in deaf children's communication are observed [11,12].

Guidance for professionals working within early intervention programs for deaf children recommends the provision of tailored, individualised support to families [13]. An important first step to being able to offer this support is comprehensive assessment. Whilst there are assessments to track the deaf child's communication skills, an assessment tool to appraise a parent's strengths and needs in communicating with their deaf child does not yet exist. A recent systematic review of 61 international studies [14] identified which parent behaviours and assessment methods are most frequently used by researchers of PCI with deaf children aged 0–3 years. The parent skills identified were attention getting, joint engagement, parental sensitivity, and facilitation techniques that either enriched the deaf child's language or ensured good access to the parent's language input (ibid). In addition, the systemic review reported that many of these parent behaviours were associated with positive child language outcomes. Researchers tended to film mothers (rather than fathers), in labs for an average of 19 minutes.

These videos were analysed frame by frame, with in-depth and time-consuming coding systems. Some of the studies used scales for measuring PCI instead of, or in addition to, coding. It is important to know the evidence-based parent behaviours positively associated with deaf children's language development, however it is not straightforward to use these methods in clinical practice.

A recent survey of 190 UK-based professionals working with deaf infants aged 0–3 years [15] reported that PCI assessments overlapped with parent skills highlighted in the aforementioned systematic review [14]. In addition, a further 18 practice-based parent behaviours not reported in the systematic review were identified. In contrast to researchers, however, professionals often observed PCI live and made mental or paper-based notes, using their own knowledge and skills to analyse the interactions. Most professionals also stated that their assessments always or often led to collaborative goal planning with parents. In a sequential, focus group study, professionals shared how complex and multi-faceted assessing PCI in families' homes can be [16]. Without any published guidance on how to conduct PCI assessments, it is difficult for professionals to know which parent behaviours are core, which to prioritise within their PCI observations, and which assessment approaches are best particularly when working within busy, complex family systems. Additionally, professionals do not have a formal way of showcasing progress to parents (or managers) through re-assessment. Therefore, an e-Delphi consensus study was designed to refine and gain expert international consensus on perceived best practice for an assessment of PCI where the child is deaf and aged 0–3 years. The objectives were to: 1) reach consensus on which parent behaviours to include in a new assessment and 2) develop best practice recommendations on how to approach assessing these behaviours.

The Delphi technique is an anonymous, iterative, and multistage method to synthesise expert opinion into a group consensus. It is carried out using questionnaires and feedback over a series of rounds [17]. The anonymity of participants aims to avoid a small number of experts dominating the discussion or the peer pressure to conform, and instead means full participation from all participants involved [18]. Delphi studies are used in health sciences to identify priorities [19], in policy making and developing practice guidelines [20], and where 'best practice' agreement is desired [21]. The current e-Delphi builds on previous research by the same authors [14–16].

## Methods

Ethical approval was granted from City, University of London's School of Health & Psychological Sciences Research Ethics Committee (ETH2122-0790). The reporting guideline for Delphi studies [22] has been used.

### E-Delphi study design and modifications

This study employed a modified, two-round, electronic, international Delphi methodology to investigate the aims outlined previously. Delphi studies traditionally utilise two to three rounds of controlled feedback [23]. Typically, the first round is used to generate ideas, opinions, and issues via literature searching and open-ended questions. Previous work [14–16] meant the aggregation of ideas in a 'classic' round 1 Delphi was obsolete. Additionally, whilst some Delphi studies use face to face and/or online meetings, an online survey format was used to facilitate optimum access to international experts.

### Statement generation and number of statements

Previous work [14–16] produced a set of parent behaviours and assessment approaches which were converted into statements. A parent involvement group (see PPI section below) also generated four statements that were relevant and meaningful to them. Final statements were reviewed and agreed by the remaining members of the authorship team.

## Pilot testing

The e-Delphi was trialled on four professionals (a QToD, an SLT, and two academics) working in the field of deafness. The piloting process was helpful in considering the usability and technical functioning of the e-Delphi. For example, following the pilot, a 'back' button was introduced to allow ratings to be changed. In addition, it was noted that once a sliding scale had been clicked on, the cursor was automatically set on 'not essential' unless moved by the participant. This had two potential consequences: it may have been difficult for participants to see they had missed a statement, and also, an incorrect rating may have been submitted. To avoid this, the original sliding scale was removed and replaced with a multiple-choice layout with the following five options: no importance (1), low importance (2), important, but not essential (3), high importance (4), and essential (5). Pilot testing also assisted with amendments to wording and ensured the terminology was appropriate for both practitioners and academics, e.g., the statement 'Parent is genuinely interested and involved' was improved by adding the sentence 'In research this is called availability'. Likewise, examples were given for statements, e.g., for 'Parent using auditory attention-getting strategies' the following example was added for clarity: 'e.g., using the child's name'.

## Definition of an expert

The use of experts in Delphi panels are fundamental to reliability [24]. Experts ensure the outcomes of an e-Delphi have content, face, and concurrent validity [25,26]. In the current study, included experts were defined as:

- An academic who has a paper included in the review related to the assessment of parent-child interaction with deaf children 0–3 years [14] or an author on the best practice principles for family-centered early intervention paper [13] and/or
- A qualified professional who self-reported to have 10 years (or more) of experience working with deaf children. This included SLTs, ToDs, Psychologists, Psychiatrists, Mental Health Practitioners (in the UK these were based at National Deaf Child and Adolescent Mental Health Services - NDCAMHS).

Turoff and Linstone [27] recommend including between 10 and 50 experts in a Delphi study. This is similar to a recent overview (review of systematic reviews) of e-Delphis [23], where the median number was 40 (but ranged from 3 to 731). Keeney, Hasson, and McKenna [28] argue that the expert sample size is dependent on the area of focus, the complexity of the problem, the heterogeneity of the sample and availability of resources. The current study included 102 experts from within the field of early years deafness and parent-child interaction as a larger, international sample helps with generalisability.

## Recruitment and inclusion criteria

Each academic participant was sent an invitation to register via email. Professional participants were recruited by three different approaches: 1) The registration link for the e-Delphi was promoted within a range of UK professional networks and clinical excellence groups; 2) Emails were sent to professionals who had participated in the UK survey [15] who had registered their interest and fit the eligibility criteria, and 3) Academics were asked to forward information about the study to any eligible practitioners within their city or country.

## Consent and registration process

To take part in the e-Delphi, participants needed to click on a registration link embedded in their invitation email. On the link's first page, a downloadable information sheet explained the study's purpose, the name and contact details of the investigator, the approximated completion time of each survey round, and information on data storage. On the second page, participants gave their consent to participate by ticking a series of tick box questions, including consent for their answers to be used in an anonymized and aggregated manner to derive consensus statements. On the third page, participants gave their name, email address, professional background, hearing status, the city and country where they were based, and the number of years of experience they had within the field. This information was only available to the first author to enable round-to-round survey monitoring. Participants were invited to register from 21st March until the 11th May 2022. Participation was voluntary, and no incentives were offered.

## Response and participation rates

Qualtrics identified each participant as a unique visitor through their IP address. There were 102 unique visitors to the information and registration page. One hundred and two (102) people agreed to participate by clicking the consent boxes. Ninety-five (95) participants continued to the registration form to leave their demographic information. Each registrant was sent their own individualised link to begin the e-Delphi. Out of the 95 participants who had registered, 83 completed round 1.

Qualtrics was used for both e-Delphi rounds. E-Delphi round 1 was open from 20th April–13th May 2022 (23 days) and e-Delphi round 2 was open from 6th June to 30th June 2022 (24 days). For each round, participants were given two prompts and a final reminder to encourage completion. Failure to respond was considered participant attrition.

## Procedure

For both e-Delphi rounds, participants were asked to consider the content and format of a new PCI assessment for deaf 0–3 year olds and their caregivers and rate each statement using a 5-point scale of no importance (1), low importance (2), important, but not essential (3), high importance (4), and essential (5). For all items in both rounds, the rating of each statement was mandatory. Participants were able to change their answers using a 'back' button. An optional open-text box was provided per item for participants wishing to explain their rating.

## Consensus

A-priori criteria were established using an adapted GRADE system [29]. The GRADE system uses clear cut and transparent rules for rating using concrete categories such as 'high', 'moderate' and 'low'. Eighty percent (80%) of e-Delphi respondents needed to rate a statement as a 4 ('high importance') or 5 ('essential') for consensus to be achieved and for the statement to be added to the proposed assessment tool. Likewise, 80% of participants needed to rate a statement as a 1 ('no importance') or 2 ('low importance') for it to be eliminated from the next round. Statements achieving consensus also needed an IQR of $<1$.

## Round 1

In round 1 of the e-Delphi, there were a total of 69 statements for participants to rate across two sections. First, there were 40 parent behaviours (PBs) to rate across five categories: attention getting (number of statements = 5); joint engagement (n = 4); parental sensitivity (n = 8); increasing access to language (n = 4); and language enrichment (n = 19). Each category was presented on a new page of the survey and each item within that category was presented in a random order to reduce order bias (the influence of the previous statement on the response to subsequent statements). After rating the 40 parent behaviours, participants were asked to list any missing parent behaviours in an open text box. In the second section of round 1, there were 29 statements related to the approach professionals should take to assess parents (abbreviated to AAs, i.e., 'assessment approach'). These were not presented to participants randomly, as the authorship team felt that a logical progression through the assessment process made more sense. Statements pertained to setting up the assessment (n = 3), how to measure skills (n = 4), informing the parent (n = 4), empowering the parent (n = 4), collaborating with the parent (n = 3), goal setting (n = 4), multi-professional joint working (n = 2), cultural competency (n = 1), and working with deaf-plus infants (n = 1).

## Feedback, review and round 2

Following round 1, participants received a report that summarised the 28 statements that had achieved consensus and the 41 statements that had not, showing the quantitative, group response per item. The report explained the reduction of items in the second e-Delphi round, i.e., the 28 statements that were not going to be presented in round 2 because participants had agreed they were essential and of highest importance, and therefore would form part of the proposed assessment tool. There were no eliminated or discarded statements, i.e., where 80% of participants rated a statement as a 1 ('no importance') or 2 ('low importance').

Statements that did not achieve high or low consensus in round 1 were then reviewed, with their wording scrutinised carefully to ensure that ambiguity was not a possible reason for items not reaching consensus (see data analysis and PPI sections below). Modifications to statements were made and re-presented for rating in round 2, as seen in other studies [22,30,31]. As before, optional open text boxes were offered for participants to justify answers. Fig 1 presents a flow chart illustrating the stages and outcomes of the Delphi process.

## Data analysis

There is limited guidance on the methods to analyse and present data within e-Delphi studies. For both round 1 and 2, we decided upon percentage agreement, medians, and interquartile ranges (IQR) as these descriptives are best suited for non-parametric data.

Awareness of divergence (i.e. IQR>1) and participants' qualitative feedback from round 1 was important for rewording the statements that lacked consensus for use in the subsequent survey round. For each of these statements, key words and recurring themes were highlighted and best attempts to use participants' own words for the restructuring of the statements were implemented. This work was led by the first author, but all qualitative feedback was reviewed by the authorship team and the PPI group, and new statements agreed upon in meetings.

Following round 2, the stability of statements not reaching the 80% consensus cut-off were analysed. Changes from round 1 to round 2 in the percent agreement measure, the median (measure of central tendency and group opinion) and the IQR (changes in dispersion and variation of opinion) were reviewed per statement. There were six borderline statements within 5% of the consensus margin. These statements were considered for inclusion. See 'After Round 2' in the PPI section below.

## Patient and public involvement (PPI)

A group of patient and public research partners have been involved in this NIHR funded research project (i.e., the development of an assessment tool) since May 2020. They are eight hearing and deaf professionals and nine hearing parents of deaf children. The lead author has

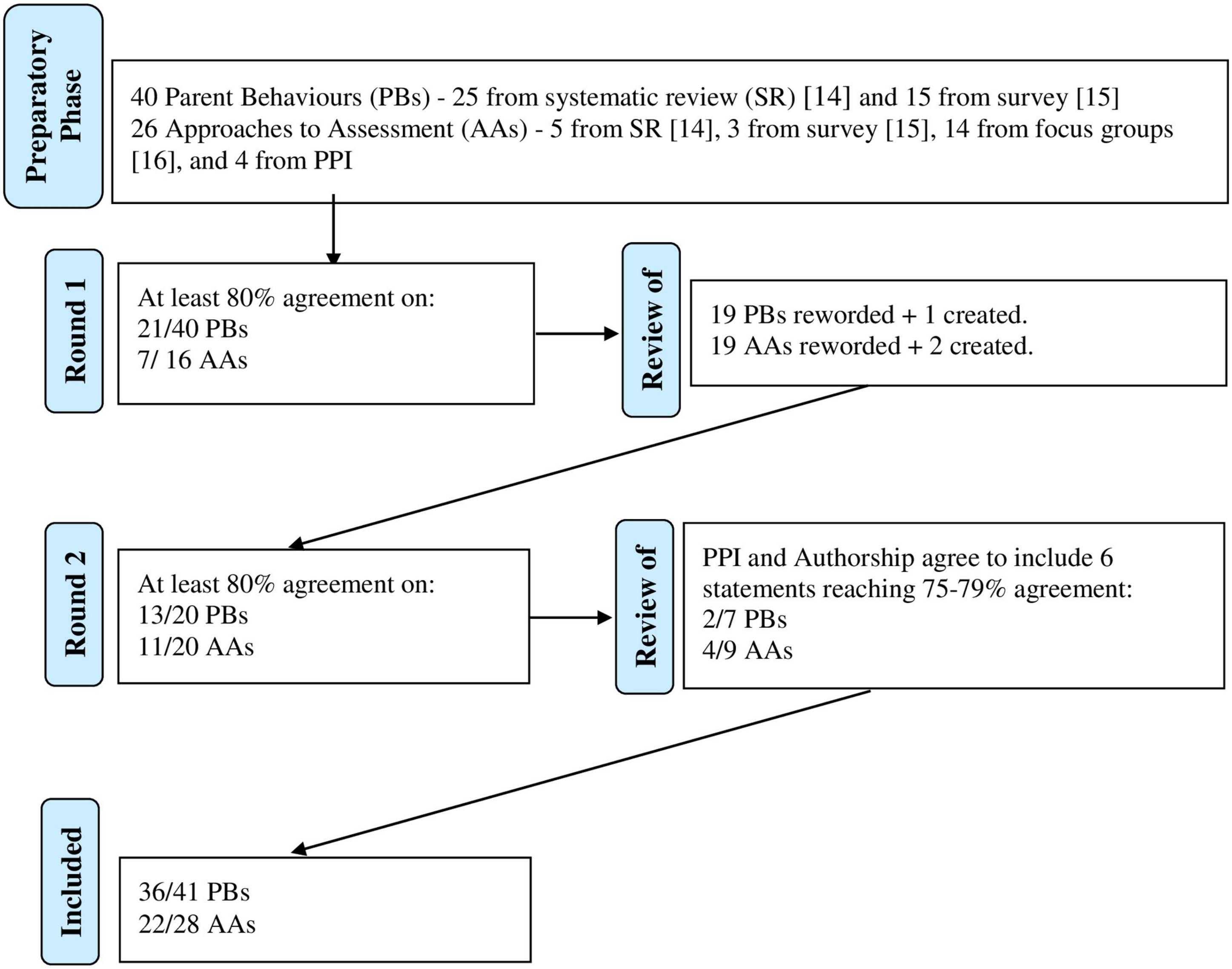

**Fig 1. Flow chart illustrating the stages of the e-Delphi process.** Note the denominator of total number of PBs and AAs changes from the 'Preparatory Phase' to the final 'Included' phase as there were some additional statements created in the 'Review of R1' phase.

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met with both groups separately and as a whole team throughout the project and they have each made contributions that has helped the work become more family-centred, and relevant to deaf infants, their families and the professionals that support them. For this e-Delphi study a considerable amount of collaboration took place with the PPI groups:

**Prior to round 1: Remote review for PPI professionals.** Videos were sent in spoken English and British Sign Language (BSL) outlining the project, explaining the e-Delphi study design, and the proposed statements for round 1. Professionals were requested to either comment on a live, online shared document or send their comments via video.

**Prior to round 1: Online meeting for PPI parents.** The systematic review (14), mixed-methods study findings (15–16) to date, the e-Delphi design and proposed statements were presented. Then whole group and smaller, break-out group discussions were had relating to 1) the wording of the current statements and 2) missing items, i.e., statements that should be added from a parent's perspective. Four statements from parents were generated for inclusion.

**After round 1: Two online meetings (one with parents and another for professionals).** In an evaluation form from a previous meeting, some parents had requested more parent-to-parent groups as the combined larger group felt very formal at times. Therefore, separate meetings were held to allow each group to speak freely, without anxiety or perceived feelings of judgement. In these meetings, statements that did not reach consensus in round 1 were reviewed. Breakout rooms were created, and one group worked on rewording the parent behaviours, and another group on assessment approaches. Reworded statements were then revisited by the authorship team before circulating round 2 to e-Delphi participants.

**After round 2: Whole group, online meeting with professionals and parents.** Following the data analysis and review of the statements that did not reach consensus after two rounds, the PPI group were presented with the six statements mentioned at the end of the data analysis section, along with the e-Delphi participants' qualitative feedback. Mostly, participants' qualitative comments spoke to small concerns with elements of the statements, which if removed, were likely to then appeal to professionals and move the statements to within the consensus threshold. Small edits or expanded explanations were decided upon for each statement by two or three members of the PPI group, using participants' feedback for each item. These are presented in the results section (see final table).

## Results

### Participants

Table 1 presents participant characteristics in terms of primary profession (many had dual roles), location, hearing status, and years of experience. Eighty-three (83) of the 95 registrants completed round 1. There was a relatively equal number of SLTs (n = 30) and academics (n = 28), with fewer QToDs (n = 22), NDCAMHS professionals (n = 2) and Psychologists (n = 1). Professionals were from thirteen different countries, with most participants contributing were from England (n = 50) and then the USA (n = 12). Most professionals were hearing (n = 78, 93%). On average, each panel member had nearly 20 years' experience of working with deaf children. Seventy-two (72) of the 83 panel members were happy for their contribution to the study (and the assessment tool's development) to be acknowledged and their names are listed in the acknowledgements section.

**Table 1. Participant characteristics.**

| **Profession** | **100% (n = 83) and Country where based** |
|---|---|
| SLT | 36% (30)–(England = 27, Scotland = 2, Malaysia = 1) |
| Academic | 34% (28)–(USA = 11, England = 5, Germany = 3, Belgium = 2, Sweden = 2, Italy = 2, Austria = 1, Canada = 1, Netherlands = 1) |
| QTOD | 27% (22)–(England = 15, Scotland = 2, Wales = 3, USA = 1, Northern Ireland = 1) |
| Mental Health Services | 2% (2)–(England = 2) |
| Psychologist | 1% (1)–(England = 1) |
| | |
| **Hearing Status** | |
| Hearing | 93% (78) |
| Deaf / Hard of Hearing | 7% (6) |
| | |
| **Years of Experience (Group Average)** | 19.7 (min 10 years and max 51 years) |

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## Round 1

Table 2 lists the statements where consensus was reached in round 1, their levels of consensus, the category the statement is in, and each statement's median and interquartile range (IQR).

**Parent behaviours.** In this first round, 21 of the 40 (53%) PB statements reached consensus, and percentages of agreement ranged from 80–99%, with IQRs <1. All eight statements within the parental sensitivity category gained consensus in this round, with seven of the eight statements in the top ten for highest percentages of agreement (94–99%). A parent being attuned or emotionally sensitive to the child's emotions and behaviour had the highest figure of agreement overall (99%) with a parent being genuinely interested and involved also highly rated (98%).

All four statements related to joint engagement also reached consensus in round 1. Experts agreed on the importance of balanced turn taking (98%), maintaining joint engagement (98%), on the parent waiting for the child to initiate (94%), and the parent and child face watching one another (84%).

The remaining nine statements that reached consensus were linked to how a parent can increase a child's access to language (1 of 4 statements achieved consensus) and how a parent can enrich their deaf child's language (8 out of 19 statements achieved consensus). Experts agreed that a parent expanding on their child's language (91%) and the parent interpreting the child's behaviours with language (84%) were some of the most important skills to assess in PCI. Likewise, for access to language, 83% of participants felt it was important to assess the parent's skills in physically positioning themselves at the child's level.

There were 19 parent behaviours that did not reach consensus. None of the five statements on 'attention getting' reached consensus in round 1, and many participants gave comments as to why the statements did not work in their current form. Participants shared that a parent using auditory based attention getting strategies with an unaided deaf child would not be effective, and likewise a hearing parent using visual or tactile attention getting strategies might not be the most effective way of gaining the attention of a deaf child who is a good user of their hearing equipment. In addition, there were 3 parent behaviours related to accessible language and a further 11 parent behaviours linked to language enrichment that did not reach consensus.

**Approaches in assessment.** Seven of the 26 (27%) statements related to assessment approach reached consensus in round 1. Participants agreed all four statements linked to goal setting were important and essential. These stated that assessments should lead to goal planning (80%), goals should be jointly discussed and agreed between the parent and professional (96%), the purpose of the parent-focused goal and impact on the child should be discussed between the parent and professional (98%) and parent-focused goals should be regularly reviewed and updated (96%).

Two of the four statements linked to developing an informed parent gained consensus. These were a parent being made aware of the purpose of the assessment (96%) and the parent having the opportunity to watch back and review a video of their PCI with a professional (91%). Lastly, one of the four statements on developing an empowered parent reached consensus. This referred to providing parents with the opportunity to assess themselves with encouraging support from a professional (88%).

Consensus was not reached on the 19 assessment approaches. These were three statements on setting up the assessment (n = 3), how to measure skills (n = 4), collaborating with parents (n = 3), multi-professional joint working (n = 2), cultural diversity (n = 1), and deaf infants with additional needs (n = 1).

**Table 2. Round 1 - consensus met (i.e., rated a '4' or a '5' by $\geq$ 80%).**

| Parent Behaviours to Assess (n = 21) | Category | Consensus % agreed | Median (IQR) |
|---|---|---|---|
| PB17 Parent is attuned and adaptive to the child's emotions and behaviour. In research, this is called emotional sensitivity. | Parental Sensitivity | 99% | 5 (4–5) |
| PB11 Parent engages in balanced communicative turn taking (verbal or visual). | Joint Engagement | 98% | 5 (4–5) |
| PB14 Parent is genuinely interested and involved. In research this is called availability. | Parental Sensitivity | 98% | 5 (4–5) |
| PB9 Parent maintains joint engagement with their child. | Joint Engagement | 98% | 5 (4–5) |
| PB16 Parent responds to their child with on-topic behaviour or language. In research, this is called responsivity and/or contingent talk. | Parental Sensitivity | 96% | 5 (4–5) |
| PB19 Parent predominantly strives for a positive connection with their child. In research, this can be referred to as consistency or emotional regulation. | Parental Sensitivity | 96% | 5 (4–5) |
| PB13 Parent shows enthusiasm, warmth. In research this is called positive regard. | Parental Sensitivity | 95% | 5 (4–5) |
| PB18 Parent interacts with appropriate pace, play, and language for the child's age/stage. In research, this is referred to as structure and stimulation. | Parental Sensitivity | 95% | 5 (4–5) |
| PB10 Parent pauses or waits to give time for the child to initiate. | Joint Engagement | 94% | 5 (4–5) |
| PB15 Parent follows their child's lead. In research, this is called non-intrusiveness. | Parental Sensitivity | 93% | 4 (4–5) |
| PB31 Parent expands on their child's language by adding 1 or 2 more words or signs. | Language Enrichment | 91% | 4 (4–5) |
| PB38 Parent uses praise / encouragement. | S Parental Sensitivity | 91% | 5 (4–5) |
| PB26 Parent interprets their child's behaviour with language. | Language Enrichment | 89% | 4 (4–5) |
| PB27 Parent uses a range of different word types (i.e., nouns, verbs, adjectives). | Language Enrichment | 87% | 4 (4–5) |
| PB25 Parent comments on or describes an action, an object, a picture, etc. | Language Enrichment | 85% | 4 (4–5) |
| PB6 Parent and child mutually face-watching one another. | Joint Engagement | 84% | 4 (4–5) |
| PB8 Parent alerts their child to, or explains, environmental sounds (where appropriate). | Language Enrichment | 84% | 4 (4–5) |
| PB20 Parent physically positions themselves at the child's level. | Language Access | 83% | 4 (4–5) |
| PB35 Parent uses repetition (of their and/or their child's language, gesture, or vocalisations). | Language Enrichment | 82% | 4 (4–5) |
| PB36 Parent offers and labels choices. | Language Enrichment | 80% | 4 (4–5) |
| PB24 Parent labels items. | Language Enrichment | 80% | 4 (4–5) |
| **Approaches to Use in the Assessment (n = 7)** | | | |
| AA65 The purpose of the parent-focused goal, and its impact on their deaf child, should be discussed with the parent. | Goal Setting | 98% | 5 (5–5) |
| AA66 Parent-focused goals should be regularly reviewed and updated. | Goal Setting | 96% | 5 (4–5) |
| AA46 Parents should be made aware of the purpose of the observation / assessment. | Informed Parent | 96% | 5 (5–5) |
| AA63 Parent-focused goals should be jointly discussed and agreed between the parent and professional. | Goal Setting | 96% | 5 (4–5) |
| AA51 Parents should have the opportunity to watch back and review video recordings of their parent-child interaction with a professional (within the same visit if appropriate). | Informed Parent | 91% | 5 (4–5) |
| AA53 Parents should be given the opportunity to assess themselves, with encouraging support from a professional. | Empowered Parent | 88% | 4 (4–5) |
| AA62 Assessment outcomes should lead to goal setting | Goal Setting | 80% | 4 (4–5) |

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**Review and rewording.** Across both sections of round 1, there were no statements that were eliminated or discarded, i.e., where 80% of participants rated a statement as a 1 ('no importance') or 2 ('low importance'). Therefore, all 19 PB statements and 19 AA statements were reviewed by the authorship team and the PPI group. There were seven PBs and six AAs where more divergent responses were present (i.e., IQRs >1). These are marked with an asterisk in the tables below. All of the statements, but particularly those with dissenting judgements, were carefully scrutinised using participants' qualitative responses to aid the rewording of items. The review and rewording process resulted in less divergence in round 2. S1 Table displays the changes in wording for all 38 statements from their original round 1 presentation to how they were presented to participants for round 2.

Within the parent behaviours section, the main changes included creating different categories linked to *child language use* rather than parent skill. Participants had made it clear in their qualitative feedback in round 1 that some PBs were dependent on the language choice made by parents. For example, attention getting statements PB1, PB3, PB4 and PB5 were grouped together, and participants were informed that these would be most relevant where the deaf child benefitted from access to lip patterns and facial expressions. Similarly, attention getting statement PB2 and access to language statements PB21, PB22 and PB23 were grouped together, and participants were informed that these skills would be most relevant for deaf children who have access to sound and the potential to understand and use spoken language. Following the review of participants' comments, it was decided that the remaining 11 reworded statements were relevant for all deaf children, regardless of listening skills and language choices. Two prominent reframes of statements within this section were PB30 'Parent reduces questions and increases on-topic comments' and PB34 'Parent uses open questions'. Participants' feedback had the following themes: PB30 said two things at once; it is impossible for parents not to ask questions; a professional might only want a parent to reduce questions if there is overuse, not all question types negatively impact language use; it is the balance between parent and child that is important, and balance between questions and comments is also key for parents. As they are linked, feedback on PB34 was similar but participants also made the case that open questions needed to be asked when the child was developmentally ready. It was decided that PB30 would be reworded and focused on question type: 'Parent uses open questions in favour of closed questions' and that PB34 would be more about the *balance* of a parent's language use: 'Parent balances open questioning with on-topic comments'. Disclaimers about the child's developmental stages of cognition and language were added to PB28, PB29, PB32, and PB39. Lastly, one new parent behaviour was added to the 'access to language' category and this was about the parent's use of child-directed speech or sign to pique the child's interest. Therefore, for round 2, there were 20 parent behaviours to rate.

Within approaches to assessment, the categories and 'essence' of each statement mostly stayed the same, but statements were expanded to provide more clarification or better examples. Other adaptations included using softer, conditional terms such as 'where appropriate' and 'could' instead of 'should'. This was to acknowledge participants' feedback that professionals work with a highly heterogenous population and approaches in assessment would be context-bound. One statement that underwent extensive review was AA61, which related to families whose home language was not the officially recognised native language of the country in which they resided. This statement was split into three to gain consensus on whether: families should be observed in their home language (AA61a); professionals should acknowledge the culture of the family to prevent misinterpreting PCI assessment results (AA61b); and even where there may be cultural differences at play, all families could benefit from adapting their communication behaviours if unhelpful for the language development of the deaf child (AA61c). The team also added an optional question related to AA61abc with an open-text response to gain information on how participants have worked successfully in this area. From review of round 1 feedback and the preliminary work [14–16], it was decided that an additional free text box would also be added to AA50 (related to deaf-plus infants), as more expert insight would be beneficial for working with this population. Therefore, for round 2, there were two free text boxes and 21 statements on approaches in assessment.

## Round 2

For round 2, 81 of the 83 (98%) participants returned. Table 3 lists the statements that reached consensus in round 2, the category the statement is in, the percentages of agreement, and each statement's median and interquartile range (IQR). Consensus data from round 1 is also displayed, along with the change in percentage of agreement per item across the two rounds.

**Parent behaviours.** In the second and final round, a further 13 of the 20 (65%) reworded parent behaviour statements reached consensus, with agreement ranging from 80–95% and an IQR<1. This included six of the seven previously divergent PBs (i.e., IQR>1). Seven out of the 13 remaining statements within the language enrichment category, three out of the five remaining statements from the attention getting category, and three out of four statements remaining on access to language reached consensus. In this round, PB12 ('parent waits and watches their child's behaviours and gaze, using the child's cues to tailor the language they will use') gained the highest level of consensus (95%). This was a 23% increase from its agreement figure in round 1 and the only parent behaviour statement in round 2 that reached a consensus above 90%.

Many of the reworded parent behaviours discussed in the 'Review and Rewording' section above reached consensus. These were five of the seven statements re-grouped by child language (PB1, PB5, PB21, PB22, PB23), the new entry on child-directed language ('PBnew') and the reframed statements on questions and comments (PB30 and PB34).

Two of the largest increases in percentage agreement were for PB39 ('Parent provides language input that is appropriate to child's developmental stage') and PB7 ('Parent watches and waits when the child looks away, to allow the child to explore, to take a rest from interacting, to take a turn in initiating'). PB39 moved from 31% agreement (round 1) to 88% agreement (round 2), an increase of 57%, two points on the scale in terms of median score and had less divergence (IQR = 2 to IQR = 1). PB7 gained 28% of participants' agreement (round 1) but achieved 83% agreement (round 2). The smallest change observed between round 1 and round 2, was PB28 ('Where appropriate, parent uses mental state verbs i.e., 'like', 'know', 'think'). In round 1, the statement achieved 77% (median 4, IQR 4–5) and in round 2, the statement achieved 81% (median 4, IQR 4–5). Due to the slight decrease in the number of expert participants between round 1 and round 2, this is likely to mean that one more person rated the statement a 4 or 5.

There were seven out of 20 (35%) reworded parent behaviour statements that did not achieve consensus. Table 4 displays these ratings and the observable changes from round 1 to round 2.

Five of these statements had an increase in the percentage of agreement between participants, with changes in agreement ranging from 6 to 29%. Two statements decreased in their agreement percentages, i.e., their agreement level lowered following rewording. These were PB4 (parent uses multiple strategies at one time to gain a child's attention) and PB40 (parent uses touch as a tactile way of highlighting speech, tone, or rhythm in language). For PB4 (divergent in round 1 but not in round 2), participants argued that one mode at a time would be enough–auditory strategies, visual strategies, or tactile strategies. This would allow a parent to monitor which approach in attention-getting the child responds to best, so that the approach is child-led, and the child is not overwhelmed or over-stimulated by multiple methods. For PB40, many participants thought this was quite unnatural and intrusive for PCI and play, but rather a helpful strategy in word learning and/or syllable counting. Participants also

**Table 3. Round 2 –reworded statements achieving consensus (n = 24).**

| **Parent Behaviours to Assess** | **Round 2 rating** | **Round 2 Median (IQR)** | **Round 1 rating** | **Round 1 Median (IQR)** | **Category** | **⇅** |
|---|---|---|---|---|---|---|
| PB12 Within the interaction, parent waits and watches their child's behaviours and gaze, using the child's cues to tailor the language they will use. | 95% | 5 (4–5) | 72% | 4 (3–5)* | Language Enrichment | ↑ **23%** |
| PB5 Where the child benefits from access to lip patterns, facial expressions, and/or visual perception of sound, parent actively waits or pauses their communication until their child looks at them. | 89% | 4 (4–5) | 69% | 4 (3–5)* | Attention Getting | ↑ **20%** |
| PB new Parent uses appropriate child-directed language (e.g., exaggerated, or tuneful intonation, exaggerated facial expressions, gesture, a larger signing space). | 89% | 4 (4–5) | N/A | N/A | Language Access | **N/A** |
| PB34 Parent balances open questioning with on-topic comments. | 88% | 4 (4–5) | 68% | 4 (3–5)* | Language Enrichment | ↑ **20%** |
| PB39 Parent provides language input (i.e., average number of signs/ words) that is appropriate to child's developmental stage. | 88% | 5 (4–5) | 31% | 3 (2–4)* | Language Enrichment | ↑ **57%** |
| PB1 Parent uses visual attention-getting strategies (e.g., moving into the child's visual field). | 88% | 4 (4–5) | 68% | 4 (3–4) | Attention Getting | ↑ **20%** |
| PB21 Where the child is using/developing skills in spoken language, parent uses appropriate voice volume. | 86% | 4 (4–5) | 76% | 4 (4–5) | Language Access | ↑ **10%** |
| PB7 Parent watches and waits when the child looks away, to allow the child to explore, to take a rest from interacting, to take a turn in initiating. | 83% | 4 (4–5) | 28% | 3 (2–4)* | Language Enrichment | ↑ **55%** |
| PB2 Parent uses auditory attention-getting strategies (e.g., using the child's name). | 82% | 4 (4–5) | 72% | 4 (3–4) | Attention Getting | ↑ **10%** |
| PB23 In earlier stages of development, where the deaf child has access to spoken language, parent makes accompanying sounds to the child's action/ toys/ items. | 82% | 4 (4–5) | 66% | 4 (3–4) | Language Enrichment | ↑ **16%** |
| PB28 Where contextually and pragmatically appropriate (developmental stage / relevant moment), parent uses mental state verbs (i.e., 'like', 'know', 'think') within the interaction. | 81% | 4 (4–5) | 77% | 4 (4–5) | Language Enrichment | ↑ **4%** |
| PB30 Parent uses open questions in favour of closed questions. | 80% | 4 (4–4) | 76% | 4 (4–5) | Lang Enrichment | ↑ **4%** |
| PB22 Where the child is using/developing spoken language, parent is mostly within 1 to 2 metres of the child's amplification device(s) where possible. | 80% | 4 (4–5) | 70% | 5 (3–5)* | Language Access | ↑ **10%** |
| **Approaches to Use in the Assessment** | | | | | | |
| AA60 Where a family has more than one professional involved, the assessing professional should share information from the assessment with the rest of the team. This will reduce duplication of assessment and allow quicker access to intervention / support. | 95% | 5 (4–5) | 58% | 4 (3–4) | Joint Work | ↑ **37%** |
| AA61b The culture of the family should be acknowledged when observing parent-child interaction, to prevent the professional misinterpreting assessment results. | 94% | 5 (5–5) | AA61 65% | 4 (3–4) | Cultural Diversity | ↑ **29%** |
| AA61a Families should have their parent-child interaction observed in the language of the home, with assessors using interpreters or bilingual co-workers to understand the language used. | 93% | 5 (5–5) | AA61 65% | 4 (3–4) | Cultural Diversity | ↑ **28%** |
| AA50 For some children, e.g., those with additional or complex medical needs, the activities within parent-child interaction assessments may need to be more flexible and varied, i.e., whenever the child is most interactive within their daily routines. | 90% | 5 (4–5) | 63% | 4 (3–4) | Deaf-Plus | ↑ **27%** |
| AA52 The review of the parent-child interaction assessment should be largely strength-based, i.e., identifying what is working well. There could also be scope to sensitively highlight behaviours with potential to improve, as long as the overall review is positive and encouraging. | 89% | 4 (4–5) | 77% | 4 (4–5) | Empowered Parent | ↑ **12%** |
| AA64 Goals should be mostly focused on a parent's current strengths in the assessment. The parent may also wish to pick an important behaviour they would like to practice / become more confident with. | 87% | 4 (4–5) | 77% | 4 (4–5) | Empowered Parent | ↑ **10%** |
| AA61c All parents, even where there may be cultural differences at play, may benefit from adapting their communication behaviours if unhelpful for the language development of the deaf child. The review of an assessment video can assist with these discussions. | 86% | 4 (3–4) | AA61 66% | 4 (3–4) | Cultural Diversity | ↑ **20%** |

(*Continued*)

Table 3. (Continued)

| Parent Behaviours to Assess | Round 2 rating | Round 2 Median (IQR) | Round 1 rating | Round 1 Median (IQR) | Category | ⇅ |
|---|---|---|---|---|---|---|
| AA43 To accurately capture and then reflect on parent-child interaction, a video recording is recommended at least once in parent/professional partnership work. Timing of when this formal measure is taken will depend on parental well-being, parental personality and the strength and trust within the parent/professional relationship. | 84% | 4 (4–5) | 69% | 4 (3–5)* | Informed Parent | ↑ **15%** |
| AA45 Parents could be encouraged to send videos to an early intervention provider for review, where the professional is not present (especially if the child has additional needs, the child does not engage, or parents require support within a particular context). | 80% | 4 (4–4) | 64% | 4 (3–4) | Empowered Parent | ↑ **16%** |
| AA56 Where possible, the parent should be offered the choice of receiving a copy of the parent-child interaction recording, following the assessment session with the professional. | 80% | 5 (4–5) | 57% | 4 (3–5)* | Informed Parent | ↑ **23%** |
| AA48 Where possible, parents should be asked where they would prefer to be observed. | 80% | 4 (4–5) | 74% | 4 (3–5)* | Collaborate | ↑ **6%** |

*An asterisk signifies divergent views within the response, i.e., an IQR >1.

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felt that this strategy may be more appropriate for a therapist or teacher to use in direct work, because parents should not feel they need to be teachers during interactions with their infants.

A closer look at the low agreement statements highlighted two parent behaviour statements within the language enrichment category which were very near to achieving consensus: PB29 (parent talks ahead of actions or events; 77%), and PB32 (parent rephrases a child's incorrect grammar; 76%). Both statements had increased in their percentage agreement figures (PB29 by 12% and PB32 by 7%) and in their spread of opinion when compared to round 1 results (IQRs of 3–4 in round 1 and IQRs of 4–5 in round 2). Qualitative feedback for PB29 was either that is not always possible to pre-warn a child of a change and that this parent behaviour is dependent on the age and stage of the child. For PB32, participants were keen to note that PCI should not include corrective grammar lessons as this can impact bonding and self-esteem. The remaining five parent behaviour statements that did not achieve consensus (PB4, PB3, PB33, PB37, and PB40) were considerably lower in percentage agreement (ranging from 62–13%) with a substantial gap from the statements bordering close to consensus, suggesting clear views from experts that the remaining five were less essential and less important items. Further, PB37 became divergent in round 2, i.e., an IQR>1. Through discussion, across the authorship team and in PPI meetings, it was agreed that statements PB29 and PB32 would be retained in the final list of statements and reworded to include caveats noted by participants in their qualitative feedback (see Table 5). Conversely the other five parent behaviours were not core and not included.

**Approaches in assessment.** Eleven of the 21 (52%) reworded statements related to assessment approach reached consensus in round 2. This included three of the six previously divergent AAs (i.e., IQR>1). These were all three statements on cultural diversity (AA61a,b,c), the statement on deaf children with additional needs (AA50), the remaining two statements on developing an informed parent (AA43, AA56), the remaining three statements on empowering the parent (AA52, AA64, AA45), one of the three statements on collaborating with parents (AA48), and one of the two statements on multi-professional joint working (AA60).

The four statements with the highest percentages of agreement were also the four statements with the highest changes in agreement scores between round 1 and round 2. AA60 on joint working (professionals sharing information) had the highest number of agreement (95%) with a 37% increase from round 1 (58%). In their comments, participants agreed that with

**Table 4. No consensus reached following rounds 1 and 2 (n = 17 statements).**

| Parent Behaviours to Assess | Round 2 rating | Round 2 Median (IQR) | Round 1 rating | Round 1 Median (IQR) | Category | ⇅ |
|---|---|---|---|---|---|---|
| PB29 Parent informs the child of an action or event ahead of doing it, using a range of visual cues if appropriate for the child's understanding. | 77% | 4 (4–5) | 65% | 4 (3–4) | Language Enrichment | ↑ **12%** |
| PB32 Within the interaction, parent supportively rephrases the deaf child's language with correct grammar (where contextually and pragmatically appropriate, i.e., developmental stage, a natural moment). | 76% | 4 (4–5) | 69% | 4 (3–4) | Language Enrichment | ↑ **7%** |
| PB4 Parent uses multiple strategies at one time to gain the child's attention (e.g., moving into the child's visual field and saying 'wow', tapping and saying the child's name). | 62% | 4 (3–4) | 74% | 4 (3–5)* | Attention Getting | ↓ **12%** |
| PB3 Parent uses tactile attention-getting strategies (e.g., tapping). | 51% | 4 (3–4) | 45% | 4 (3–4) | Attention Getting | ↑ **6%** |
| PB33 Parent rephrases their child's language into a question, i.e., the child says/ signs "cake" and the parent rephrases into "Can I have cake daddy?' | 47% | 3 (3–4) | 18% | 3 (2–3) | Language Enrichment | ↑ **29%** |
| PB37 Parent models mistakes in their own language if/when they arise, i.e., 'The fireman is crying. . . I mean climbing! I used the wrong word/sign'. | 33% | 3 (2–4)* | 22% | 2 (2–3) | Language Enrichment | ↑ **11%** |
| PB40 Parent uses touch as a tactile way of highlighting speech / tone / rhythm in their language (e.g., parent says 'Hel-lo Ma-ya' with taps for each syllable). | 13% | 2 (2–3) | 40% | 3 (3–4) | Language Access | ↓ **27%** |
| **Approaches to Use in the Assessment** | | | | | | |
| AA49 As well as observing interaction in play, professionals could sample interactions within daily routines (e.g., mealtimes, dressing) where parents are willing. | 78% | 4 (4–5) | 78% | 4 (4–5) | Set up | - |
| AA47 Where possible, assessments of parent-child interaction should take place in the child and parents' most natural, most familiar settings. | 76% | 4 (4–5) | 69% | 4 (3–5)* | Set up | ↑ **7%** |
| AA44 Though a video recording of 10 minutes of interaction should provide enough material for watch back and reflection, the length of a video recording should be discussed with parents as they may request more or less time. | 75% | 4 (4–5) | 50% | 4 (3–4) | Collaborate | ↑ **25%** |
| AA57 If the family requests or the context deems it necessary, all main caregivers (i.e., mothers, fathers, grandparents, older siblings) should be given the opportunity to have their interaction skills observed and reflected upon. | 75% | 4 (4–4) | 66% | 4 (3–5)* | Collaborate | ↑ **9%** |
| AA42 Joint engagement could be observed by noting how long a parent and child remain connected. In some cases, it may be appropriate to estimate this, particularly for the purpose of reviewing progress. | 66% | 4 (3–4) | 40% | 3 (3–4) | Measuring skills | ↑ **26%** |
| AA41 Evaluating joint engagement could be observing the connected turns between parent and child. In some cases, it may be appropriate to count these turns. | 65% | 4 (3–4) | 58% | 4 (3–4) | Measuring skills | ↑ **7%** |
| AA54 Parents and professionals could reflect on each parent behaviour together using scales. Professionals could describe each parent behaviour before the parent reflects on their interactions. The wording of the scale to be parent-centred and positively framed. | 63% | 4 (3–5)* | 58% | 4 (3–4) | Measuring skills | ↑ **5%** |
| AA58 To reflect everyday language in the home, the observation may need to take account of, and potentially include, other siblings present at home with the deaf child. | 64% | 4 (3–4) | 57% | 4 (3–4) | Set up | ↑ **7%** |
| AA55 Parent-child interaction behaviours can be presented as a list with the parent and professional discussing and then selecting which ones they use and feel confident with. | 57% | 4 (3–4) | 32% | 3 (2–4)* | Measuring skills | ↑ **25%** |
| AA59 Where appropriate, deaf professionals (e.g., deaf teachers of deaf children, deaf language specialists, deaf professionals working in mental health services) are recommended to be involved in the assessment of parent-child interaction where possible. | 55% | 4 (3–5)* | 38% | 3 (3–4) | Joint Work | ↑ **17%** |

An asterisk signifies divergent views within the response, i.e., an IQR >1.

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consent, information sharing is essential for reducing stress for families. The next statements with high levels on consensus were two items on cultural diversity. First AA61b (acknowledging the culture of the family) achieved 94% consensus and AA61a (observing PCI in the home

**Table 5. Reworded statements following the second and final e-Delphi round (n = 6).**

| Parent Behaviours: Round 2 Statements | Reworded and Included Following PPI Review |
|---|---|
| PB29 Parent informs the child of an action or event ahead of doing it, using a range of visual cues if appropriate for the child's understanding. | PB29 **Where necessary or possible**, parent informs the child of **next steps or a change** using a range of visual cues appropriate for the child's understanding**, i.e., parent leaving the room for water.** |
| PB32 Within the interaction, parent supportively rephrases the deaf child's language with correct grammar (where contextually and pragmatically appropriate, i.e., developmental stage, a natural moment). | PB32 Parent **models** the correct grammar back to a child for what they have just said. For example, the child says, 'Teddy eat' and the parent would say 'Yes, Teddy is eating'. **There is no expectation the child will repeat back what the parent has said. The rephrase should be developmentally appropriate and parents should avoid overuse of this behaviour.** |
| AA49 As well as observing interaction in play, professionals could sample interactions within daily routines (e.g., mealtimes, dressing) where parents are willing. | AA49 **Giving parents the opportunity**, professionals could **observe** interactions within daily routines (e.g., mealtimes, dressing) as well as observing interaction in play. |
| AA47 Where possible, assessments of parent-child interaction should take place in the child and parents' most natural, most familiar settings. | AA47 Where possible, observing parent-child interaction should take place in **the families' chosen optimal setting, where the child will be most communicative**. |
| AA44 Though a video recording of 10 minutes of interaction should provide enough material for watch back and reflection, the length of a video recording should be discussed with parents as they may request more or less time. | AA44 A video recording of **up to 10 minutes** of interaction should provide enough material for watch back and reflection. The length of a video recording should be discussed with parents as they may request more or less time. |
| AA57 If the family requests or the context deems it necessary, all main caregivers (i.e., mothers, fathers, grandparents, older siblings) should be given the opportunity to have their interaction skills observed and reflected upon. | AA57 If the family requests or the context deems it necessary, all main caregivers (i.e., mothers, fathers, grandparents, older siblings) **could** be given the opportunity to have their interactions observed and reflected upon. |

Bold text signifies altered text after round 2 to incorporate participant comments/ reflections/ concerns/ caveats.

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language) achieved 93%, their changes in percentage agreement were 29% and 28% respectively. For these items, participants suggested that it would be best to involve professionals that share the culture of the family as they can inform the assessment, and make families feel more confident and comfortable using their own language. This would increase the validity of the observation. Some participants suggested that the PCI assessment could be done in the home language, and then if the parent speaks English, they could translate for the professional upon watching back. Another important point for professionals unable to work with bilingual coworkers or cultural brokers was that whilst it is important professionals understand the culture of the family, they should not make any general assumptions as variations exist. All participants' responses to the open-text question on cultural diversity are provided in S2 File.

Another statement that achieved high levels of consensus was AA50 (flexible observations when working with deaf-plus children and their families), achieving 90% agreement which was an increase of 27% and one scale point from the results for this statement in round 1 (63%). Participants commented that parents could send their own videos to the professional as this would mean there was less pressure for the parent and child to 'perform' on the visit, or that the professional could observe highly interactive moments as well as moments where communication was more limited, where parents may need more support and guidance. Participants' responses for the open-text question on working with the deaf-plus population are provided in S1 File.

There were 10 out of 21 (48%) reworded statements on assessment approach that did not gain consensus. These are displayed in Table 4. These were all three statements on setting up the assessment, all four statements on how to measure skills two statements on collaborating with parents, and one related to multi-professional joint working. For all of these statements, more participants increased their rating between round 1 and round 2, with changes in percentage of agreement figures ranging between 5 to 26%.

As with parent behaviours, statements that did not reach consensus within assessment approaches were reviewed. There were four statements that were very close to the consensus threshold of 80%, The first was AA49 (observing daily routines) with 78%. The percent agreed, median and IQRs for this statement remained high and stable between round 1 and 2. We did not gain much qualitative feedback from participants who rated this statement as a 1, 2, or 3 on the scale, other than this was harder to achieve for professionals working in clinical settings. Our PPI group of hearing parents felt this was an essential statement to include as so much communication centres around daily routines such as mealtime, feeding, bath time, nappy changing, and dressing, therefore a slight reword was made and this statement retained.

Statement AA47 (assessing in natural, familiar settings) had a percentage agreement of 76%. Statements AA44 (video recording length) and AA57 (giving all primary caregivers the opportunity to have PCI assessed) both achieved 75%. For all three statements, the percentage agreement increase was between 7–25% and all IQRs were narrower/less divergent in round 2 results. These statements were viewed as essential by both the authorship team and the PPI group and were reworded (see Table 5). Participant feedback was used to modify statement AA47 in order to give a parent more power, choice, and convenience when deciding on optimal settings for interaction. Similarly for AA57, participants shared this would be great but unrealistic with busy caseloads and hence ‘should’ was replaced with ‘could’. For statement AA44, many participants felt that three to five minutes was adequate and that 10 minutes of video recording was excessive. When these comments were presented to our PPI panel, parents of deaf children felt strongly that ‘up to 10 minutes’ should be the wording as they felt that a parent might need more than three to five minutes ‘to warm up’ and ignore the camera/the professional but agreed that more than 10 minutes of video recording would be excessive. Most importantly, parents felt video recording length should be discussed and agreed upon before the filming had begun. The remaining statements on approaches to assessment (AA42, AA41, AA54, AA58, AA55, AA59) were considerably lower in percentage agreement (ranging from 66–55%). AA54 and AA59 increased in divergence. Whilst they were not included in the final list of statements, it was noted that the majority of participants (i.e., over 50%) agreed they were important. Four of these statements were about measuring PCI, one about including siblings, and another about working with deaf adults.

### Combined results

After rounds 1 and 2, there were 52 statements out of 69 (75%) that reached consensus and 16 statements (25%) that did not. As mentioned, following extensive review and discussion, six statements from the close-to-consensus group were reworded and retained (see Table 5). Therefore, a final total of 58 of the 69 (84%) statements were included for the proposed assessment tool. S2 Table displays the number of statements per category that achieved consensus in round 1, round 2 and following the post e-Delphi data analysis and review discussed above.

## Discussion

This study gained expert opinion on the core content and principles of a new assessment for PCI where the child is deaf and aged 0–3 years. Statements reviewed in the e-Delphi were based on a systematic review [14] and a studies of professional practice [15,16]. In addition, co-production work with a PPI team (17 hearing and deaf parents and professionals) was embedded throughout each study phase. Eighty-three experts (SLTs, QToDs, NDCAMHS professionals, Psychologists and academics) working internationally with deaf infants and their families agreed on the importance of 52 statements out of a possible 69 through two rounds of voting and feedback. A further six statements were included following data analysis and discussion between the authorship team and PPI group. Experts joined from all four nations of the United Kingdom, the USA and Canada, Malaysia and six European countries. On average, each expert participant had 20 years of experience in the field. Across the two rounds, there was excellent retention of expert participants, suggesting a good estimation of the degree of consensus in the final results (i.e., minority opinions did not leave the study).

The first objective of the study was to reach consensus on which parent behaviours to include in an assessment. All statements related to *parental sensitivity* achieved high levels of consensus. The importance of parental sensitivity in PCI with deaf infants is well evidenced [2,32,33]. In their large-scale, longitudinal study of 285 deaf children with cochlear implants, Cruz and team [34] found deaf children had 1.52 years less of a language delay when their parents had above average skills in maternal sensitivity and language stimulation. Pressman and colleagues [35] found that maternal sensitivity was not correlated with initial child language scores, but correlations were present in the follow up assessments 12 months later. They calculated that maternal sensitivity predicted expressive language and had a larger positive effect on the sample of deaf children compared to their hearing sample (ibid). It is appropriate therefore, that the top five behaviours with the highest agreement were related to the parent being attuned and adaptive to the child's emotions and behaviour, the parent having a genuine interest in their child, and the parent responding to the child with on-topic behaviour or language.

All four statements on *joint engagement* also reached consensus, with balanced communicative turn taking, and maintaining joint engagement nearing total agreement. Many studies have shown the positive relationship between deaf children's language scores and time spent in co-ordinated (or mutual) joint engagement between parent and child [2,36,37], i.e., the longer a parent and child are engaged, the better the child's language will be over time. A particular behaviour linked to more successful instances of joint engagement was non-intrusiveness, i.e., following the child's interest rather than directing them [2,37]. Parental sensitivity and initiating and maintaining joint engagement are therefore intertwined and reliant one another: a parent who is interested and attuned to their child's behaviour, who shares the same interest as their child, will offer contingent comments and behaviours, and the dyad will be mutually engaged. The parent must also be aware of the balance in engagement, the space for the child to 'take a turn', verbally or non-verbally, in order to maintain the mutual participation of both child and parent. The longer the connection, the more bonding, enjoyment, and opportunities for language there can be. The fact that all sensitivity and joint engagement behaviours gained the highest levels of consensus fits with the existing literature; joint engagement and parental sensitivity are important to observe within PCI assessment.

Whilst most parent behaviours were viewed by experts as beneficial for developing spoken and/or sign languages, there were some that diverged across participants because of language choices made by parents. For example, a parent's volume of voice or proximity to the child's listening device would be more relevant for a deaf child who relies on their listening devices and is responding to and developing spoken language, than for a child who is developing sign language. Similarly, methods used to gain the child's attention may differ. For children who are responding to and developing sign language, and/or benefiting from lip patterns and facial expressions, a visual way of gaining attention may be more effective. Parents of deaf children make more frequent use of visual and tactile strategies to gain their child's attention when compared to hearing parents of hearing children [38]. In this current e-Delphi, tactile strategies for gaining attention or using multiple modes of attention getting at one time did not reach consensus. Participants chose PBs that were child-led, to see which methods (visual or auditory) the child responded to first. Rather than tactile strategies, the more passive attempts at getting a deaf child's attention [39–43] were favoured by the e-Delphi's expert panel. These include behaviours such as the parent actively waiting or pausing their communication until the child looks. A parent who displays this behaviour may well be following the more 'non-intrusive' patterns of gaining and maintaining attention mentioned above, where the parent follows the child's lead and pace.

Many of the statements that achieved high levels of agreement were centred on the parent's response to their deaf child, rather than the parent instigating anything new themselves. Expert participants seemed to value the statements that required a parent to step back, observe, receive the child's action or utterance, and then respond. Statements achieving high agreement were the ones that promoted balance and a respect for the child's place within the interaction, a respect for their gaze, actions, interests, and contributions. This responsive, child-centred ethos in interacting with deaf infants aged 0–3 years may also explain why participants did not highly rate behaviours such as PB33 (rephrasing grammar) or PB37 (modelling or highlighting mistakes in parent's language). As many participants noted, the teaching of grammar, vocabulary, or speech production is not the job of a parent of a deaf child, particularly not at this age, and therefore it is not a vital behaviour to assess or promote in PCI work. *Modelling* language and *exposure* to grammar is important, hence our inclusion of PB33 in our final list of parent behaviours, however, parents should not be encouraging their deaf child to repeat, correct, or rephrase their utterances.

The second objective of the study was to develop best practice recommendations on *how* to conduct an assessment of PCI. Participants agreed that parents should be aware they are being assessed and have the power to choose where to be observed and what type of interaction they would like to have assessed (e.g., play, dressing, mealtime). Partnership working with parents, where the parent is seen as the expert of their child, forms the general principle of many policies and codes of practice in the UK such as the SEN Code of Practice [44] and The Best Start to Life [45]. Helpful, internationally accepted, guidance on working with families and deaf infants can be found within the position statement 'Principles and Guidelines for Early Hearing Detection and Intervention Programs' [10] and Moeller and team's paper 'Best practices in family-centered early intervention (FCEI) for children who are deaf or hard of hearing. . .' [13]. Both of these documents also highlight the importance of parent/professional partnerships and recommend the role of the professional is to be a 'supporter, partner, and coach' ([10], p.25). The current study's findings align with this philosophy; many participants agreed that PCI should be video recorded (at least once) and that parents should be given the opportunity to watch the interaction and assess themselves before receiving feedback from the supporting professional. Further, participants agreed that video feedback should be strength-based, i.e., parent and professionals identifying what is working well, but there could also be scope to sensitively highlight behaviours with potential to improve, as long as the overall review is positive and encouraging. The JCIH statement [10] recommends professionals use evidence-based practices and build on families' strengths, fostering their confidence and competence in providing a range of jointly attended-to language opportunities with regular conversational turns throughout natural daily interactions.

A goal of FCEI [13] is also the development of trusting, respectful family-provider partnerships, characterised by honesty, shared tasks, and open communication. They also recommend a focus on facilitative family–child interactions, rather than child-directed therapies. These recommendations align with our participants' agreement on collaborative conversations about goal setting, and sharing responsibility for the child's developmental outcomes. The mention of 'family-child' interactions rather than one parent also speaks to our high agreement statements on giving all caregivers the opportunity to have their PCI assessed where appropriate and possible. For the first time, this consensus paper and the upcoming PCI assessment tool provides specific guidance on how to achieve an asset-based observation of parent-deaf child interaction, jointly reviewed by parent and professional.

Participants agreed that, for families who have a deaf-plus child, i.e., a deaf child with additional needs, more flexibility may be required for the assessment. For example, parents may find it is better suited to send the professional a video of interaction rather than video record a live visit, as the child may be more interactive without the external visitor. Likewise, participants agreed assessing less familiar daily routines should be considered and professionals should be prepared to watch less successful instances of communication (if that is the parent's choice) in order to provide assistance with daily routines. Around 40% of deaf children are reported to have an additional disability [46] which can affect each family in different ways. As per expert comments in S1 File, it is therefore important to follow each family's lead in how to assess PCI and to respect the parent as the expert of their child and their child's conditions. Including deaf-plus children in studies that record every day routines is emerging [47–49], but these studies used audio-only recording software (LENA) which limits an analysis of PCI.

Experts concurred that families should be assessed in their home language with bilingual co-workers and/or interpreters helping to interpret the findings. Emerging research is now providing evidence that deaf children can learn two spoken languages [50,51] and that professionals should not discourage bilingualism to parents [52] providing the deaf child has good access to sound. Experts also agreed that cultural diversity and family context should be acknowledged when assessing and drawing conclusions from the PCI assessment, and that if there are behaviours that are unhelpful for the development of the deaf child, these should be raised and discussed sensitively using the video recording of PCI. Government data in England [53] have shown that deaf students who have English as an additional language (EAL) do less well at school than their deaf and hearing EAL peers and the need for better family support and education has been acknowledged. As many of our expert participants shared (see S2 File), a way of connecting with and accurately assessing and supporting parents who have EAL is through the use of video, bilingual co-workers, and using culturally based songs, toys, and games in the assessment.

In this study, expert participants agreed that parents should be given the opportunity to assess their own skills via a video review, but how this is done practically did not reach consensus. The two methods presented in our e-Delphi were the use of scales or a checklist. When using a scale, the professional might describe each parent behaviour before the parent reflects on their skill competency in that area. Scales were used in 34% of the research papers within the systematic review on assessing PCI with deaf infants aged 0–3 [14] and may be more sensitive to skill change than a present/not present checklist. When using a checklist, the professional may again describe the behaviour before the parent and professional discuss which skills were observed on the video. Checklists do not feature in PCI research in deafness but are used in therapies such as Palin PCI Therapy for Stammering [54]. A checklist has the potential to be less threatening than a scale as parents are in charge, simply selecting which behaviours they observed rather than reflecting on their competence in key skills. In the current e-Delphi, the use of scales achieved a slightly higher consensus (63%) than checklists (57%), but both failed to achieve the consensus threshold. When advising on Delphi studies, Hasson and colleagues state that consensus does not necessarily mean the correct answer has been found [55] and that results can help to structure discussion, raise items for debate, and help to streamline focus. Further discussion around professionals' reservations with scales and checklists will help to better understand the responses and potential differences between professional groups.

With regards to the next stages of the PCI tool's development, how to measure parents' skills will be decided upon in co-production stages with parents of deaf children and hearing and deaf professionals working in the field.

Many participants commented that the assessment tool was a worthwhile way of closing the gap between research and practice, but it was also the case that money, time, resources, and a heterogenous population [56] often led to huge variations in services being offered to families. A new PCI assessment might be more effective in allocating resources towards each family. However, we also acknowledge that organisational and contextual factors influence practice.

Professionals had mixed views about the inclusion of others in PCI assessments, specifically siblings and deaf professionals. Professionals who argued for sibling inclusion noted these points: increased ecological validity; highly informative; siblings are essential to modelling language; sibling communication is important for the deaf child; and regular individual special time may not be possible. Professionals who rated '1', '2' or '3' provided no justification for their response, so limited insight can be gained here. We expected that if a parent has a deaf child at home along with another infant (perhaps under 5 and not in childcare), the observation might need to include siblings in order to reflect everyday language, everyday dynamics, and the natural environment. Despite its conditional wording i.e., 'the observation *may* need to include siblings', this statement was deemed less important and not essential to include in a PCI assessment.

There are three possible explanations for the mixed views around inclusion of deaf professionals. Firstly, the vast majority of panel participants were hearing. Secondly, many participants noted it was impossible to organise deaf professional inclusion because not all early intervention services employ deaf ToDs, deaf sign language instructors, deaf Language Specialists, deaf Family Support Workers or deaf mentors. Lastly, most participants were based in England, where there are no laws about the inclusion of deaf adults in early intervention. In the USA, including deaf adults in practice is federal law. If a larger sample had been recruited from that country, the statement may have achieved consensus. Both FCEI [13] and JCIH [10] recommend the inclusion of deaf adults in early intervention programs, not only for sign language instruction, but to offer families and deaf children support, guidance, and mentorship. There are multiple reported for families when deaf adults are involved in family-centred early intervention, such as reductions in stress and increased confidence [57], the opportunity to see possible successes for their children [58], learn a range of visual strategies to assist with language learning [59], and deaf adults being role models for families and deaf children [60]. If, once developed, the proposed tool is used internationally, discrepancies between countries on issues such as involving deaf adults should be included in the tool's manual.

## Limitations

The current study's findings may be biased towards the UK as 70% of participants came from this region and it has been suggested that a diverse panel leads to better outcomes as it allows for a wider range of alternatives and perspectives [61]. Whilst there are merits in the highly experienced, international, and multi-professional expert participants, we did not collect information on the ethnicities or cultural backgrounds of those recruited. Despite not knowing the cultural or linguistic backgrounds of participants, nearly all participants were recruited from western, educated, industrialised, rich, and democratic countries (WEIRD). This likely means that their research, practice and/or experiences will be grounded in a mainstream view of language acquisition for deaf infants, summarised in a systematic review [14]. This may also explain low instances of divergence. Some caution therefore must be taken when interpreting these findings more globally.

In addition, 'professionals as experts' was the focus of this study, however parents are recognised as experts in their children's lives, and their views were not reflected here. Parents' views will feature strongly in the next phase of this larger research project, through co-production.

It is important to note the inherent limitations within Delphi studies, that are also relevant to this research project. Firstly, how survey items are designed, such as their use of abstract language and sentence length, has a proven influence on Delphi outcomes [62]. The piloting phase with a range of professional groups within our study addressed this issue to some degree. Secondly, participants were self-selecting individuals utilising their opinion to answer survey items. Individual agency, values, experiences, interpretations, agendas, and social and political climates underscore the answers given within Delphis [63]. We invite the reader to hold these limitations in mind when interpreting the results.

A limitation specific to this study was not presenting the qualitative comment summaries to participants between round 1 and round 2. Providing access to this data would have provided participants with more insight into people's thinking, which may have led to more people adapting their response after seeing new, anonymous perspectives from others. Due to the number of statements and the range of feedback received, this would have meant sending participants a lengthy document to read in between rounds. We were concerned that this would create burden for those involved and may have led to attrition. Whilst the format or length of feedback has not been investigated, it is known that a higher number of items in e-Delphis is significantly associated with reduced response in the second round [64]. We therefore opted for a six-page feedback document with a short summary page at the beginning, followed by all statements and their percentage agreement.

Finally, the a-priori consensus threshold may have been better decided upon a-posteriori, or perhaps a flexible range suggested instead, e.g., items above 80% would be considered as 'consensus achieved' and items between 75–79% would be reviewed by the authors and involvement group. The decision to choose a higher cut off for consensus was influenced by the overview of systematic reviews from Niederberger and Spranger [23] where they highlighted that lower consensus thresholds mean more participants do not agree with the consensus, risking the neglect of relevant and unusual judgements. We wanted consensus to be based on high levels of agreement between experts, but also reflect the views of our parent PPI group. In their systematic review of 30 Delphi studies, Junger and team [22] found that percentage of agreement was usually 75 or 80% but that some studies used the stability of group response over successive rounds or a cut off inclusion based on a 'natural break' in the overall scores. With hindsight, a cut off based on a natural break may have been a better choice than an a-priori figure as there was a noticeable gap between our borderline statements 75–79% and the other statements with low agreement. For the purposes of transparency, we upheld our 80% threshold, and have been clear in our reporting of the included statements where consensus was between 75–79%.

## Implications

Many of our expert participants in the e-Delphi shared their reservations on the clinical and critical tone of several of the e-Delphi items. Whilst participants agreed there is a need to identify a parent's strengths and needs, and to show and celebrate progress, there was strong suggestion for a more family-centred, collaborative, and non-judgemental approach within the assessment. Consideration of family readiness, and of the parents' emotional well-being should always be in the foreground for any PCI assessment [16]. Establishing a balanced parent/professional partnership based on compassion, openness, and trust can result in a family who are more likely to positively receive the assessment and ongoing support, and then begin to build their own efficacy [16]. We therefore remind the reader that the outcome of this e-Delphi was to gain consensus on the core content of a new assessment tool and approaches to be used. We would not advise the use of this content in its current state as there is another important phase to follow for the assessment's development: coproduction with parents of deaf children and hearing and deaf professionals.

Since sharing the findings with our PPI group, parents of deaf children have shared concerns over professionals using the terms 'assessment' and 'goal' in families' homes. Thus, coproduction work will address issues such as language-use and develop terminology and an approach for observing PCI and evidencing skill-change that is non-judgemental, and family-centred while remaining evidence-based. As can be seen in S1 Table, reworded statements were longer in almost every instance, suggesting that contextual information and/or conditional elements such as language use were important factors in increasing consensus. There will therefore be longer statements within the assessment tool.

A pilot version of the Early Parent Interaction in Deafness (EPID) Tool and manual will be created in 2024. Once coproduction phases are complete, the EPID will be piloted in early years services in England so as to test the tool's psychometrics (i.e., reliability, validity, and responsiveness). We will also look at the tool's impact on parental knowledge, self-efficacy and on professionals' competence in appraising PCI in a supportive, strengths-based way. Following EPID training of a wider group of professionals, the clinical utility of the EPID and the extent and quality of its use will be investigated. This will include reviewing the acceptability, appropriateness, applicability, feasibility, adoption, and fidelity of the EPID in different services and cultural and language contexts. Data will be gathered through observation, feedback loops and surveys. We invite professionals interested in trialling the tool, both in the UK and internationally, to contact the lead author, but acknowledge that the tool may not be universally applicable in its pilot form. For some global contexts, more situational research and consideration is required before implementing a video-based tool that is grounded in the western view of language acquisition.

Whilst the assessment tool is still in development at this point, the outcomes of this study provide practitioners, academics, educators, and parents with a list of the internationally agreed, evidence-based, parent behaviours important for PCI where the child is deaf and aged 0–3. There are also some agreed recommendations on how to achieve a best practice PCI assessment; these will assist the coproduction phase.

## Conclusion

This study recruited 83 experts in the field of deafness to agree on the core content of a tool for PCI assessment for use with parents and deaf infants. A large number of parent behaviours reached consensus including parental sensitivity, positive affect, responsivity, maintaining joint engagement, and language facilitation techniques to ensure language is accessible and / or enriched. Some recommendations were also agreed upon for how a professional might approach an assessment of PCI. These included involving and educating the parent within the review of the assessment and being collaborative about next steps (i.e., discussing and jointly deciding upon areas to improve or adapt within their everyday routines). Developing e-Delphi statements into a PCI tool will support parents and professionals to effectively identify strengths within a parent's interactions with their deaf child, leading to a more informed, empowered parent who has greater impact on their deaf child's language.

## Supporting information

**S1 Table. Reworded statements from round 1 used in round 2.**
(DOCX)

**S2 Table. Number of statements per category achieving consensus.**
(DOCX)

**S1 File. Open text responses - additional needs.**
(DOCX)

**S2 File. Open text responses - multilingual families.**
(DOCX)

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# 7: Integrated Discussion

This integrated discussion (Lewis et al., 2021) will provide an overall summary of the findings from the studies that form the thesis, as well as a brief summary of each published article. Then, nine discussion points will be explored, where content across each study will be interrelated and discussed alongside existent literature. The content of the EPID assessment tool is presented, along with recommendations on how to approach the assessment. Immediate next steps following the EPID assessment (goal setting) are also discussed.

Most limitations have already been presented at the individual article level, but some broad limitations will be discussed in this chapter. The implications of this thesis for practice and education will be outlined, along with other recommendations for future research. Finally, the chapter will conclude, with a statement on the original contribution of this integrated body of knowledge to the field of early childhood deafness and parent-child interaction (PCI) assessment.

## 7.1 Purpose

The purpose of this PhD was to develop the approach and the core content of a new PCI assessment to use with parents of deaf children aged 0-3 years.  As mentioned in chapter 1, the rationale for developing such an assessment is based in the strong evidence that suggests the quality and quantity of parental interaction predict how well a deaf child develops language (Pressman et al., 1999; Quittner et al., 2013; Holzinger et al., 2020). The tool's core content was developed in three phases. In the first phase, research on PCI which included some form of assessment used with deaf children and their parents was investigated in a systematic review (Curtin et al., 2021b). Then a mixed-methods study of PCI assessments used in professional practice was conducted (Curtin et al., 2023; 2024a). The parent behaviours and methods of assessments used in each of these two phases were extracted and presented to an expert, multi-professional panel of researchers and practitioners in order to form agreement on core items in the third phase, an e-Delphi study (Curtin et al., 2024b). Throughout each phase, a group of hearing parents of deaf children and hearing and deaf academics, practitioners and charity executives have been involved in shaping each study's design through a patient and public involvement (PPI) group.

I am the primary investigator of this clinical doctorate. I am employed as a Highly Specialist Speech and Language Therapist, and the Clinical Lead for deaf children and young people working in a community healthcare setting, within a deprived London borough. I am a native speaker of English and proficient in British Sign Language. I have worked effectively with deaf adults and have valued the education they have provided me throughout my career in deaf culture, deaf education, deaf languages, and in audism (Bauman, 2004). I am a supervisor, mentor, and educator of student and qualified SLTs. Practicing in an evidence-based manner is core to a healthcare professional's conduct (Lehane et al., 2019). Evidence based practice is defined as using the best evidence, the best practice, and encompassing patients' preferences in order to provide effective care (Aveyard, Greenway and Parsons, 2023). I value coproduction and collaboration, and wholly believe in the value of listening to and building on the perspectives of experts by experience (i.e., deaf adults and parents of deaf children). These values and beliefs, and my own ‘situatedness’ (Haraway, 1988) have underpinned how the studies in this thesis were planned, analysed, and reported.

## 7.2 Completed research

The first paper in this thesis (Curtin et al., 2021a) was a short review and opinion piece that outlined the importance of parent child interaction within a deaf child’s early years. It argued for the need to develop an assessment tool to support parents and professionals in monitoring PCI in an evidence-based and structured way. The paper also outlined the risks associated with not supporting this area, i.e., a lack of assessment may mean that PCI intervention is not tailored to each family’s context, or worse still, that PCI intervention is not offered at all.

The second paper was a systematic review (SR) with a narrative synthesis (Curtin et al., 2021b). The aim of the SR was to uncover which parent behaviours have been assessed in PCI research with deaf children aged 0-3 years over the past 40 years. The SR also identified research papers that had demonstrated associations between parent behaviours and deaf children’s language, and the methods adopted to measure and analyse PCI by researchers. Five main parental behaviours were identified. These were: attention getting, joint engagement, parental sensitivity, parental communication (accessible language and enrichment of language), and touch. In the published SR, a table was presented displaying all 61 papers with their year of publication, location, study design, levels of deafness included, number of dyads, PCI behaviour assessed, method of assessment, whether child language was assessed, and the paper’s risk of bias. The SR reported associations between child language and joint engagement in four studies, and associations between child language and parental sensitivity in seven studies. Two studies, both between-group intervention studies, reported positive effects on deaf children’s language following the training of parents in communication strategies with their deaf infants.

In terms of methods used, the main findings from the SR synthesis were that there were no measurement tools of PCI used in the 61 studies that were specifically designed for deaf children. Most PCI assessments took place in labs, with mother-child dyads. Detailed coding to analyse videos frame-by-frame was the most used method for measuring and deciphering PCI. This was because the studies were carried out by researchers rather than clinicians. Scales were the other tool used for PCI assessment. Across the 61 studies, 13 papers used validated scales and 12 used novel scales.

The third and fourth papers in this doctorate examined professional practice in assessing PCI with deaf child-hearing parent dyads (Curtin et al., 2023; 2024a). First, an 85-item, quantitative survey investigated the professional practice of 190 UK-based Speech and Language Therapists (SLTs), Qualified Teachers of Deaf Children and Young People (QToDs), psychologists, and professionals working in national deaf child and adolescent mental health services (NDCAMHS). The study aimed to find out whether professionals assessed PCI, which behaviours were assessed, which were considered the most important, and how assessments were conducted in practice. In addition, how assessment results influenced goal setting, and whether parental wellbeing was considered, were also investigated. The study also sought to examine differences in responses by professional role and hearing status. The survey study reported that 92% of the professional participants assessed PCI in their practice and the parent behaviours assessed were closely aligned with the behaviours that had been reported in research studies in the SR (Curtin et al., 2021b). The most assessed behaviours were attention getting strategies, parental sensitivity, and language enrichment. Joint engagement markers (such as number of connected turns) were assessed by fewer professionals overall. This may be because it is difficult to do, or because other behaviours such as parent responsiveness or being face to face suggest joint engagement is in action. Similar to the SR, professionals tended to assess mothers and deaf infants engaged in play-based activities, but in the home and not in labs. Professionals did not often use video recordings, but instead carried out live, sometimes covert, observations and used their own knowledge and skills to judge the quality of PCI rather than a checklist. Professionals varied in how frequently they asked families about how they felt about their child's deafness, as well as other stressors or external pressures. These are important questions related to PCI because of the prominence of negative feelings of well-being and stress in parents (Henderson, Johnson, and Moodie, 2014; Robinson, Bowman and Barker, 2023) and how these affect parent-child relationships, and deaf children's socio-emotional outcomes (Hintermair, 2006). Finally, 76% of professionals *always* set goals, but only 42% *always* set goals for parents.

The findings of the survey study (Curtin et al., 2023) assisted with the planning and design of the follow-up, qualitative study (Curtin et al., 2024a). In this study, 18 hearing and deaf professionals were sampled from the survey study and invited to attend a 90-minute, online focus group. Four focus groups were run in total with 4 to 5 participants in each. As no differences were found between various groups in terms of professional role, hearing status, or languages used at work, focus group participants were sampled purposively on a range of demographic identifiers. The qualitative study aimed to expand on and seek explanations for the survey results reported in Curtin et al., (2023). In order to understand the motivations and perspectives of professionals who use PCI assessments to inform their work, explanation-seeking 'How?' and 'Why?' questions were posed. Six themes were generated from the data. Some themes centralised the core role parents play in a deaf child's language development, and the importance of involving parents in the assessment process and in goal setting. Other themes illustrated the complexity of assessing multiple, equally important parent behaviours at one time within naturalistic PCI, as opposed to how researchers often assess one parent behaviour in detail. The qualitative data also revealed the complexity of working with a range of families of deaf children in varied contexts, e.g., working with families that have deaf children with an additional need, families that do not use English, and/or busy families with a large number of children. The professionals interviewed suggested that using video was the optimal way to accurately capture and analyse PCI. Professionals agreed that PCI assessment could only begin once the family's culture, context and the individual child were discussed and appreciated and a parent-professional alliance established, where parental wellbeing had been acknowledged. Knowing these prerequisites improved the professionals' evaluation of the PCI assessment; they were better informed on the context, the child and parent being observed, and could better analyse behaviours and interactions with additional information on areas such as cultural norms, comorbidities, or the parent's state of emotional well-being.

The final study in this PhD was a modified, electronic Delphi study carried out over two-rounds (Curtin et al., 2024b). The study included 83 international expert academics and professionals who rated 69 statements in accordance to perceived importance. These statements were generated from the previously presented studies (Curtin et al., 2021b; 2023; 2024a) and were either parent behaviours to be included in the tool or approaches to be implemented during the assessment appointment. Consensus was gained on 36 parent behaviours which were seen as essential or highly important to assess. There were a further 22 statements which gained consensus on assessment approach. Parental sensitivity and joint engagement were the parent behaviour categories that reached the highest levels of consensus. Many of the communication-focused parent behaviours centred on the parent following the child's lead and adding language contingent to their child's interests, actions, or behaviours, termed as expansion or contingency in the child language research literature (Shonkoff and Bales, 2011; Chen, Cabrera, and Reich, 2023). Whilst many of the parent behaviours were relevant for families using signed and spoken languages, there were nine parent behaviours that were reworded and then explicitly categorised into two groups: parent behaviours where the child may be relying on gesture, sign, lip patterns (i.e. visually motivated), or those more suited to children who are accessing sound and have the potential to understand spoken language. For assessment approaches, many of the highly rated statements were family centred. For example, expert participants agreed that parents should be informed and involved throughout the assessment process, and that parents should choose when and where the assessment should take place and engage in discussions around what to film (i.e. capturing the child and parent at their most communicative). It was also agreed that parents should engage in a joint review of the PCI video recording alongside a trained professional and discuss and decide on goals collaboratively. Participants felt a family-led assessment would reduce burden and improve the assessment. The parent knows the child best, and therefore may suggest times of the day and activities to use to capture more naturalistic PCI, something that would be enjoyable for them both that would provide richer data to analyse together in the joint review.

Consensus was not achieved on how to measure parent behaviours, on whether to include siblings in video recordings, and on whether to involve deaf professionals in PCI assessments. Whilst it is clear that the EPID assessment will require a method for measuring parent behaviours (see Integrated Discussion Points 7.3.4 and 7.3.5), the latter two areas mentioned (siblings and deaf professionals) may not be appropriate or necessary for all parent-child dyads in the early years. As highlighted by professionals in the focus groups study (Curtin et al., 2024a), siblings may need to be included in the PCI assessment if multiple children are at home all day and therefore PCI with the deaf infant sits within a busier dynamic. It could be just as useful to assess the parent's interactions with only the deaf child, if the parent is able, and so the lack of consensus on siblings is understandable. Lastly, not all parent-child dyads will require (or be provided with access to) a qualified deaf professional to assess their PCI.

## 7.3 Integrated Discussion Points

### *7.3.1 Addressing the void*

Across all three phases of this thesis, a deaf-specific, PCI assessment that focuses on the parent's behaviours within the interaction was not discovered. In the SR (Curtin et al., 2021b), the most common tool to assess PCI across all the research papers was the Emotional Availability Scales (EAS, Biringen, 2008). The EAS is comprised of six Likert subscales, four that evaluate the parent's skills in non-hostility, non-intrusiveness, structuring and sensitivity, and two that evaluate the child's responsiveness and involvement of the adult. The EAS was used in 7 of the 13 papers that utilised validated scales in the SR. Whilst the EAS is widely used with hearing and deaf populations (Lotzin et al., 2015), its psychometric properties have come into question with researchers suggesting the scales within are not empirically discriminable (Aran et al., 2022; Müller and Elvert, 2024). Ten studies from the SR used their own novel scales with constructs similar to those measured by the EAS, such as the rating scale on mother-child interaction (Meadow-Orlans and Steinberg, 1993), the Mother and Child Interaction Analysis (Choo and Dettman, 2016), and the Maternal Sensitivity Rating Scale (Abu Bakar, Brown and Remine, 2010). There was variable and limited information provided by researchers on how these measures were developed and tested. Research measures of PCI are not appropriate for use in practice as researchers often prioritise scoring to facilitate comparisons between samples, between skills (i.e., cognition and language), and/or between assessment measures. The tools used are not designed with practitioner priorities such as joint PCI assessment reviews, goal setting discussions, or intervention provisions in mind.

In the survey study (Curtin et al., 2023), participants listed many formal checklists and scales used in their practice, such as the Autism Diagnosis Observation Scale (Lord et al., 2012) or the Rosetti Infant Toddler Language Scale (Rosetti, 2006). These are not designed to measure parent interaction. Similarly, the therapy checklists listed by some survey participants such as Hanen (Manolson, 1992) and Palin PCI (Kelman and Nicholas, 2020) are not assessment tools, but rather lists of principles to work through in intervention. Further, these checklists were not designed with deafness as a focus. In the focus groups study (Curtin et al., 2024a), the most common resource mentioned was a camera to record PCI, but no further assessment tools were discussed.

In the e-Delphi study (Curtin et al., 2024b), a large sample of international, multi-professional experts completed rounds one and two. Many respondents left encouraging comments to suggest that the output of this thesis will begin to address a void in research and practice where there is a lack of evidence-based, deaf-specific, parent-focused measures. As outlined in 1.7 of the introductory chapter, as PCI is so important for a deaf child's developmental outcomes, it is essential to have valid and reliable tools to monitor it. An evidence-based assessment tool would assist parents and professionals with identifying strengths and needs, and with developing individualised family-centred goals. The multidisciplinary group for Family-Centred Early Intervention for children who are Deaf or Hard of Hearing (FCEI-DHH) have recently expanded and updated their core principles (Moeller et al., 2024a). They recognise that families are the constant in their deaf children's lives and that practitioners should seek to understand and build on the family's existing strengths and provide support to address family-identified goals (Moeller and Szarkowski et al., 2024b). The EPID assessment tool could be the first step of a family's support package, as it centres the parent's role in their child's development, it involves them in the assessment process, identifies strengths, and stimulates goal-setting discussions. The EPID assessment will also be deaf-specific which is important because it will include parental behaviours that do not feature in hearing PCI (Roberts and Kaiser, 2011; Gridley et al., 2019). Parent behaviours specifically for deaf children centre around attention getting, synchronicity in joint engagement, and language access (e.g., being face to face, near to amplification devices). In the next four discussion points, the behaviours to be included in the tool and a method of assessing these behaviours will be outlined.

### *7.3.2 Parent behaviours*

PCI is a naturally occurring, often intuitive, phenomenon that takes place between all caregivers and their children. Researchers have identified variability in PCI quality in the hearing population and have found associations with children's language development outcomes (Hoff and Laursen, 2019). A similar focus has occurred in hearing/deaf dyads, but in studies with fewer participants due to the low incidence of childhood deafness. Many of the parent behaviours identified across the included studies (Curtin et al., 2021b, 2023, 2024a) are the same for hearing parent-child dyads (Roberts and Kaiser, 2011; Gridley et al., 2019), with a few exceptions as mentioned above (i.e., attention getting, joint engagement, and language access behaviours). As mentioned in 1.4 of the Introduction chapter, the quality of a parent's interactions is just one factor implicated in deaf children's language acquisition. A child's level of identified deafness, cognitive abilities, and social-communicative competence are examples of additional factors that will influence outcomes (Boons et al., 2012; Wiggin et al., 2021).

The parent behaviours assessed by UK professionals working with deaf children and their families, i.e. naturalistic PCI (Curtin et al., 2023; 2024a), were aligned to those identified within research contexts (Curtin et al., 2021b). These were categorised as: parental sensitivity; joint engagement; attention getting; and access to, and enrichment of, language. It is important to include and monitor these behaviours within the EPID assessment as each domain will assess whether the parent is receiving and responding to the socio-emotional, cognitive and language needs of the deaf child. There are strong associations between these parent behaviours and deaf children's language outcomes (Pressman et al, 1999; Desjardin, 2003; Yoshinaga-Itano, 2003; Ambrose et al., 2015; Holzinger et al., 2020). Within this integration point, the findings related to parent behaviours from each of the studies will be triangulated and the relationships between them explored, including why they are important for child language development.

Parental sensitivity emerges as important across all four of the completed studies and should feature as a core component of the proposed EPID assessment tool. Almost half of the studies in the SR considered parental sensitivity, more than 85% of professionals assessed it in practice, and more than 91% of e-Delphi experts considered it an important domain to monitor in families with deaf children (Curtin et al., 2021b; 2023; 2024a; 2024b). The umbrella term 'parental sensitivity' has been adopted from Bowlby (1969) to refer to domains that comment on a parent's positive affect, availability, responsiveness, emotional attunement, consistency in interaction, and level of structure or control. Much research relates these parenting skills with positive language outcomes in both hearing (Raab et al., 2013) and deaf children (Pressman et al., 1998; 1999; Quittner et al., 2013; Ambrose, 2016; Quittner al., 2016; Dirks and Rieffe, 2019). Professionals in the focus groups study explained: 'Without that involvement and interest and emotional availability, I think it's difficult to focus on any [other] skill' (Curtin et al., 2024a, p.11). Parental sensitivity is important for language because it means a parent will modify their interaction style in response to the child's developmental needs. They will coordinate opportunities for connection and language learning, in a timely manner, directly linked to the child's attention and interest (Tamis-LeMonda, Kuchirko, and Song, 2014). Some evidence suggests parental sensitivity has a larger positive effect on the language of deaf children compared to hearing children (Pressman et al., 1998).

The next important domain to include in the EPID assessment is joint engagement. This featured in a fifth of the papers in the SR, was assessed by more than 68% of professionals in the survey study, was regularly discussed as important in the focus groups study, and more than 84% of e-Delphi experts formed consensus on its inclusion (Curtin et al., 2021b; 2023; 2024a; 2024b). Throughout the thesis, 'joint engagement' has been used as a synonym for inter-subjectivity, shared intentionality, and joint attention. Joint engagement is defined as the state of mutual focus between the parent and the child (Dunham and Moore, 1995). In the SR (Curtin et al., 2021b), there were differentiations in the papers between supported joint engagement (SJE) and coordinated joint engagement (CJE). SJE is where the parent works hard to follow the child's lead by waiting, watching, and responding to them. CJE is coordinated mutual focus between parent and child, i.e., the child also helps to maintain the interaction. In the survey study (Curtin et al., 2023), 68-71% of professionals assessed the length of joint engagement or the number of turns, but slightly higher numbers (79%) assessed whether the PCI was SJE or CJE. In the focus groups study (Curtin et al., 2024a), balanced communicative turn taking and waiting for the child to initiate first were viewed as important to assess within PCI for deaf infants. Research suggests a focus on SJE rather than CJE is more important. Evidence from a hearing sample found that SJE in PCI had positive associations with hearing children's expressive and receptive language scores at 24 and 36 months (Conway et al., 2018), but not at 48 months. CJE did not have these associations. SJE may therefore provide the optimal language learning environment for a child up to the age of 36 months. SJE is much less cognitively taxing for the infant because the parent takes on the majority of 'the work' by following the child's lead and sharing the child's interest (Bakeman and Adamson, 1984). Coordinated attention (CJE) is a skill that the child acquires later i.e., 18-36 months (Cejas et al., 2014).

SJE is also referred to as 'serve and return interactions' (Chen, Cabrera and Reich, 2023), where the child takes the lead in 'serving' a verbal or visual turn, and the parent 'returns' a verbal or visual response. Chen, Cabrera and Reich' (2023) definition of 'serve and return interactions' also includes 'promptness' (a response by the parent that is close in time to the child's initiation, i.e. 2-3 seconds) and 'meaningful' (i.e., semantically relevant responses to the infant's interest/action/gaze/language). They found that prompt and meaningful serve and return interactions contributed to early language development in their sample of 148 hearing families that diversified by ethnicity and social-economic status, clearly showing the universal need for a child to receive a prompt, contingent response to their communication attempts (ibid). If we look to SJE (prompt and meaningful serve and return interactions), we see conceptual overlap between joint engagement and some aspects of parent sensitivity. Prompt parental responses that are contingent and meaningful to a child's interests, actions, or utterances would present as joint engagement. Likewise, a parent who is actively present with their child, waits for the child to lead with an initiation, and takes balanced turns, would be a non-intrusive parent, partaking in supported joint engagement. Non-intrusiveness in hearing mothers of deaf children is positively associated with instances of joint engagement, and with deaf children's receptive and expressive language (Dirks and Rieffe, 2019). These findings therefore suggest that parent behaviours that observe joint engagement and *some* elements within parental sensitivity (i.e. non-intrusiveness, contingency) may be the same conceptually. The relationship between items in the EPID assessment tool will need to be tested empirically within a trial phase. This is discussed further in the next section (7.3.3).

Joint engagement can present differently when comparing parents with deaf children and parents with hearing children. The parent of a deaf child needs to show particular synchronicity to a deaf child's attention in order to remain jointly engaged (Morgan, Curtin, and Botting, 2021). This has potentially different dynamics to the same behaviour in a hearing child-hearing parent dyad. A hearing child can centre their gaze on objects and still benefit from the auditory language input provided by their parent during SJE and /or CJE. The parent of a hearing child does not need to consider whether their child-directed language is accessible or perceivable. A child's attention is the core mechanism that underlines parental contingency and language learning (Masek et al., 2021). From four to six months, an infant's attention allows them to engage in contingent interactions and also enables the contingent input to lead to learning, because their parent's synchronous and responsive input heightens and focuses their attention (ibid). Having a deaf child can alter the typical patterns of PCI seen in both SJE and CJE. Hearing parents are less successful in establishing and maintaining episodes of joint engagement with their deaf children (Dirks and Rieffe, 2019) and as a result, deaf children use less language (Gale and Schick, 2008; Barker et al., 2009).

Establishing and maintaining joint engagement is more difficult because the parent must be very sensitive to the deaf child's visual and auditory attention and provide contingent, synchronous language input when their child is looking and/or listening (Houston, 2022). For deaf children using spoken language, speech perception in a noisy listening environment adds another layer of difficulty in terms of attended-to language, indeed, speech in noise has been deemed inaccessible (Majorano et al., 2021). For deaf children developing signed languages, a parent must be asynchronous and ensure the child perceives the sign, any visual referents (eye gaze, pointing) and the real object sequentially, all through their visual channel of attention (Lieberman, Finch, and Borovsky, 2022). Gaining the child's visual attention is a common strategy used with deaf children developing spoken and signed languages (Loots, Devisé, and Jacquet, 2005; Wille, Van Lierde, and Van Herreweghe, 2019; Lammertink et al., 2022). Deaf infants (pre cochlear implant) have been shown to sustain visual attention longer than hearing children (Monroy et al., 2019) and research shows deaf children develop sophisticated skills in switching visual attention between their parent and objects (Lieberman, Hatrak, and Mayberry, 2014). Similar to hearing children, attention is the core mechanism for language learning (Masek et al., 2021), but the parent of a deaf child must gain skills in 'the dance' of joint engagement, i.e., following the child's lead and providing language that is accessible and attended to by the deaf child. One strategy that can help a parent achieve this is by looking at the deaf child's face.

'Parent and child mutually face watch one another' was a behaviour that gained consensus in round 1 of the e-Delphi study (Curtin et al., 2024a). It did not require review or revision, suggesting that face watching, no matter the language mode, is important for all language learning (Curtin et al., 2024b). Mutual gaze or joint looking was a parent-child interaction behaviour that featured across all studies in this thesis. In the SR (Curtin et al., 2021b) it was linked to two categories: attention getting (14 papers) and joint engagement (12 papers). Many papers assessed the methods used by parents to gain their deaf child's attention; six of these also examined the child's eye gaze back to the parent. Eye contact and eye gaze help all children sustain and control their attention (Niedźwiecka, Ramotowska, and Tomalski, 2018) and learn visual and linguistic information about their environment (Çetinçelik, Rowland, and Snijders, 2021). However, as outlined in the previous paragraphs, mutual gaze is even more important for language learning in deaf children. Eye contact and eye gaze can also be a marker for joint engagement, but it is fleeting and developing in the early months and can vary among deaf children with additional needs. As a way of accounting for variability in eye contact with younger deaf infants and those with additional needs, professionals in the focus groups study shared that assessing or expecting 'mutual face watching' was sufficient because maintaining eye contact with young infants could be a challenge (Curtin et al., 2024, p.11).

To conclude this section on joint engagement, assessing whether a parent is face watching their deaf child is important for two reasons. First, a parent who is looking to the child and monitoring their interests, eye gaze and actions, will use these child's initiations as opportune moments to remain jointly engaged and provide prompt contingent responses or language. Secondly, monitoring the child's gaze helps the parent time their own language input (be it vocal and/or visual) better, aiming for their contributions within the PCI to be accessible, attended to, and perceived by the child. Professionals in the focus group study (Curtin et al., 2024a) shared that mutual face watching was rarely present in initial PCI assessments with deaf infants. Often parents had not made the link between the child being in a position where they could look to the parent in order to access and perceive language. This behaviour often needed explicit discussion and modelling in therapy so face watching is certainly a skill to assess.

E-Delphi participants agreed most behaviours were deemed important for all families, regardless of the language(s) used. How the deaf child's attention is gained was one area that *did* require explicit re-wording in order to acknowledge how the language preference(s) of a family may impact which strategies are assessed. Professionals using the EPID assessment should select the attention-getting behaviour(s) relevant to each family's language choices (i.e. auditory attention getting strategies for families using listening and spoken language, or visual attention getting strategies for families using sign or for children who are more visually motivated). In the SR (Curtin et al., 2021b), the largest grouping of children, in terms of child communication mode, was 'spoken and signed language'. Where a family is aiming to develop skills in signed and spoken languages, it may be that both visual and auditory attention getting behaviours remain relevant.

One particular method for gaining attention identified in the SR (Curtin et al., 2021b) was the parent waiting for the child to look before communicating. This behaviour was frequently assessed in the professionals' survey study (97%) and professionals in the focus groups study explained that not much language would be perceived by the child if joint looking was not present (Curtin et al., 2023; 2024a). Professionals appeared to prefer this attention getting method as it was less directive than other visual attention getting strategies such as waving in the child's visual field. As outlined in the paragraphs above on joint engagement, mutual face watching is seen as an essential behaviour to assess for all families. Many scholars would argue that facial expressions and lip patterns are universal and inherent for learning any spoken and/or signed language (Reilly and Bellugi, 1996; Sueyoshi and Hardison, 2005; Sutton-Spence, 2007; Zwanziger, 2021). However, e-Delphi participants wanted to also acknowledge that not all deaf children require a parent to *pause* their communication until the child is looking. In their qualitative feedback in this section, e-Delphi participants shared views such as: this may be important initially but as a deaf child develops (and starts using their hearing equipment effectively) always looking to the parent may be less essential; permanent eye contact is not typical for any form of PCI; and it depends on the child, the equipment use, the situation and the listening environment. As above, the practitioner should therefore include the attention-getting parent behaviours that are relevant for each individualised assessment, based on the child, the family, and the context being observed.

Visual and auditory attention getting strategies both gained consensus in the e-Delphi study once they had been re-worded to acknowledge the family's communication preferences. Tactile attention getting strategies did not reach consensus in the e-Delphi study (Curtin et al., 2024). Expert panellists in the e-Delphi study shared concerns about a child being overwhelmed if the parent used visual, tactile, and auditory methods to gain a deaf child's attention (Curtin et al., 2024b). Despite their prevalence in research contexts (Curtin et al., 2021b), tactile attention getting behaviours are perhaps too intrusive, especially if an auditory bid or visual bid can achieve the same outcome. Further, with a strong focus on following the child's lead and responding to a child's initiations, *all* these attention getting bids may have less focus when the EPID assessment tool is being trialled.

The next four behaviours focus on how a parent makes their language accessible or perceivable to a deaf child. The first is the parent using infant-directed language (speech or sign). This was assessed by 95% of professionals in the survey study, was also discussed in the focus groups study, and achieved consensus of 89% from the expert panellists in the e-Delphi study (Curtin et al., 2023; 2024a; 2024b). Deaf infants with cochlear implants show reduced attention to speech compared to hearing peers (Houston et al., 2003). Infant directed speech enhances deaf infants' attention to spoken language and greater rates of enhanced attention to infant-directed speech is correlated with higher receptive and expressive language scores (Wang, Bergeson, and Houston, 2017). In wider hearing research, we see that infant directed facial expressions (used with infant directed speech) sustains interest (Kim and Johnson, 2014). Infant-directed sign also attracts and maintains babies' attention more than adult-directed sign (Masataka, 1997; Mayberry and Squires, 2006). Therefore, regardless of the language(s) used, a parent's ability to be infant directed (using their face, speech and/or sign) is important to assess.

‘Proximity to the child’ and ‘using appropriate voice volume’ were parent behaviours linked to language access suggested by the professionals in the survey study (i.e. uncovered in practice and not in research). Both of these behaviours achieved consensus in the e-Delphi study, along with ‘being within two metres of the listening device’ (sourced from the SR, Curtin et al., 2021b). Proximity to the child was seen as important for all deaf children regardless of language(s) used in the home. To achieve consensus in round 2 of the e-Delphi study, voice volume and closeness to the amplification device needed additional wording added, i.e., ‘only appropriate for parents whose children are developing skills in spoken language and listening’.

Language enrichment was the final feature that emerged as core across all of the completed studies. Examples of language enrichment behaviours include the parent commenting on the child’s play or rephrasing a sentence with correct grammar. These were highly assessed by professionals in practice, and almost all parent behaviours that centred on language enrichment gained consensus in the e-Delphi study (Curtin et al., 2023; 2024a; 2024b). In keeping with the behaviours already discussed around responsiveness, contingency, and supported joint engagement, many of these language enrichment strategies were explicitly linked to the child’s gaze, actions, behaviours, or utterances. Therefore, it may first be important to assess whether the parent is attempting SJE, i.e., whether they are observing their child’s eye gaze, actions, and initiations, and then whether they are using language to build on the child’s initiations. In the next discussion point, a progression is proposed from assessing skills in parental sensitivity and joint engagement towards language facilitation. This is not to suggest that language enrichment is a less important feature of successful parent-child interaction. Parental language enrichment is an essential element to aid language development in deaf children, but it is most effective when the parent’s language is contingent to the child’s actions and interests.

There is a strong relationship between parent behaviours that focus on child language enrichment and deaf children’s language (Holzinger et al., 2020). In their systematic review focusing on deaf children (who wear cochlear implants and use spoken language), there were seven papers that reported this relationship (ibid). A meta-analysis on four of these studies (cumulative sample size = 176) found that higher level facilitation language techniques (HL FLTs) significantly predicted the growth in deaf children’s expressive language and accounted for 31.7% of the variance in child language scores. HL FLTs are parent responses to the child’s utterances through expansions, recasts, describing, commenting, and open-ended questions (Desjardin, Ambrose and Eisenberg, 2009; Rüter, 2011; Cruz et al., 2013; Szagun and Schramm., 2016). All of these HL FLTs feature in the EPID assessment tool as they were also uncovered in the SR, in the studies on professional practice, and reached consensus in the e-Delphi study (Curtin et al., 2021b; 2023; 2024a; 2024b)

Training parents in the use of HL FLTs shows significant differences in the communication skills of their deaf children compared to children whose parents were not trained (Roberts, 2019; Nicastri et al., 2021; Brock and Bass-Ringdahl, 2021). Therefore, there is a need to assess these behaviours within the EPID assessment and use the joint review with parents as an opportunity to discuss them in depth, using the video recording and supporting research.

### *7.3.3 The proposed EPID Assessment*

PCI assessments in practice are not conducted by observing one parental behaviour at a time, but instead through live, multi-simultaneous, skill observations (Curtin et al., 2023; 2024b). Therefore, selecting the single most important behaviour in PCI is not necessary, or perhaps possible. In the previous discussion point, it was proposed that a core set of parental behaviours should be prioritised in assessment for all families of deaf children aged 0-3 years, regardless of the languages used at home. With this in mind, the initial structure of the EPID assessment is presented in Table 7.1. This structure comprises of three sections: core parent behaviours, language enrichment behaviours, and communication-specific attention getting and language access behaviours. The structure presented in table 7.1 will be further refined by future research.

**Table 7.1: The Initial Structure of The EPID Assessment Tool**

| **A: EPID Core Parent Behaviours** | | **E-Delphi source** |
|---|---|---|
| A1 | Parent and child mutually face-watch one another | PB6 |
| A2 | Parent physically positions themselves at the child's level | PB20 |
| A3 | Parent tunes in and adapts to the child's emotions and behaviour | PB17 |
| A4 | Parent is genuinely interested | PB14 |
| A5 | Parent supports joint engagement by noticing their child's interests, behaviours, and language | PB9 |
| A6 | Parent pauses or waits to give time for the child to initiate | PB10 |
| A7 | Parent follows their child's lead, i.e., non-intrusiveness | PB15 |
| A8 | Parent predominantly strives for a positive and consistent connection with their child | PB19 |
| A9 | Parent shows enthusiasm and warmth | PB13 |
| A10 | Parent turns are balanced in length and frequency, and connected in topic to a child's previous action or language | PB11 |
| A11 | Parent interprets the child's initiations and makes prompt, on-topic responses using behaviour or language | PB16,<br>PB12<br>PB26 |
| A12 | Parent interacts with pace, play, and language that is appropriate for the child's developmental stage | PB18<br>PB39 |
| A13 | Parent uses praise / encouragement | PB38 |
| A14 | Parent uses appropriate child-directed language, e.g., exaggerated or tuneful intonation, exaggerated facial expressions, gesture, a larger signing space | PB new |
| A15 | Parent watches and waits when the child looks away, to allow the child to explore, to take a rest from interacting, to take a turn in initiating | PB7 |
| **B: EPID Language Enrichment Behaviours** | | |
| B16 | Parent expands on their child's language by adding 1 or 2 more words or signs | PB31 |
| B17 | Parent balances open questioning with on-topic comments | PB34 |
| B18 | Parent uses a range of different word types, i.e., nouns, verbs, adjectives | PB27 |
| B19 | Parent labels, describes or comments on objects, actions, and/or pictures | PB24,<br>PB25 |
| B20 | Parent alerts child to, or explains, environmental sounds | PB8 |
| B21 | Parent uses repetition of their and/or their child's language, gesture, or vocalisations | PB35 |
| B22 | Where contextually and pragmatically appropriate (developmental stage / relevant moment), parent uses mental state verbs (i.e., 'like', 'know', 'think') within the interaction | PB28 |
| B23 | Parent offers and labels choices | PB36 |

| | | |
|---|---|---|
| B24 | Parent uses open questions in favour of closed questions | PB30 |
| B25 | Where necessary or possible, parent informs the child of next steps or a change using a range of visual cues appropriate for the child's understanding, i.e., parent leaving the room for water | PB29 |
| B26 | Parent models the correct grammar back to a child, based on what they have just said. For example, the child says, ‘Teddy eat’ and the parent would say ‘Yes, Teddy is eating’. There is no expectation the child will repeat back what the parent has said. The rephrase should be developmentally appropriate and parents should avoid overuse of this behaviour | PB32 |
| **C: EPID Attention-Getting and Access to Language** | | |
| The following six parent behaviours will be influenced by the child’s hearing status, their access to spoken language (over distance/over noise), the use of their audiological devices and/or may depend on the family’s communication preferences. The first two parent behaviours may be particularly relevant for children who are using sign language, or for those who are using spoken language and benefit from access to lip patterns and facial expressions. The final four may be more relevant for children who are developing skills in listening and spoken language. | | |
| C27 | Where the child benefits from access to lip patterns, facial expressions, and/or visual perception of sound, parent actively waits or pauses their communication until their child looks at them | PB5 |
| C28 | Parent uses visual attention-getting strategies, e.g., moving into the child’s visual field | PB1 |
| C29 | Parent uses auditory attention-getting strategies, e.g., using the child’s name | PB2 |
| C30 | Parent uses appropriate voice volume | PB21 |
| C31 | Parent mostly positions themselves within 1 to 2 meters of the child’s amplification device(s) where possible | PB22 |
| C32 | In earlier stages of development, parent makes accompanying sounds to the child’s action / toys / items. | PB23 |

To create the framework above, guidance was sought from the Consensus-based Standards for the selection of health status Measurement Instruments (COSMIN) (Mokkink et al., 2018) and from Swan et al.’s (2023) ten-step process to develop and validate a new measurement instrument. To begin, the included parent behaviours from rounds 1 and rounds 2 of the e-Delphi study (Curtin et al., 2024b) were combined and ordered by percentage of agreement. The parent behaviours with the highest levels of agreement were parental sensitivity and joint engagement. Attention getting, language access, and language enrichment followed in a mixed order. The wording of the parent behaviours agreed upon in the e-Delphi study has been retained.

Parent behaviours that were interchangeable and synonymous in meaning were combined in three instances (see table 7.2 below). This synthesis reduced the number of parent behaviours from 36 to 32. Whilst there are other behaviours in the framework that likely overlap, similarity between items is advised (Swan et al., 2023) and is a desirable feature of the early stages of scale item generation (Streiner and Norman, 2015). Multiple similar items support good coverage of the target construct (DeVellis and Thorpe, 2021). Future field-testing will lead to item reduction based on statistical analysis and user feedback (De Vet et al., 2011).

Table 7.2: Newly constructed parent behaviours for the EPID assessment

| EPID Item (see Table 1) | Newly constructed EPID parent behaviour | E-Delphi Study Source Statements |
|---|---|---|
| A10 | Parent interprets the child's initiations and makes prompt, on-topic responses (verbal or visual). | PB16: Parent responds to their child with on-topic behaviour or language (responsivity and/or contingent talk<br>PB12: Parent waits and watches their child's behaviours and gaze, using the child's cues to tailor the language they will use<br>PB26: Parent interprets their child's behaviour with language |
| A12 | Parent interacts with pace, play, and language that is appropriate for the child's developmental stage. | PB18: Parent interacts with appropriate pace, play, and language for the child's age/stage, i.e. structure and stimulation<br>PB39: Parent provides language input that is appropriate to the child's developmental stage |
| B19 | Parent labels, describes or comments on objects, actions, and/or pictures | PB24: Parent labels items<br>PB25: Parent comments on, or describes an action, an object, or a picture |

As previously mentioned, parent behaviours were ordered in the framework in accordance with percentage agreement in the e-Delphi study (Curtin et al., 2024b). There were three exceptions to this. Firstly, PB6 ('parent and child mutually face-watches one another') and PB20 ('parent physically positions themselves at the child's level) gained the consensus of 84% and 83% of experts and therefore appeared lower in the list. These behaviours have now been moved to the top of the EPID assessment (and listed as 'A1' and 'A2') because they both signal closeness, connection, balance, and the proximity required for subsequent behaviours such as parental sensitivity, joint engagement, and monitoring a child's gaze. Similarly, PB7 ('parent watches and waits when the child looks away, to allow the child to explore, to take a rest from interacting, to take a turn in initiating') was also moved higher on the EPID assessment list (now listed as 'A15') as this behaviour is interlinked to non-intrusiveness, to emotional regulation, and to following the child's lead.

The idea of different items or dimensions on scales having more weight than others is decided upon by researchers guided by empirical evidence, statistical modelling, selected by patients in consensus procedures, or through feedback in pilot testing (De Vet et al., 2011). As per the synthesis in section 7.3.2, the first fifteen behaviours that centre on parental sensitivity, joint engagement and the parent's physical positioning are core. These are listed in Table 1 as 'Core Parent Behaviours' (items A1 to A15). Whilst they may not hold a greater weight in terms of scoring when the tool is developed, it is proposed these behaviours appear first in the EPID assessment. These first fifteen behaviours can be assessed in a range of home-based parent-child activities. In the literature they have strong correlations with child language (Pressman et al., 1999; Gale and Schick, 2008; Quittner et al., 2013; 2016; Ambrose, 2016; Dirks and Rieffe, 2019) and had high levels of agreement in the e-Delphi study (Curtin et al., 2024b).

Following the core behaviours, 11 more parent behaviours are listed in Table 1 under 'B: EPID Language Enrichment Behaviours' (items B16-26). These are facilitative language techniques that achieved consensus in the e-Delphi study (Curtin et al., 2024b) and are seen as important for both spoken and signed language development (Desjardin, 2006; Quittner et al. 2013; 2016;

Roberts, 2019; Nicastri et al., 2021). In practice, SLTs and QTODs would not expect nor advise a parent to demonstrate all of these language behaviours at one time. The developmental stage of the child and the type of activity being observed would likely lead to specific language facilitation behaviours being assessed.

When an infant's attention leads the interaction, parents' contingent responses have a better chance to support language learning (Yu and Smith, 2016; Masek et al., 2021). Therefore, the EPID assessment framework begins with assessing connection, non-intrusiveness, and responsivity to ensure that contingent language facilitation follows. The division of the EPID tool into A and B sections is to make it clear to professionals and parents using the assessment that parent language that is not child-led or child-centred has reduced effectiveness.

Following sections A and B in Table 1, the final six parent behaviours are presented (section C). These behaviours either focus on getting the deaf child's attention or improving the child's access to language. All six of these parent behaviours achieved consensus in round 2 (80-89%) once the statements had a disclaimer that they may not appropriate for all families. Some are more appropriate for families who are focused on their deaf child's listening and spoken language skills (i.e., C29 – C32: auditory attention-getting strategies, appropriate voice volume, proximity to audiological device, and making accompanying sounds to the child's action), whereas the other two may be useful for those using sign language or taking a bimodal-bilingual approach (i.e., C28: visual attention-getting behaviours and C29: the parent actively waiting or pausing their communication until their child looks).

### *7.3.4 Measuring parent behaviours*

The approaches employed to assess parent-child interaction across research and practice are very different. In research, as synthesised in the SR (Curtin et al., 2021b), groups of parents and their children were video- and audio-recorded interacting in the same room in a lab, with a standard set of toys. These video clips were uploaded into software such as ELAN (Max Planck Institute) for frame-by-frame, detailed analysis and a code or a scale score was added. The recordings analysed were, on average, nine minutes in duration. Often, a proportion of these videos were viewed and scored by an additional, independent rater to ensure the methods used for coding or scaling were reliable.

In contrast, in practice, professionals made informal observations at opportune moments where the parent and child were interacting (Curtin et al., 2023; 2024a). They made a mental or live note and used their own skills and knowledge to make a judgement on the quality of the PCI. For professionals who used filmed recordings to assess PCI (22%, *n* = 33), film recording length was generally between 3 and 5 minutes with the same length of time watched in analysis (Curtin et al., 2023). These differences exist due to the range of drivers behind each context. In research, where often theories are being tested or interventions are being trialled, controls are in place in order to improve the rigor of the study and the validity of the resultant findings. In practice, time-poor professionals aim to balance a range of factors in families' lives. Without a PCI assessment available, using and relying on informal observations appears to be the favoured method for quickly identifying needs in order to select a suitable intervention.

There was considerable agreement on PCI assessment approaches in the e-Delphi study (Curtin et al., 2024b), such as the use of video, recording up to 10 minutes of PCI, assessing PCI in the home, and including the parent in the joint review of the PCI recording. One area that did not achieve consensus, however, were the methods to use for measuring the parent behaviours. Expert panellists were asked to rate two statements that proposed how to measure parent behaviours, one suggested the use of scales and the other suggested a checklist. Neither statement achieved consensus in round 2, scoring 63% and 57% respectively. Consensus studies aim to identify clustered opinions (Birko, Dove and Ozdemir, 2015) and are a well-used methodology in assessing the content validity of health measurement scales (Terwee et al., 2018), but a lack of consensus does not necessarily equate to 'the wrong answer'. Following the advice of Hasson, Keeney and McKenna (2000), a lack of consensus can instead raise items for debate and help to structure deeper discussion. Conversely, consensus gained may also not necessarily mean 'correct', but could mean 'collective ignorance' (Shang, 2023). For this doctorate, the purpose of the delphi was to ensure items included were deemed relevant, comprehensive and comprehendible to an expert audience. Further field testing, psychometric studies, and evaluation will determine which items are truly the most essential in the assessment of PCI.

Returning to 'how to measure PCI', for scales, the e-Delphi panellists expressed caution on how judgemental and formal the scale might feel for a parent, suggesting that a scale could be too deficit-based, as it would highlight absent or barely established skills to a parent. Generally, established assessments for PCI in the hearing population are judgemental in nature because the scale is not usually accessed by the parent being observed. For example, the scale responses used in the 'Parenting Interactions with Children: Checklist of Observations Linked to Outcomes' (PICCOLO, Roggman et al., 2013) are 'absent', 'barely' and 'clearly'. The PICCOLO assessment is administered and scored by the assessor with some verbal feedback on scores and what to consider next suggested to the parent (Rohrman, 2020). Likewise, in Palin PCI for children who stammer, the PCI assessment video and summary chart for analysis is for the practitioner, who evaluates a parent's use of helpful strategies by ticking (or not ticking) an evidence box for each parent behaviour (Kelman and Nicolas, 2020). For the EPID assessment, it has been agreed that parents will have access to the scale and be present for the review of the video, so e-Delphi panellists' concerns about judgemental response options are worth attending to in future test development.

Regarding the use of checklists to measure parent behaviours, e-Delphi panellists also shared concerns about testing the parent, and that one would not expect a parent to demonstrate all 32 behaviours within one assessment video, and so striving towards a total score (i.e., all behaviours ticked) may not equate to the highest possible quality of PCI. Others shared that ticking a skill as present/not present does not provide information on quality, frequency, or the potential for improvement. Checklists did not feature in the SR (Curtin et al., 2021b); scales and coding were the only measures used for assessing PCI. This may have been because researchers prefer a more detailed coding method, and checklists (present/not present) are too restrictive or reductive and could lead to missing information. In addition, it may be that checklists do not show enough of a range of skill and therefore could place too many parents at ceiling, meaning the data collected is not sensitive to correlation tests.

Measurement instruments with a discriminative purpose require a discriminative function, i.e., the ability to change options on the measure as skills or status improves longitudinally (Guyatt et al., 1992). In line with this, the EPID assessment will require an ordinal scale that can reliably assess parent behaviours and capture change over time. A suggestion made both by an e-Delphi panellist and by the EPID parent partner group was for the family's SLT or QTOD to select the skills observed in the video and then for the parent and professional to assess each of the behaviours present on a scale. This approach would then eradicate other e-Delphi panellist concerns about deficit models, as parents would only be scoring themselves on behaviours observed, therefore moving towards an asset-based, therapeutic assessment approach. Parents have also suggested the assessment should function as a phone or tablet application, for ease of access and sharing with other family members. Further coproduction work with parents and professionals will be needed to decide on the acceptable wording to be used within the ordinal scale (particularly the response items), and on how to use the EPID assessment sensitively in critical situations where a parent is not demonstrating any or many of the important behaviours expected or relevant for a deaf child. Testing and coproduction will also help inform whether a useful EPID score could be generated for a professionals' needs in progress monitoring.

### *7.3.5 Defining and measuring joint engagement behaviours specifically*

All the behaviours within the EPID assessment need to be clearly defined and reliably interpreted. As such, the EPID assessment will have a manual and an associated training course. Many of the parent behaviours in the EPID assessment are straightforward to observe. For example, 'parent using praise / encouragement' can be observed through non-verbal communication and body language (touch, head nods, smiles, and/or raised eyebrows) as well as through signed or spoken language. Likewise, 'parent tunes in and adapts to the child's emotions and behaviour' can be observed through positive affect on the parent's face, touch, or the use of tone or facial expression to match or soothe the child's emotional state. However, some of the parent behaviours linked to joint engagement are more abstract. This may lead to difficulties with reliability if professionals differ in their definitions of the concept. Findings from this doctoral study point to the need for emphasis on contingency and connectedness to be made explicit with regards to joint engagement.

In the SR (Curtin et al., 2021b), joint engagement was defined in three ways: by three seconds of mutual focus, by an interaction where the child responds to the parent within five seconds, or where there are three to four connected turns between the parent and child. Correlations between lengths of joint engagement and a deaf child's language outcomes have been discussed in 7.3.2. Items such as 'parent maintains joint engagement' and 'parent engages in balanced communicative turn taking' were highly supported by nearly all e-Delphi experts (Curtin et al., 2024b). There was less agreement, however, on how to quantify these in terms of number of seconds or number of turns, with only two thirds of experts agreeing to these proposed methods. Expert panellists' qualitative feedback suggested that length of joint engagement is activity-specific and is not always indicative of quality, or active mutual focus. This will be why in research, there are often the same toys or activity for each dyad. In terms of counting the number of turns, panellists' feedback suggested that a high number may not necessarily translate as high-quality PCI either. For example, a parent and child may have two long turns each and remain connected longer than another parent and child having four quick, fleeting turns that are over within seconds.

As established in 7.3.2, a child's attention develops over time and much evidence suggests that supported joint engagement (i.e. the parent watching the child and providing prompt, meaningful input in response to the child's initiations) is effective for language learning (Masek et al., 2021; Chen, Cabrera and Reich, 2023). The question then remains: if a parent is observed to notice and observe the child's gaze, behaviour and utterances and provide prompt, semantically connected, and synchronous responses to these, is there a need for professionals to also assess (count) the number of turns, frequencies of joint engagement, or average length of jointly engaged time? Whilst these quantitative markers are used to measure joint engagement in research studies where experimental controls are implemented (Lammertink et al., 2022), and where researchers have the time to calculate them, they do not explicitly note the contingency of the sustained engagement. Contingency, as explored in 7.3.2, is embedded within the social-communicative framework upon which children build the foundations of language (Tamis-LeMonda, Bornstein, and Baumwell, 2001; Yu and Smith, 2016; Chen, Cabrera and Reich, 2023). Contingency, SJE, and 'serve and return interactions' are also described as 'connectedness' by Ensor and Hughes (2008) where one interlocutor's utterance is 'semantically related to the other interlocutor's previous turn' (p.204). The SR (Curtin et al., 2021b) measures for joint engagement mentioned at the start of this discussion point assume contingency. Within the EPID assessment, contingency and connectedness must be explained more explicitly. The following re-wording is suggested for these behaviours, to ensure professionals and parents are assessing the same, important constructs. Modifications have been bolded.

**Table 7.3: Improved definitions of parent behaviours that focus on joint engagement**

| **Original statement from e-Delphi study** | **Improved description (already incorporated into Table 1: The EPID assessment)** |
|---|---|
| Parent maintains joint engagement with their child (PB9) | A5 *Parent* ***supports*** *joint engagement* ***by noticing and following their child's interests, behaviours and language*** |
| Parent engages in balanced communicative turn taking (PB11) | *A9 Parent* ***turns*** *are balanced* ***in length and frequency****, and* ***connected in topic to a child's previous action or language*** |

### *7.3.6 When and how to start the EPID assessment*

Aspects related to the EPID assessment that are critical to its successful implementation include: being explicit that assessment is happening in the first instance; video recording; and ensuring some pre-requisites related to the family are in place first (e.g., knowledge of the culture of the family, understanding the deaf child). Parental well-being is another factor that influences when to conduct a PCI assessment. Each of these are considered in this section.

Within the research studies included in the SR (Curtin et al., 2021b), parent participants voluntarily signed up to studies via recruitment advertisements and recommendations, suggesting they were happy to be assessed and judged by researchers. Their motivations may have been altruistic (i.e., a passion to develop the evidence base and/or support other parents), intrinsic (i.e., they were promised some feedback on their PCI or on their child), or extrinsic (i.e., provided with monetary incentives for participating). In practice, 97% of professionals assess PCI overtly and covertly (Curtin et al., 2023). It is unclear whether families opt in for PCI assessment, and if they do, at what point does the assessment take place. The e-Delphi panellists formed agreement on the following statement: 'parents should be made aware of the purpose of the assessment' (Curtin et al., 2024b). This makes it clear that all parents should be told they are having their PCI observed and have the purpose explained. This aligns with the FCEI-DHH consensus group's belief that 'families are the constant in children's lives' (Moeller and Szarkowski, 2024b; p19) and therefore should be involved in all aspects of their care.

A statement that gained 84% of consensus in the e-Delphi study was 'to accurately capture and reflect on PCI, a video recording is recommended at least once… Timing of this willdepend on parental well-being, parental personality, and the strength and trust of the parent/professional relationship' (Curtin et al., 2024b). This statement recommends caution with when to embark on the PCI assessment process. The idea of video appraisal is feared by many parents, including those with hearing children (Ablewhite et al, 2015; Belletier et al., 2015). Parents experiencing higher rates of stress present with more authoritarian PCI behaviours (Chang et al., 2023). In their study of hearing parents' experiences of being videoed interacting with their children, Bennetts et al. (2017) reported that parents felt judged and also that the interactions observed were unnatural. Building a friendly, genuine, and non-judgemental environment was one way that parents suggested could support the capture of a more naturalistic PCI (ibid). For the EPID assessment to accurately capture as-close-to naturalistic PCI as possible, professionals should first seek to understand and develop awareness of each family's context and needs through a case history discussion. This links to the theme in the focus groups study 'Family First, Then Assessment' (Curtin et al., 2024a) where four prerequisites to beginning assessments were explored. They were understanding the culture of the family, understanding the deaf child, exploring and supporting parental well-being, and building a high-trust relationship. It was suggested that taking time to explore these features of family life can support parent readiness, preparedness, and engagement with PCI assessment and goal setting (Curtin et al., 2024a). Just as we see variability in a child's performance in assessment due to factors such as cultural and linguistic diversity, shyness, and a lack of familiarity with assessment (Spicer-Cain et al., 2023), we may expect the same with parents. Knowing the family's context and history may therefore help to: 1) better set up the assessment (who to invite, time of day, and activities to video record), 2) improve parent-professional bond and therefore allow a parent to feel more at ease with being videoed, and 3) help to inform a more accurate analysis of the PCI as knowledge of the child's contextual factors are known.

Participants engaged in the focus groups and e-Delphi studies agreed that knowing and understanding the cultural diversity of the family would prevent misinterpreting PCI assessment results (Curtin et al., 2024a; 2024b). 'Responsiveness to cultural and linguistic diversity is critical' (Szarkowski and Moeller et al., 2024a, p.127) as it centres the family and helps to build strong family-professional partnerships. Depending on their background, families may display different child-rearing values. For example, a study of PCI with Chinese hearing families highlighted cultural differences with regards to verbal praise (Leung et al., 2009). Similarly, cultural differences in levels of eye contact were observed between hearing European American and Mexican American parents and their children (Schofield et al., 2008). Another example of cultural differences can be seen in Canada, where Inuit families reported that adults sitting on the floor was considered demeaning (Paradis, Genesee and Crago, 2021). As mentioned by a professional in the focus groups study (Curtin et al., 2024a): 'You don't know what everybody's culture is like, you can't have that basis of knowledge for every single culture, so I'm trying to work with bilingual support workers' (p.6). Expert panellists in the Delphi study (Curtin et al., 2024b) agreed that families should have their PCI assessed in the language of the home and interpreters and bilingual co-workers should be engaged in order for professionals to understand the culture and the language used in the video recording. The FCEI-DHH consensus group (Szarkowski and Moeller et al., 2024a) support the use of home languages and recommend that families are matched with practitioners who share their language and culture, but acknowledge that in practice, this is challenging. Instead, they recommend the use of cultural brokers, i.e. 'consultants with first-hand knowledge of a culture and its traditions and values' (Szarkowski and Moeller et al., 2024a, p.130). In the UK, these people are often referred to as bilingual co-workers. This recommendation aligns with the statements on working with culturally diverse families that gained consensus in the e-Delphi study (Curtin et al., 2024a). Professionals should begin with sensitive curiosity in order to gather important information about the deaf child and the family's culture, before beginning the EPID assessment. As mentioned in sections 7.3.3 and 7.3.4, a professional should not expect or advise all EPID behaviours within one ten-minute video. The developmental stage of the child, the type of activity, and in reference to above, the culture of the family and their differences in child-rearing may lead to different presentations of parent interaction. The EPID is designed to be flexible and individualised (i.e. family-centred and strength-based), using positive parent behaviours already present as a starting point for discussion.

Parental well-being should also set the pace for when to begin the EPID assessment. Parents in the EPID parent partner group were approving of the suggestions made by professionals in the 'parental wellbeing' sub-theme of the 'Family First…' finding. Time taken to understand a parent's emotional perspective upon learning of their child's deafness diagnosis is important and can trigger onward referrals and further support. Some families may need more time to ask questions, process and absorb diagnoses, understand equipment use, process their feelings, and/or discuss how to explain the diagnosis to others. When experiencing heightened emotions and anxieties, the idea of being assessed or judged may not be an appropriate step for the family. For families with children with additional needs, when to begin the EPID assessment process may need to be even more flexible and varied as other priorities may take precedence. Flexibility in pace and when to start aligns with behaviour change theory. For any family, a parent's physical and psychological capability and the context in which they live, i.e., their physical environment, economic environment, their culture, and/or their levels of social support, will determine their capacity and readiness to accept support and begin to adapt or change behaviour (Michie, Van Stralen and West, 2011). As mentioned, these factors may warrant an increase in additional interventions to first alleviate or address some of the external pressures (e.g., allocating a family support worker to the family, planning extra appointments to assist the family with form-filling for accommodation or financial support).

To summarise, when to introduce the EPID assessment will be entirely led by each family. Prior to using the EPID assessment, a professional is required to spend time understanding the family context, the deaf child, and the parents' well-being. Professionals should strive to build genuine, trusting relationships with families and work closely with other professionals within the family's support circle to share information. Only then, with all of these factors considered and supported, should a professional raise the suggestion of an EPID assessment. Whilst this recommendation may conflict with professionals' time and resource allocation, particularly for professionals with stretched caseloads, being family-centred and responding to diversity are the first two core principles for supporting families of deaf children (Moeller and Szarkowski et al., 2024b) and are further reinforced by international documents that support families who have children with disabilities more widely (e.g., EASPD, 2022; WHO and UN Children's Fund, 2020; UNESCO, 2001).

### *7.3.7 Gentle on the approach*

In the previous point, the prerequisites for beginning the EPID assessment were discussed. Another outcome of the thesis was to form agreement on how the EPID should be used with parents in practice. Firstly, the notion of offering parents flexibility when setting up the assessment was important. In practice, professionals favoured observing play and daily routines at home (Curtin et al., 2023; 2024a). E-Delphi panellists agreed that families should be asked where they would like to have their PCI assessed, although they were just shy of forming consensus on PCI assessments also sampling daily routines (78% achieved on rounds 1 and 2, Curtin et al., 2024b). When this statement was discussed with the EPID parent partner group, there were strong opinions expressed. Some parents felt that play was a luxury, particularly in busy households and that an assessment of PCI in daily routines (if given the choice) could be a preferred option by families so that the discussion that followed was more relevant. In wider research contexts, embedding support into daily routines has proven benefits for families in terms of generalising skills (Novak, 2011).

Families can be comprised of a variety of types and numbers of caregivers. The importance of the mother–child bond has long been the focus of research and practice, but fathers are known to have positive impact on the deaf child's academic, language and social–emotional development too (Hintermair, 2006; Amodia-Bidakowska, Laverty, & Ramchandani; 2020). Gender differences in PCI have been found between mothers and fathers of deaf children (Loots & Devisé, 2003; Wille et al., 2019; Löfkvist et al., 2022). In the e-Delphi (Curtin et al., 2024b), the statement on observing other main caregivers such as fathers, grandparents and siblings (AA57) only achieved 75% consensus, yet following review, it was included as per the other items with 75-79% agreement. Thus, observing PCI with other caregivers and the deaf child is a recommendation of the EPID process. Including fathers is important because active involvement of all caregivers has the potential to benefit the family system (Moeller et al., 2024b). Many authors recommend including fathers in parent-child interaction work as early as possible in order to promote *both* parents' levels of self-efficacy (Hintermair & Sarimski, 2019; Dirks & Szarkowski, 2022).

The length of video also required some decision making. In the SR, the average length of PCI videos analysed was 9 minutes (Curtin et al., 2021b). In the survey study, only 22% of professionals used video in their PCI assessments, but those that did only used 3-5 minutes of film (Curtin et al., 2023). In the e-Delphi study (Curtin et al., 2024b), consensus was not gained on an agreed video length (75% consensus gained in round 2). When this statement was discussed with the EPID parent partner group there were strong opinions in favour of including this statement as parents were cautious that 3 minutes of filming would not be enough time for a parent to 'warm up' but that more than 10 minutes may feel excessive. Ultimately, parents in the EPID parent partner group wanted consultation and involvement in the decision process because how a parent feels on the day of the visit may impact on what they are happy to do in the EPID assessment. For these features (where and what to assess and for how long), practitioner flexibility, equity between families, and offering parental choice is favoured. These principles are highly aligned with the updated FCEI-DHH guiding values (Moeller and Szarkowski, 2024b).

Providing parents with an opportunity to watch the PCI video recording with a professional, and to self-assess their own skills and lead discussions is another important outcome of the EPID assessment approach, with high levels of agreement (91%) in the e-Delphi study (Curtin et al., 2024b). Self-reflection and self-assessment are engaging sources for adult learning, presenting to the learner what is known and yet to be known (Schunk and Ertmer, 2000; Boud, Lawson and Thompson, 2013; Kolb, 2014; Yan et al., 2022). Supportive dialogue and discussion with a knowledgeable other can act as an additional 'change-agent' (Wink, 2000, p.47) and help the learner to internalise the learning, build on existing knowledge and skill, and create multiple understandings (Vygotsky, 1978; Wink, 2000).

Consensus was formed on the statement that the PCI assessment review would be largely strength-based in order to keep the assessment positive and encouraging (Curtin et al., 2024b). Much research shows the positive impact of strength-based practice with families (Thomas and Zimmer-Gembeck, 2007; Pentti, Fagerlund, and Nyström, 2019; Devaney et al., 2023). As positive-focused psychology grows (Lopez, Pedrotti, and Snyder, 2018), new schemes in healthcare improvement such as 'Learning from Excellence' are based on the idea of identifying and capturing episodes of peer-reported excellence with the view that studying success augments learning and has a positive impact on the workforce (Kelly, Blake, and Plunkett, 2016). In the focus groups study (Curtin et al., 2024a), professionals were able to share that highlighting a positive parent behaviour (and the resultant positive impact on the deaf child) was an important feature of the feedback and learning cycle. Engaging parents as learners is important for a parent's confidence and for enhancing knowledge in language development and strategies for their own child's language learning (Levickis et al., 2020).

The involvement of hearing parents of deaf children has been embedded throughout the thesis. The EPID parent partner group are keen for a positive experience that helps a parent to observe their interaction skills, learn about the intuitive behaviours they already use that are useful, see the impact they can have on their child and then begin to build on their skill set over time. They want to feel involved, be informed, and over time, celebrate progress. Evidence suggests that involved and engaged parents are more likely to positively impact child outcomes (Burney, McCann and Arnold-Saritepe, 2024). The decisions on approach discussed in this section support this notion.

### *7.3.8 Goals*

Collaborative goal setting will be an explicit and immediate next step following the EPID assessment. Three quarters of UK professionals set goals all the time or often (Curtin et al., 2023), but as explained in the focus groups study, not all professionals share these with families: 'For me, it's something that I know, I write in my notes 'we are working on this' and 'I don't write down 'these are targets for the parent and share that with the parent' (Curtin et al., 2024a, p.13). The parents in the EPID parent partner group also reported not receiving feedback post-assessment or collaborating on goals with professionals (Curtin et al., 2024a, p.4). As discussed in 7.3.4, PCI assessments have been for professionals' own information historically. Findings (including the goals) have not always been disclosed to families (Curtin et al., 2024a). This may be because of professionals' reduced time, reduced skill in providing feedback to adults (as they are more used to working with children directly), or because of a lack of framework or structure to guide observations and follow-on discussions.

Expert panellists in the e-Delphi study agreed on all four of the goal setting statements (Curtin et al., 2024b). These were: assessment outcomes should lead to goal planning; parent-focused goals should be jointly discussed and agreed between parent and professional; the purpose of the goal and the impact of it on the deaf child should be discussed; and goals should be regularly reviewed and updated. More widely, goal setting and goal planning are core to behaviour change theory (Bailey, 2019). Goals regularly feature as the first step in parent-mediated language interventions because the mechanism for change in these interventions is the parents' full knowledge and understanding of the goals themselves (Barnett, Stringer and Letts, 2024). Feedback, monitoring, and review is another behaviour change technique (Michie et al., 2013) that assists with maintaining changed behaviour (NICE, 2014). It can take the form of being monitored by others, or through self-monitoring. Monitoring and reviewing PCI behaviours with visual feedback is a feature observed in many parent-led language interventions (Stoner et al., 2012; Kaiser and Roberts, 2013; Song et al., 2016).

As uncovered in the focus groups study goal setting (and attainment) can be variable depending on parent engagement and readiness to receive support. Much research has identified the 'intention-behaviour gap' (Hagger and Luszczynska, 2014), i.e., that identifying an area to improve or change does not always result in a change being achieved. There is evidence to suggest that motivation is a strong driver for changed behaviour (Michaelsen and Esch, 2021). In order to build on and maintain a parent's motivation, it is important that professionals approach families positively, build their trust, and work towards the ‘shared vision’ for the child (Stoner et al., 2012). Goals that are self-selected are intrinsically more motivating. Other goal-related suggestions to support behaviour change include the wording of the goal, where one develops ‘approach’ goals rather than ‘avoid’ goals. An approach goal is positively framed, i.e., ‘I will follow my child’s lead’ rather than a negatively worded avoid goal such as ‘I will stop interrupting and controlling the interaction’. This behaviour change strategy has been addressed in the EPID assessment framework as all parent behaviours are positively worded, ready for selection following the joint review of the PCI assessment video.

Another strategy is to develop mastery goals rather than performance goals. Mastery goals focus on increasing already existing abilities or learning new skills, whereas performance goals have pass or fail responses. For example, an EPID mastery goal might be ‘I can support joint engagement’ and a performance goal might be ‘I will stay jointly engaged with my child for 5 minutes’. Performance goals could lead to a perceived failure of skill if not achieved, whereas not attaining a mastery goal could be viewed as part of the learning, and can prompt deeper conversation, greater engagement, and increased self-efficacy over time (Heyman and Dweck, 1992). Another effective way of supporting behaviour change is action planning (Carey et al., 2019). This involves deciding where, when, how, and how often a goal will be actioned (Lorig et al., 2014).

Knowledge, understanding and co-creation and co-planning of the goal supports parents’ learning and motivation. Goals also provide a baseline for reviewing the progress of both the parent’s skill set and the child’s communication and deciding on what to adapt/change next if appropriate. It is proposed that within the EPID assessment proforma, there will be follow-on prompt questions following the joint review of the video recording, such as ‘From all the behaviours we have observed and discussed today, which ones were the most helpful to learn about?’ This will ensure that parents and professionals use their assessment findings to shift towards informed action, and so that parents continue to build their understanding of how they can facilitate their deaf child’s development. This parallels the model used in therapeutic assessments in psychology (Finn, 2007), where the client becomes the ‘co-interpreter’ of the assessment findings and through the review process gains useful understanding of themselves, and journeys towards growth or self-enhancement (Durosini and Aschieri, 2021).

#### *7.3.9 Researcher Reflexivity and Parent and Professional Involvement (PPI)*

This doctorate began with the intention to produce a formal, clinical assessment tool. The main objective was to provide SLTs and QToDs with an assessment to identify a family’s strengths and needs with PCI, in order to understand where to begin with intervention. Shortly after embarking on the data analysis of my SR, I met with the EPID parent partner group. They shared a range of stories on how they were told their child was deaf, how the first year was about audiology and not much joy, how it feels to have your natural ways of communicating with your child judged in your home by ‘an expert’, and how scary and overwhelming it feels to know you do not know how to help your child progress at first. After processing these experiences, it was clear to me that the EPID assessment’s end user needed to be parents of deaf children, with the support and guidance of a well-trained professional. The EPID assessment could generate more impactful outcomes than just a score for a clinician’s caseload notes. It has the capability to provide parents with a learning opportunity on their own PCI, and an opportunity to pause and reflect more deeply on the impact their behaviours have on the communicative competence of their child. This moulded the EPID tool into more of a dynamic, therapeutic assessment where the ‘test subject’ was privy to assessment analysis and outcomes.

The ways in which PPI shaped the research questions and analysis of each phase is documented within each publication. Overall, I believe parent involvement has left a distinctive mark on the tool's design and how it should be used in practice. Parent involvement has centred the importance of parent well-being, of parent/professional relationship building, and the sharing of power and responsibility. I have been fortunate to hear parents' early journeys and have been allowed to ask questions of how things could have been better. Whilst it is not within this doctorate (or the EPID tool's) remit to improve diagnosis sharing within audiology departments, or to work on a nationally used and recognised resource that educates parents on what they need to know, a parent's early journey *is* important for the EPID assessment.

In our meetings, parents consistently shared feelings of grief, guilt, and negativity, of not feeling able, skilled, or good enough to support their deaf child. As a professional working in deafness for 12 years, I knew that grief and shock were normal responses to a deafness diagnosis, but hearing such a range of stories had a great impact on me. It provided me with new levels of empathy, it brought parental well-being to the forefront of my own clinical practice. It made me realise that all professionals should hear a range of diagnosis stories, a range of 'how we told our extended family members' stories, a range of stories that focus on how it feels at first to realise you are raising a deaf child and not a hearing child. I am also fortunate that many of the EPID parent partner group were willing to share their stories widely and so, with further coproduction, there will be an EPID assessment training module around the early journeys that parents take. This is to prompt professionals to ask about and listen to similar stories from families on their own caseloads, because how a parent begins the journey into deafness will frame how accepting they are of professionals being in their home, how engaged they will be with the concept of the EPID assessment, and of any other onward support. Much research shows the positive effects of a healthcare professional's initial communication and interaction style and proximal outcomes such as satisfaction with care, motivation to adhere to care, trust in the clinician and the system, self-efficacy, patient-clinician relationships, reduced stress, and shared understanding (Street et al., 2009; Jenstad et al., 2023). These early journey discussions may also help parents and professionals determine when it might be a suitable time to conduct the EPID assessment, as discussed in 7.3.6.

With a parent's emotional well-being in mind, the PPI group have scrutinised and debated the terminology relating to the nature of the EPID assessment and made strong recommendations that the EPID is not called an 'assessment' with parents, but instead 'a tool'. They have also drafted scripts for future professionals to follow so the language is more parent friendly. As well as the language used within the EPID assessment, how the tool is used also needs to be further developed. As mentioned in 7.3.4, initial ideas have centred on a mobile application (app) that could have a family's PCI videos uploaded and 'magic moments' of PCI notated by parent and professional during the joint review. An ordinal scale will need to be designed so that parent behaviours can be measured, and progress monitored. If the EPID assessment is an app or web based tool, then videos, notes and scales can be held on the parents' device, permitting easy sharing with other professionals and other family members. Further coproduction work should explore elements such as:

- the design of an ordinal scale to use that is easy for a range of families to understand
- response items for each scale, i.e. 'seen a lot today / seen a little…'
- whether to also assess which skills a parent finds interesting or motivating (as a way to begin goal setting discussions).
- whether to also assess parent confidence, self-belief, or stress.

## 7.4 Limitations

Across all studies, the generalisability of the results is limited by the EPID assessment's westernised underpinning. In phase one, papers not written in English, of which there were nine, were excluded. In phase two, all professionals were working within the United Kingdom. In phase three, almost all expert panellists were working in North America or Western Europe. The EPID assessment tool may therefore lack universal application where resources (human and financial) and supportive, co-ordinated health and education infrastructures are not available. Further, these westernised underpinnings may also affect the EPID's applicability to diverse communities living *within* western countries.

In general, there is a westernised skew on all language acquisition research. In their review of speech perception, Singh, Rajendra and Mazuka (2022) found only 10% of published studies focused on infants learning Asian languages despite 60% of the global population residing in Asia. Studies on speech perception in Africa and South America were almost entirely absent (ibid). In a broader review of various topics within language acquisition over the last 45 years, Kidd and Garcia (2022) reported that 87% of the articles had authors based in North America or Europe. They stressed that we cannot assume that understudied languages and the features of language within them are based on the same underlying system (ibid). More recent research on 1,001 children across six continents uncovered substantial correlations between child language and amount of adult talk (Bergelsen et al., 2023). Emerging evidence from the global south indicates mothers with more years of education spend more time with their children in interactive contexts (Padilla-Iglesias et al., 2024). These studies suggest perhaps there *are* some universal, adult-focused factors that predict child language variability. More research with Global South populations is required to confirm or deny this.

Whilst not a limitation per se, the methodological choice of carrying out a quantitative survey and then a qualitative focus groups study may have altered the findings. Instead, qualitative focus groups could have happened first and been exploratory, i.e. open questions to gain broad views on assessment practice, and then the survey could have tested whether these findings were generalisable or representative of practices within the professional population. I selected a quantitative, then qualitative sequence for three reasons. Firstly, I wanted to enhance the rigor of the quantitative survey by having it underpinned by the sixty-one studies in the SR (Curtin et al., 2021b). Secondly, I wanted to investigate if professional practice was aligned with research findings. And lastly, I wanted to use the qualitative element of the study in an explanatory fashion, rather than an exploratory one. I wanted the survey findings to be explained in more depth by professionals sharing their perspectives and experiences. To combat the suggestion of the quantitative survey narrowing responses due to the topics being determined by the SR, open text boxes were incorporated into the survey to allow for participants to share behaviours or practices that were not listed. A mixed-methods paper that integrates the two studies using the pillar integration process (Johnson, Grove, and Clark, 2019) is planned for 2024/25. Finally, a limitation of the focus group study was not requesting more demographic information from the deaf professionals recruited for the study, i.e., levels of hearing, their equipment use, languages used at work, and perhaps whether they were born to deaf parents or hearing parents. Knowing this information may have supported interpretation of the deaf professionals' lived perspectives.

## 7.5 Implications

Each phase of this doctorate has contributed to the development of the EPID assessment's core content and approach. Thirty-six (36) evidence- and practice-based parent behaviours were agreed upon by an international, multi-disciplinary panel of experts. These behaviours cover a range of attributes within PCI and a novel PCI assessment structure (the EPID Tool) was presented in this chapter (7.3.3). Once tested and refined, the EPID assessment will support professionals, educators, and academics when working with deaf infants and their families. It is recommended that identifying strengths in parental sensitivity and supported joint engagement should perhaps be an initial priority, followed by a parent's use of language enrichment techniques. Each EPID assessment should be individualised and family-centred, focusing on the parent behaviours that support interaction within each family unit. Whilst all the parent behaviours within the EPID assessment are known to benefit PCI and child development, the list is not prescriptive. Flexibility may be required with using the EPID with various sub-groups (i.e., fathers, families with deaf-plus children, families from the global majority), with future research aiming to investigate these further.

As mentioned in this discussion, over the last four years of the doctorate, the focus on parental well-being increased. This has meant that the tool is not currently ready as many more design decisions on the EPID's language and approach are required. In the e-Delphi study, professionals and academics did not form consensus on how the behaviours should be measured and shared concern over the somewhat clinical and critical tone of the wording used. In light of this and in keeping with the philosophy of coproduction, how to measure skills and monitor progress feel to be decisions that parents are best placed to make, once educated in the development of health measurement tools.

On the topic of parental well-being, it is recommended that professionals follow the 'Family first, then assessment' philosophy outlined in the focus groups study, where professionals take time to build relationships and understand each family system they are working with. Once trialled and tested, it is hoped that the EPID will replace professionals' old strategies of informally looking at PCI and making informal notes. Instead, the EPID will provide a structured, systemised way of assessing PCI, where video clips and the EPID tool can provide the means by which parents can be included, informed and empowered to understand their PCI in a joint review with a professional. The findings of the EPID assessment and joint review should lead to collaborative goal setting, where goals for the parent (not the deaf child) are jointly discussed and agreed upon.

Across the studies there were a few implications for researchers also. Firstly, from the SR (Curtin et al., 2021b), researchers were prompted to improve their reporting of child and parent demographics, and their reporting on PCI assessment methodologies. Researchers were also advised to increase the representativeness (and diversity) of their samples by recruiting more families with deaf children who have additional needs, recruiting families from global majority cultures, and recruiting families with low levels of social-economic status. These recommendations were echoed in the focus groups study. If pursued, improvements such as these would lead to an evidence base more reflective of real life.

## 7.6 Future Research

The research presented across the included papers have culminated in agreement on the EPID's content and process. Further research and coproduction will be required to understand if the recommendations *are* the most acceptable, feasible, and impactful ways to support families. For example, the EPID's parent behaviours that will be assessed may be comprehensible to an academic and / or professional working with deaf children but may not be clear to a parent participating in the EPID shared review. Therefore, some participatory design workshops, with some small-scale trials and feedback loops would be insightful. Likewise, whilst 'Core behaviours' (section A, Table 7.1) may be relevant to all families, using *all* the behaviours listed in 'Language Enrichment Behaviours' (section B, Table 7.1) may not be so essential. Collecting videos of PCI and generating EPID response data may be useful, as statistical tests such as principal component analysis and item response theory could indicate how similar, important, extreme, and comparable the items are.

There will be four more phases to the EPID Tool's development and use. They are the coproduction of a digital assessment, psychometric testing, measuring the EPID's impact, and the implementation of the EPID Tool at scale. Each of these phases will continue to include the parent voice, drawing on their expertise to facilitate equitable demand for, and uptake of, the EPID across a range of settings.

### 7.6.1 ***Coproducing a digital EPID assessment and the associated training package***

This stage will require multiple meetings between parents, professionals, and digital health technology designers. As a team, we will work to embed the core content developed in this thesis with functionality requirements and the appropriate language to use, i.e. avoiding judgemental terms such as 'assessment', ensuring all parent behaviour items are comprehensible to a wide audience, using a visual, ordinal scale, and striving for positively framed mastery goals. It is my intention for this stage of the work to be supported by the NHS Clinical Entrepreneur Programme. This will ensure the technology fits within the remit and governance of the NHS. It is also envisioned that the EPID tool will have an associated manual and training session to increase professionals' sensitivity to parental well-being; to know when to start the assessment; to enhance professionals' skills in analysing PCI; and to support skills in video feedback and collaborative goal setting.

### ***7.6.2 Psychometric testing of the EPID assessment***

Following on from the initial instrument development work laid out (7.3.3), further training and guidance will be sought from COSMIN (Mokkink et al., 2018). Firstly, this will involve small-scale pilot testing to ensure comprehensibility, relevance, acceptability, and feasibility (DeVet et al., 2011) of the tool from both professional and parent perspectives. Then following adaptations and development, the EPID will undergo large scale 'field-testing' in multiple sites. Once the development phases are complete, the reliability, validity, and responsiveness of the EPID tool will be tested. It is within this phase that investigations into the EPID's relevance to various sub-groups within the UK will begin (i.e., fathers, families from the global majority, families who do not use English, families whose deaf children have co-occurring conditions, families who do not use technology). With enough data collected, various statistical tests could potentially uncover whether short-form or adapted versions of the EPID may be more relevant for different groups, as seen in previous work by Edelen and Reeve (2007). Further codesign with parents from these various sub-groups will also support the acceptability and feasibility of these potential endeavours, ensuring the EPID remains family-centred and family-specific.

### ***7.6.3 The measurement of impact***

Whilst we know there is a predictive link between PCI and deaf children's language development, the following markers feel to be more immediate and measurable in a shorter

time frame. This phase will investigate whether the EPID and its associated training course impacts:
- Parental knowledge about communicating with their deaf child
- Parental self-efficacy in communicating with their deaf child
- Parental stress
- Professionals' competence in appraising PCI
- Professionals' decision making (i.e., does the EPID trigger specific family-centred goal setting? Does it help to specify intervention planning?)

### *7.6.4 Implementation of the EPID Tool*

This phase will require much larger-scale training of professionals in order to assess the longitudinal clinical utilisation of the EPID assessment, i.e. the extent and quality of its use over time. Implementation science includes measuring the acceptability, appropriateness, feasibility, adoption, cost, and fidelity of the EPID assessment in a range of health and education services. It is envisaged that continued work to adapt and evaluate the EPID's applicability for a range of families will occur in this phase (see subgroups mentioned in 7.6.2). Following appropriate trialling and testing, there may also be scope for adaptations of the EPID's content to be developed for other childhood conditions, such as Development Language Disorder or Downs Syndrome. No clinically-based PCI assessment tools for these conditions were uncovered in the author's searches.

## 7.7 Conclusion

Good-quality PCI is widely acknowledged to be significant for a deaf child's language development. With such importance, it is therefore crucial professionals assess and monitor PCI within the family home. The outcome of the assessment may signal areas that require additional support or intervention. This doctorate used three phases (four studies) to gather an in-depth understanding of the parent behaviours that are assessed in research and in practice, and how these behaviours are assessed. Across all investigations of research and practice, a deaf-specific assessment tool that focused on the parent's behaviours in PCI was not identified.

The findings of this PhD have led to the creation of the core content and recommended approach of a video-based PCI assessment for families with deaf children aged 0-3 years. The assessment is designed for use with all deaf children, regardless of communication approach(es) or the presence of additional disabilities. The assessment (named the EPID Tool) will positively identify features of parental sensitivity, as well as parent behaviours that support joint engagement, language access, and language enrichment. This strength-based approach ensures the EPID responds to the individuality of each family's dynamic, using present behaviours as a starting point. This aligns with the theme of 'Personalised Care' within the NHS Long Term Plan (2019). Evidence suggests involving parents and providing individualised feedback improves their confidence, knowledge, enablement and satisfaction (McKay et al., 2020; Kanda et al., 2022; Sanders, 2023).

The involvement of parents of deaf children and hearing and deaf professionals working with families was embedded throughout. This meant that the core role that parents play in their deaf child's development was centred, as was parent voice, parent learning, and parent wellbeing. Parent involvement ensured a more family-centred assessment tool was developing, rather than a clinical tool purely for professional benchmarking. The insights gained from this thesis will support further coproduction work and the design of an EPID assessment prototype ready for testing and further refinement.

# Chapter 8 - Supporting Information

There is no supporting information for the first paper (Current Opinion, Curtin et al., 2021a). The supporting information for the second paper (Journal of Clinical Medicine, Curtin et al., 2021b) is included within the published manuscript, except for the PROSPERO protocol (included here). Supporting information for the remaining three papers are within this section, ordered by presentation in the thesis. This section ends with the approved ethics documentation for the mixed methods study (chapters four and five) and the E-Delphi study (chapter six).

## 8.1 Supporting Information (PROSPERO Protocol) for Chapter Three:

*Curtin, M., Dirks, E., Cruice, M., Herman, R., Newman, L., Rodgers, L., & Morgan, G. (2021b). Assessing parent behaviours in parent–child interactions with deaf and hard of hearing infants aged 0–3 years: A systematic review. Journal of Clinical Medicine, 10(15), pp. 3345-3375.*

**PROSPERO**

**International prospective register of systematic reviews**

Martina Curtin, Evelien Dirks, Madeline Cruice, Ros Herman, Gary Morgan. What are the range and frequencies of parent interaction behaviours that have been assessed in parent-child interaction research with deaf children aged 0 – 5? What are the reported effects of these behaviours on child communication?. PROSPERO 2020 CRD42020198567 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020198567

Review question  [1 change]

What are the range and frequencies of parent interaction behaviours that have been assessed in parent-child interaction research with deaf children aged 0 – 5? What are the reported effects of these behaviours on child communication?

Searches  [1 change]

The searches will be conducted by the lead author and an information specialist, working closely with the research team, advisory board and patient, public (PPI) and expert groups to finalise sources and search terms. We aim to search the following databases PubMed
PsycINFO, CINAHL,
Communication Source Cochrane Library Databases, Embase,
Web of Science ERIC
and Scopus.

Reference lists of included studies will also be checked to ensure publications are not missed that were not found by the search.

'deaf' OR 'deaf*' OR 'hearing impair*' OR 'hearing loss' OR 'hard of hearing' OR 'd/hh' OR 'dhh' OR 'cochlear implant' OR 'hearing aids' OR 'hearing disorders'
AND
Child OR child* OR infant* OR baby or babies OR preschool OR kindergarten OR nursery OR toddler
AND
'parent' OR 'parent*' OR 'caregiver' OR 'care giver' OR 'mother' OR 'father' AND
'involvement' OR 'interaction' OR 'engagement' OR 'parent communication' OR 'parent engagement' OR 'child-directed interaction' OR 'facilitative communication' OR 'parent interaction characteristics' OR 'sensitivity' OR 'responsiv*' OR 'linguistic input' OR 'language input' OR 'relationship' OR 'communication support strategies' OR 'dyad' OR 'availability' OR 'intersubjectiv*' OR 'attention' OR 'attend'

### Types of study to be included [1 change]

We will include a broad range of study designs. Intervention studies (randomised and non-randomised) and observational studies (including cohort, case-series, cross-sectional) will be included.
Excluded work includes single case studies, commentaries, opinion papers, books, letters, personal blogs, newspapers. Exclusions will also be made if articles report child-data only or articles that are subjective or use parent self-report data.

### Condition or domain being studied [1 change]

Play-based parent-deaf child interaction. Assessment in speech and language therapy.

### Participants/population [1 change]

Children aged 0-5 with a confirmed diagnosis of deafness, any severity.

Any amplification technology (Hearing aids, cochlear implants or Bone Conducted Hearing Aid) or none.
Any communication mode (spoken language/sign language/both)
Interaction with child and mother only, father only, both parents, grandparents, guardians - any caregiver where interaction with their deaf baby is being assessed.

Hearing or deaf parent/carer

Deaf children with additional needs will be permitted, but not deafness with Autism Spectrum Disorder or Visual Impairment (parent behaviours and strategies may be significantly different within these sub-populations).

### Intervention(s), exposure(s) [1 change]

We will include any study (intervention or observational) where the interaction skills between the parent and deaf child are assessed during a play-based session. This may be part of an RCT where one intervention is compared to another/compared to normal practice, or part of an observational study, i.e. a cross-sectional snapshot where observations of interaction skills are the focus, not outcomes post-intervention.

### Comparator(s)/control [1 change]

Not relevant.

### Context [1 change]

Focused on parent-child play based dyads in any contexts – in a lab, in a home, in a nursery and not studies that look exclusively at artificial gallery tasks, book reading sessions or in observations of daily routines.

### Main outcome(s) [1 change]

Range of parent behaviours.
Frequencies of parent behaviours across studies. Range of measures of assessment and their properties.

### Measures of effect

Not applicable.

### Additional outcome(s) [1 change]

Where available, child communication outcomes (including pre-linguistic skills).

### Measures of effect

Where possible, we will compare pre-and post-intervention outcomes for child language.

### Data extraction (selection and coding) [2 changes]

Following the searches, results will be imported into Covidence and duplicates removed. The remaining records will be screened by two independent reviewers using titles and abstracts to decide if papers meet the inclusion/exclusion criteria below. Researchers will be blinded to each other’s decisions. Disagreements in

the screening stage will be discussed and resolved between the two independent reviewers, with support from a third reviewer where necessary.
Following this, full papers will be obtained and screened again by the same two independent reviewers, both blinded to each other's screening. Discrepancies will be solved through discussion and consultation of a third reviewer. An audit trial of excluded results will be made.

Inclusion Criteria:
Child aged 0-5
Confirmed diagnosis of deafness, any severity Any amplification equipment (or none)
Any communication mode (spoken language/sign language) Hearing or deaf parent
Focused on parent-child play based dyads in any contexts – in a lab, in a home, in a nursery All study types (qual, quant, mixed)
Objective data – can be observational, can be intervention studies Data can be from validated or non-validated measures
Research papers will report data on parent outcomes (and child outcomes where included but not essential)
International coverage, published in English
Detailed data extraction forms will be used for each eligible study, results will be extracted by two reviewers using Covidence.

Key data to be extracted:
Study features (location of study, funding, aims, study design, sample size)
Child features (age, deafness level, amplification used, additional needs, other measures assessed)
Parent features (age, hearing status, socio-economic status, languages used, family size, other measures assessed)
Methods of assessing interaction (no. of dyads assessed, measure used (incl. no of items, skills being assessed), single interaction or series, length of interaction, length of assessed interaction, context)
Results (stats, themes, recommendations)

### Risk of bias (quality) assessment  [1 change]

For randomised control trials, risk of bias will be assessed using the Cochrane Collaboration's assessment tool for assessing risk of bias in randomised trials (the Cochrane Handbook for Systematic Reviews of Interventions, version 5.1.0; Higgins & Green, 2011). For non-randomised studies, the ROBINS-I tool (Sterne et al, 2016) will be used. Other tools, such as the CERQUal (Lewin et al., 2018), the EPOC appendix (Glenton et al., 2019) and the Mixed Methods Appraisal Tool (MMAT) will also be considered if findings require it.
These assessments will be conducted by two reviewers working independently. Any discrepancies will be resolved through discussion and by consulting a third reviewer where consensus cannot be reached.

### Strategy for data synthesis  [1 change]

It is proposed that the researcher will use a narrative synthesis. There are four main elements to a narrative synthesis process. Firstly, one must consider which theoretical models may need to be considered in order to set the review question and decide on which types of studies to include (less relevant here as we are not assessing effectiveness or implementation, and our theoretical concept of parent-child interaction (PCI) is well-established).

The next elements include a preliminary synthesis of findings from the included studies, followed by explorations of relationships between the papers and then a review of the robustness of the synthesis (Popay et al., 2006). The researcher will use a combination of thematic analysis and tabulation to synthesise the SR's content.

The first table will chart each outcome measure used to assess PCI, outlining the methods of collection, the scoring format and the constructs being assessed. The second table will use thematic analysis to aggregate results into summarized themes of parent behaviours, where relationships between measures will be explored. Tables will be clear and ensure traceability (i.e. they will allow the reader to trace characteristics back to primary studies).

This table will be further supplemented with more detailed text descriptions of each theme. It is also proposed that, where available, information on the reported effect of these behaviours on child communication skills will also be added as a subheading into each of these groupings.

### Analysis of subgroups or subsets [1 change]

Subgroup analyses will be undertaken on the basis of key clinical differences such as age of child, level of deafness, additional needs, amplification used, communication mode (signed or spoken language) and/or the presence of a deaf parent.
We accept there may be more sub-groups of interest (particularly after discussions with our advisory board and parent PPI group).

### Contact details for further information

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### Organisational affiliation of the review [1 change]

Homerton University Hospital NHS Trust and City, University of London www.gethackneytalking.co.uk and www.city.ac.uk

### Review team members and their organisational affiliations [1 change]

Ms Martina Curtin. Homerton University Hospital NHS Trust / City, University of London
Dr Evelien Dirks. Dutch Foundation for the Deaf and Hard of Hearing Child (NSDSK, Amsterdam) Dr Madeline Cruice. City, University of London
Professor Ros Herman. City, University of London Professor Gary Morgan. City, University of London

### Type and method of review [1 change]

Narrative synthesis, Systematic review

### Anticipated or actual start date [1 change]

01 July 2020

### Anticipated completion date [2 changes]

31 May 2021

### Funding sources/sponsors [1 change]

M.Curtin is an NIHR Clinical Doctorate Research Fellow and this work forms the first phase of her CDRF.

### Grant number(s) and State the funder, grant or award number and the date of award

NIHR300558 – ICA Clinical Doctorate Research Fellowship (Round 5)

### Conflicts of interest Language [1 change]

(there is not an English language summary)

### Country [1 change]

England, Netherlands

### Stage of review [1 change]

Review Completed published

### Details of final report/publication(s) or preprints if available [1 change]

https://www.mdpi.com/2077-0383/10/15/3345

### Subject index terms status

Subject indexing assigned by CRD

### Subject index terms

Child; Child, Preschool; Communication; Humans; Parent-Child Relations; Parents

### Date of registration in PROSPERO

06 August 2020

### Date of first submission

13 July 2020

### Stage of review at time of this submission [1 change]

| **Stage** | **Started** | **Completed** |
|---|---|---|
| Preliminary searches | Yes | Yes |
| Piloting of the study selection process | Yes | Yes |
| Formal screening of search results against eligibility criteria | Yes | Yes |
| Data extraction | Yes | Yes |
| Risk of bias (quality) assessment | Yes | Yes |
| Data analysis | Yes | Yes |

### Revision note

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### Versions

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# 8.2 Supporting Information (Appendices A – E) for Chapter Four:

Curtin, M., Morgan, G., Cruice, M., & Herman, R. (2023). Assessing parent interaction with deaf infants: A quantitative survey of UK professional practice. *International Journal of Language & Communication Disorders*, *58*(4), 1148-1167.

## 8.2.1 Appendix A – Networks where the survey was distributed.

The following organisations and networks were approached and disseminated the survey on the lead author's behalf:

British Association of Teachers of the Deaf (BATOD)

National Deaf Children's Society (NDCS)

Scottish Sensory Centre / Edinburgh University (QToD Course)

Clinical Excellence Networks for SLTs working in Deafness all over the UK.

Royal College of Speech and Language Therapists (RCSLT)

Cochlear Implant Centres in the UK

National Deaf Child and Adolescent Mental Health Services

The NatSIP Heads of SI Support Services (HOSS) Forum

Facebook groups: Teacher of the Deaf, Manchester Deaf Education, Speech and Language Therapy.

You Tube videos were made and circulated on lead and co-authors' Twitter accounts, i.e. EXAMPLE LINK REDACTED

## 8.2.2 Appendix B – Survey Questions.

### Part One: Anonymous information about you and your role.

1. **Age:** 20 – 29, 30 – 39, 40 – 49, 50 – 59, 60 – 69, 70+
2. **Gender**: she, he, they, other
3. **Hearing status**: Deaf or Hard of Hearing, Hearing, Other
4. **Preferred language to communicate in**: Spoken English, BSL, Spoken English and BSL, Other
5. **At work, I use the following languages**: Spoken English, BSL, Spoken English and BSL, Other
6. **Please select your highest qualification**: Degree, Post-Grad, i.e. PGCE, Masters, PhD, Other
7. **Please select your profession**: Qualified Teacher of the Deaf, Speech and Language Therapist, Deaf CAMHS Professional, Psychologist / Psychiatrist / Other
8. **How many years of experience do you have in your profession**: Under 3 years, 4 – 10 years, 11 – 15 years
9. 16 – 20 years, +21 years
10. **Select your type of employer**: [Tick any that apply] NHS, Local Authority, Private Practice, University,
11. Other, please state

12. **Geographical area you work in**: Northern Ireland, Scotland, Wales, England – North West, England – North East, England – Yorkshire and the Humber, England – West Midlands, England – East Midlands, England – East, England – London, England – South East, England – South West
13. **Though you may work with a range of client groups, for children who are deaf, which age groups do you work with currently?** [Tick all that apply] Early Intervention (0-3), Preschool Years (3-4), Primary School (5+), Secondary School (11+), Post-16

14. **What proportion of your work is spent working with deaf children age 0-3**? 0 – 25%, 26 – 50%, 51 – 75%, 75 – 100%
15. **Current (approximate) number of pre-school deaf children on your caseload**? [Enter number of children]
16. **Which settings have you worked in (with deaf children) throughout your career**? [Tick all that apply: early years clinics, early years home visiting, mainstream nursery settings, deaf specialist early years, complex needs early years, other – please state
17. **Do you consider yourself to have specialist knowledge and skills in working with deaf children and young people?** [Yes / No ]
18. **How regularly do you receive regular formal supervision or mentoring from a more experienced professional for your role in deafness?** Once a week, Once a month, Once every six weeks, Once every three months, Twice a year, Once a year, Never, Other, i.e. peer to peer mentorship, please state:
19. **How regularly do you provide regular formal supervision to less-experienced staff working with deaf children and young people?** Once a week, Once a month, Once every six weeks, Once every three months, Twice a year, Once a year, Never, Other, please state.

**Introduction Question:**

20. Please select the following statement that best describes your practice:
    I assess / informally observe parent-child interaction
    I do not assess / informally observe parent-child interaction at all.

If '*I do not assess PCI'* selected, then skip to:

21a) **If you don't assess parent-child interaction, is there someone else involved with the family who does this?** [Yes/No]

21b) **Who is the person typically responsible for this task?** TOD, SLT, Psych, Portage, Other, please state:

21c) **Is this person always involved with deaf children and their families in your service?** [Yes/No]

Then skip to: End of Survey.

*If 'I assess PCI' is selected, then skip to Part Two*

**Part Two: Which parent behaviours do you assess in parent-deaf child interaction?**

We'll give you a definition of the parent behaviour, then we'd like you to tick which ones you assess when the deaf child is aged 0 - 3. Remember, when we use the term 'assess', we refer to all formal and informal methods of observing and evaluating parent-child interaction. Whichever method you use, we want to know which behaviours you are observing and how. We acknowledge every parent-child interaction is different and you may not assess every skill below. We are interested in routine practice.

***Definition of Attention Getting Behaviours:*** Explicit bids, made by the parent, with the intent of gaining or directing their deaf child's attention.

22. **Visual strategies: I watch to see if the parent uses any of the following to gain or direct the deaf child's attention [Tick any that apply]** waving, gesturing, reaching, pointing, making eye contact, switching gaze between an object and the child, holding or moving an object or toy directly into the child's visual field, offering an object manipulating an object, demonstrating play with toys, making faces, displacing the location of a sign into the child's vision or signing space.
23. **Auditory strategies: I watch to see if the parent uses any of the following to gain or direct the deaf child's attention [Tick any that apply]** using voice to call the child's name, using a word such as 'look!', non-words (e.g. 'whee' or 'pssst!'), humming, singing, use of the body to make sounds (outside of the child's visual field) such as clapping or clicking, use of toys or objects to make sounds
24. **Tactile strategies: I watch to see if the parent uses any of the following to gain or direct the deaf child's attention [Tick any that apply]** making gestures or signs on the body of the child, tapping, touching, hugging, holding the child, grabbing on to the child's clothing, moving the child's limbs or

head, touching the child with a toy (out of their visual field), tapping the ground to create vibrations, physically adjusting the child's position to direct their attention.

25. **I watch to see if the parent uses any combination of the above, i.e. multi-modal strategies to gain or direct the deaf child's attention (i.e. saying a name and tapping a child)?** [Yes/No]

***Definition of Waiting/Timing*:** Parent actively waiting or pausing their action to prompt the child to look.

26. **I watch to see if a parent waits for their deaf child to look before they communicate** [Yes/No]

***Definition of Joint Engagement / Joint Attention:*** A state of mutual focus and shared involvement between a parent and child, where both participate in reciprocal, on-topic and socially directed behaviours.

27. **I note how many connected turns there are between a parent and their deaf child in joint engagement**. [Yes/No]
28. **I note the length of time a parent and child remain in joint engagement once it is established**. [Yes/No]
29. **I note who is helping to maintain the joint engagement, i.e. the difference between a parent working hard to support the joint engagement by waiting, watching and responding to the child versus co-ordinated joint engagement, where both parent and child are exclusively engaged with each other and the activity.** [Yes/No]
30. **A parent and deaf child are jointly engaged and their age-appropriate interactions are physical (body movements, facial expressions, tickles). What would you call this in your written notes?** [free text]
31. **A parent and deaf child are jointly engaged and their age-appropriate interactions are based in language (signed or spoken). What would you call this in your written notes?** [free text]

***Definition of Parental Sensitivity:*** *A* set of skills that enables a parent to be emotionally connected, in-tune and responsive to their child's needs, goals, and communicative attempts.

32. **I observe / assess: [Tick all that apply]**
    - **Positive regard:** A parent showing enthusiasm, warmth, pleasure, love, and respect for their child.
    - **Availability:** A parent who is genuinely interested and actively involved in participating in *accessible* interactions with their child.
    - **Contingent and Responsive:** A parent that follow's their child's lead and pace and responds with contingent, on-topic behaviours or language.
    - **Emotionally sensitive:** A parent who is emotionally attuned and adaptive. Able to recognise and respond to distress, disinterest and repair or resolve misunderstandings or conflict.
    - **Structure and Stimulation:** A parent who is able to support a child's interest by guiding and developing the interaction with appropriate pace, play and language, accepting a change in play or routine put forward by the child.
    - **Consistency:** A parent who can absorb and regulate a range of their child's emotions and behaviours, whilst remaining mostly constant in their own behaviours, predominantly striving for a positive interaction.

***Definition of Parental Communication Behaviours:*** Language-focused strategies used by parents during moments of interaction with their deaf child.

33. **I watch to see whether a parent uses any of the following to increase the child's access to language: [Tick any that apply]** communicates within a child's line of sight, i.e. face to face, communicates within 1-2m of a child's amplification device(s), carries out Ling sound checks for users

of amplification devices, uses child-directed language, where a parent may modify their **speech** to be more child orientated, i.e. exaggerated pitch / acoustic highlighting or stress, uses child-directed language, where a parent may modify their **sign** to be more child orientated, i.e. palm orientation so the child can see more, exaggerated non-manual features, larger sign space and range of motion.

34. **I watch to see if a parent uses any of the following language-input behaviours. [Tick any that apply]** models play, makes accompanying sounds to the child's action, labels items or feelings, comments on the child's action, interprets their child's behaviour with language; expands their child's language by adding 1 or 2 new words; re-casts their child's utterance into a question; uses praise / encouragement; rephrases the sentence with correct grammar; rejects or ignores their child's communication; corrects their child's communication; prohibits their child's behaviour (i.e. disciplines or reprimands the child, ceases the child's action)
35. **I observe the number of words / signs a parent uses in a phrase when communicating with their deaf child.** [Tick one] Always, Often, Sometimes, Rarely
36. **I note the parent's proficiency in sign language.** [Tick one] Always, Often, Sometimes, Rarely
37. **I assess the frequency of a parent's use of touch when they are interacting with their deaf child aged 0-3**. [Tick one] Always, Often, Sometimes, Rarely
38. **I assess the purpose or function of a parent's use of touch when they are interacting with their deaf child.** [Tick one] Always, Often, Sometimes, Rarely
39. **Are there any other parent skills linked to parent-child interaction that you assess that are not mentioned in this survey?** Please state
40. **Select and rank exercise. We have presented all the parent behaviours again. There are 33 of them. We'd like you to choose the 10 most important parent behaviours to assess. Please focus on hearing parents with deaf infants aged from 0 -3:**
    Parent using visual attention-getting strategies
    Parent using auditory attention-getting strategies
    Parent using tactile attention-getting strategies
    Parent using multi-modal attention-getting strateiges
    Waiting–parent actively waits or pauses until their child looks
    Joint engagement/joint attention – number of turns
    Joint engagement/joint attention – length of time
    Level of Joint engagement/joint attention – jointly attending to each other's non-verbal behaviours
    Level of Joint engagement/joint attention – jointly attending to each other's language
    Positive regard: A parent showing enthusiasm, warmth.
    Availability: A genuinely interested and involved parent.
    Contingent and Responsive: Follow's their child's lead, responds with on-topic behaviours or language.
    Emotionally sensitive: A parent who is attuned and adaptive.
    Structure and Stimulation: A parent who interacts with appropriate pace, play and language.
    Consistency: A parent who predominantly strives for a positive interaction.
    Access to language: being face to face
    Access to language: being within 1-2m of amplification device(s)
    Access to language: doing Ling checks
    Parent uses child-directed language to raise child's interest
    Language-based behaviour: parent labels items
    Language-based behaviour: parent comments/describes
    Language-based behaviour: parent makes accompanying sounds to the child's action
    Language-based behaviour: parent interprets their child's behaviour with language;
    Language-based behaviour: parent expands their child's language by adding 1 or 2 new words;
    Language-based behaviour: parent re-casts their child's language into a question;
    Language-based behaviour: parent uses of praise / encouragement
    Language-based behaviour: parent rephrases the sentence with correct grammar.
    Language-based behaviour: parent rejects or ignores their child's communication
    Language-based behaviour: parent corrects their child's communication

Language-based behaviour: parent prohibits or disciplines their child's behaviour
Language-based behaviour: number of words/signs used by a parent
Language-based behaviour: parent's proficiency of sign
Parent's frequency and use of touch

41. **Here are the ten behaviours you selected. Please rank them in order of priority. For example, if you were short on time, which of these areas would you assess first, second and so on? Remember the focus is on <u>hearing</u> parents with deaf infants aged from 0 – 3.** Participant re-orders the behaviours

## Part Three: How do you assess parents when they interact with their deaf child (aged 0-3)?

Please remember these questions are about normal practice, before Coronavirus-19.

42. **When I assess parent's interaction skills, mostly I:** do not let the parent know and I observe this informally; let the parent know I'd like to see how they interact or play with their child
43. **When I inform parents I'd like to watch their interactions with their child, I mostly request to watch:** play, singing songs, book sharing, feeding / snack time, other, please state______________________
44. **When I assess parent's interactions, I usually:** observe live and make written notes of the behaviours, observe live and make a mental note of the behaviours, make a video recording
45. **When I press 'record', I usually:** stay in the room and watch, stay in the room, but I don't watch / try to busy myself, leave the room, other, please state, N/A – I don't use film
46. **I watch the video back:** Alone, after the appointment is over, With the parent, at the **<u>same</u>** appointment / visit, With the parent, at the **<u>next</u>** appointment / visit, Other, please state, N/A – I don't use film
47. **Do you use any other tech that hasn't been listed? Apps, etc. If yes, please state**: ________
48. **When I watch parent-deaf child interaction, I mostly use:** observe and make judgements using my own skills, expertise, training and knowledge, a tool that I / my service have developed. Please describe__________, a formal, validated assessment tool. Please name_______________, a formal checklist from a therapy intervention, e.g. Palin PCI. Please name_________ , a descriptive analysis – a written transcript of the behaviours observed, a tally of parent behaviours observed, Other, please state:
49. **I mostly carry out assessments of parent-child interaction:** Alone, With another professional, Other, please state
50. **When I *have* carried out joint-assessments of parent-child interaction, I do this with: [Tick all that apply]** Qualified Teachers of the Deaf, Speech and Language Therapists, Deaf Instructors, BSL Interpreters, Interpreters for families who use alternative spoken languages, Clinical Psychologists, Portage workers?
51. **I mostly assess parents: [Select one]** in the family home, at a community clinic, at a hospital appointment, at a nursery visit, at a specialist centre
52. **Who do you assess interacting with the deaf child? [Please enter percentages, i.e. the total must equal 100].** mum / dad / older siblings / grandparents / au pair/nanny / wider family members / other, please state___________________
53. **I usually film a parent interacting with their child for:** 0 – 2 minutes, 3 to 5 minutes, 6 - 10 minutes, 11 - 15 minutes, 15 - 20 minutes, 21 – 30 minutes, 31 minutes and over, N/A – I don't use film
54. **The amount of film I usually watch back for analysis is between:** 0 – 2 minutes, 3 to 5 minutes, 6 - 10 minutes, 11 - 15 minutes, 15 - 20 minutes, 21 – 30 minutes, 31 minutes and over, N/A – I don't use film
55. **I usually re-assess a parent's interaction with their deaf child.** [Yes / No]
    **If yes, how often?** Once a week, Once a month, Once every few months, Yearly, Other, please state
56. **I feel confident observing / assessing the deaf child when they are interacting with their parent. Please slide the dot along the scale:** 0 Not confident at all - 100 Extremely confident.

57. **I feel confident observing / assessing a parent's skills when they are interacting with their deaf child**. Please slide the dot along the scale: 0 Not confident at all - 100 Extremely confident.

**Part Four: Goal-setting, support and service provision**

58. **My assessments lead to goal planning?** [Yes / No / Sometimes]

**If 'no', skip to:**

I don't set any parent-behaviour goals, **instead** I:
    give advice on interaction
    model target behaviour
    coach the parent in the session
    other please state

59. **As well as child focused outcomes, I also give parents goals linked to interacting with their deaf child.** Yes, all the time, Often, Sometimes, Rarely, No, never
60. **When I set a goal…** I tend to choose an interaction skill based on what I've observed, The parent and I discuss this and jointly decide on a behaviour to practice, I ask the parent to think about their interaction and choose a skill to practice, Other, please state:
61. **I have a time-frame in mind for the parent to achieve their interaction goal**. Yes / No
62. **I share this time-frame with the parent.** Yes / No
63. **I revisit or review the parent's interaction goals.** Yes / No
64. **I review the parents' interaction goals**... Once a week, Once every 2-4 weeks, Once every term (10-12 weeks), Once a year
65. **I share my goals with other members of the multi-disciplinary team.** Yes / Sometimes / No
66. **Here are the 10 most important parent behaviours you selected earlier. If a parent was not displaying any of your top 10 behaviours, which two would you prioritise in intervention?** [Tick two]
67. **What post-qualification training do you have in supporting parent-child interaction?** [Tick any that apply] No additional training to date, Palin PCI, VERVE Interaction Therapy, Hanen Training, please state the course, Auditory Verbal Therapy, Video Interaction Guidance (VIG), Video-feedback Intervention to Promote Positive Parenting (VIPP), Other, please state:
68. **I provide families with access to deaf role models**. Yes/No/Comments
69. **I ask parents/caregivers about their feelings towards their child's deafness diagnosis.** Yes, regularly, Often, Sometimes, Rarely, No, Never
70. **I ask parents/caregivers about stress/external pressures.** Yes, regularly, Often, Sometimes, Rarely, No, Never
71. **I ask parents/caregivers about external sources of support, i.e. friends and family, access to community.** Yes, regularly, Often, Sometimes, Rarely, No, Never
72. **Does the child's level of deafness dictate whether or not you focus on parent-child interaction with the family?** Yes / No
73. **Please continue to think about your parent-child interaction work. What proportion of your focus is spent with children with the following levels of deafness (approximately)?** The total must add up to 100. Unilateral, Mild, Moderate, Severe, Profound, deaf with additional needs
74. **How many minutes, on average, is one of your appointments for a deaf child (0-3) and their family, where some or all of the focus is on parent-child interaction?** _________
75. **Of your parent-child interaction related work, what proportion (%) of your role is spent on the following activities?** The total must add up to 100. Assessment, Goal setting, Support/Intervention, Reviews
    Liaison
76. **In your opinion, who is responsible to support successful interaction between a parent and their deaf child?** [Tick all that apply] Qualified Teacher of the Deaf, Speech and Language Therapist, Clinical Psychologist, Portage, Deaf Instructor, Others? Please state:

77. **I believe that assessing parent-child interaction is valuable when supporting the language development of deaf children.** [Select one option only] Strongly Agree, Agree, Neither Agree or Disagree, Disagree, Strongly Disagree
78. **I would use an assessment tool to monitor and appraise parent's behaviours if one was available to me.** [Select one option only] Strongly Agree, Agree, Neither Agree or Disagree, Disagree, Strongly Disagree
79. **During the Coronavirus-19 pandemic, assessing parent-child interaction was more difficult than usual.** [Select one option only] Strongly Agree, Agree, Neither Agree or Disagree, Disagree, Strongly Disagree
80. **What do you consider to be the benefits of assessing and/or supporting parent-child interaction remotely during the Coronavirus-19 pandemic?** [free text]
81. **What do you consider to be the challenges of assessing and/or supporting parent-child interaction remotely during the Coronavirus-19 pandemic?** [free text]

## 8.2.3 Appendix C: Parent Behaviours Assessed by Profession

| | SLTs (n=77) | QToDs (n=69) | Deaf CAMHS (n=6) | Psychologists/ Psychiatrists (n=3) |
|---|---|---|---|---|
| **Attention Getting Behaviours**<br>I watch to see if the parent uses any of the following to gain or direct the deaf child's attention: | | | | |
| **Q22 Visual Strategies** | | | | |
| waves | 86% (n=66) | 84% (n=58) | 100%(n=6) | 100% (n=3) |
| gestures | 95% (73) | 94% (65) | 100% (6) | 100% (3) |
| reaches | 55% (42) | 57% (39) | 100% (6) | 67% (2) |
| points | 95% (73) | 90% (62) | 100% (6) | 100% (3) |
| makes eye contact with the child | 95% (73) | 99% (68) | 100% (6) | 100% (3) |
| switches their gaze between an object and the child | 73% (56) | 77% (53) | 100% (6) | 100% (3) |
| holds of moves an object into the child's visual field | 78% (60) | 90% (62) | 100% (6) | 100% (3) |
| offers an object | 95% (73) | 88% (61) | 100% (6) | 100% (3) |
| manipulates an object | 57% (44) | 64% (44) | 100% (6) | 100% (3) |
| demonstrates play | 88% (68) | 91% (63) | 100% (6) | 100% (3) |
| makes faces | 75% (58) | 86% (59) | 100% (6) | 100% (3) |
| displaces their sign into the child's visual field or signing space | 62% (48) | 62% (43) | 83% (5) | 100% (3) |
| **Q23 Auditory Strategies** | | | | |
| calling the child's name | 99% (76) | 99% (68) | 100% (6) | 100% (3) |
| using words such as 'look' | 93% (72) | 94% (65) | 100% (6) | 100% (3) |
| using non-words such as 'whee' | 82% (63) | 78% (54) | 67% (4) | 67% (2) |
| humming | 23% (18) | 26% (18) | 67% (4) | 33% (1) |
| singing | 80% (62) | 81% (56) | 67% (4) | 67% (2) |
| clapping or clicking | 57% (44) | 70% (48) | 83% (5) | 100% (3) |
| using a toy or object to make sound | 81% (62) | 90% (62) | 83% (5) | 67% (2) |
| **Q24 Tactile strategies** | | | | |
| making gestures or signs on the body of the child | 58% (45) | 73% (50) | 100% (6) | 67% (2) |
| tapping | 83% (64) | 78% (54) | 100% (6) | 100% (3) |
| touching | 90% (69) | 84% (58) | 100% (6) | 60% (3) |
| hugging | 34% (26) | 51% (35) | 67% (4) | 67% (2) |

| | **SLTs (n=77)** | **QToDs (n=69)** | **Deaf CAMHS (n=6)** | **Psychologists/ Psychiatrists (n=3)** |
|---|---|---|---|---|
| holding the child | 51% (39) | 64% (44) | 83% (5) | 67% (2) |
| grabbing onto the child's clothing | 26% (20) | 23% (16) | 50% (3) | 67% (2) |
| moving the child's limbs or head | 38% (29) | 41% (28) | 50% (3) | 67% (2) |
| touching the child with a toy (out of their visual field) | 35% (27) | 48% (33) | 100% (6) | 100% (3) |
| tapping the ground to create vibrations | 57% (44) | 67% (46) | 83% (5) | 100% (3) |
| physically adjusting the child's position to direct their attention | 66% (51) | 71% (49) | 83% (5) | 100% (3) |
| **Joint Engagement**<br>Q27 I note how many connected turns there are between a parent and their deaf child in joint engagement | 68% (52) | 68% (47) | 83% (5) | 33% (1) |
| Q28 I note the length of time a parent and child remain in joint engagement once it is established. | 73% (56) | 70% (48) | 100% (6) | 100% (3) |
| Q29 I note who is helping to maintain the joint engagement, i.e., supported vs. coordinated joint engagement. | 77% (59) | 81% (56) | 100% (6) | 67% (2) |
| **Parental Sensitivity**<br>Q32 I observe / assess:<br>Positive Regard: A parent showing enthusiasm, warmth, pleasure, love, and respect for their child. | 86% (66) | 91% (63) | 83% (5) | 100% (3) |
| Availability: A parent who is genuinely interested and actively involved in participating in accessible interactions with their child. | 92% (71) | 91% (63) | 100% (6) | 100% (3) |
| Contingent and Responsive: A parent that follow's their child's lead and pace and responds with contingent, on-topic behaviours or language. | 96% (74) | 87% (60) | 100% (6) | 67% (2) |
| Emotionally sensitive: A parent who is emotionally attuned and adaptive. Able to recognise and respond to distress, disinterest and repair or resolve misunderstandings or conflict. | 87% (67) | 86% (59) | 100% (6) | 67% (2) |
| Structure and Stimulation: A parent who is able to support a child's interest by guiding and developing the interaction with appropriate pace, play and language, accepting a change in play or routine put forward by the child. | 87% (67) | 83% (57) | 100% (6) | 67% (2) |

| | SLTs (n=77) | QToDs (n=69) | Deaf CAMHS (n=6) | Psychologists/ Psychiatrists (n=3) |
|---|---|---|---|---|
| Consistency: A parent who can absorb and regulate a range of their child's emotions and behaviours, whilst remaining mostly constant in their own behaviours, predominantly striving for a positive interaction. | 70% (50) | 73% (50) | 100% (6) | 67% (2) |
| **Q33 Access to Language**<br>I watch to see whether a parent uses any of the following to increase the deaf child's access to language:<br>communicates within a child's line of sight, i.e. face to face | 92% (71) | 100% (69) | 100% (6) | 100% (3) |
| communicates within 1-2m of a child's amplification device | 84% (65) | 91% (63) | 67% (4) | 33% (1) |
| carries out Ling sound checks for users of amplification device | 52% (40) | 86% (59) | 50% (3) | 100% (3) |
| uses child-directed spoken language | 97% (75) | 96% (66) | 67% (4) | 67% (2) |
| uses child-directed sign | 56% (43) | 73% (50) | 83% (5) | 33% (1) |
| **Q34 Language Input**<br>I watch to see whether a parent uses any of the following language-input behaviours:<br>models play | 91% (70) | 99% (68) | 100% (6) | 100% (3) |
| makes accompanying sounds to the child's action | 91% (70) | 94% (65) | 67% (4) | 67% (2) |
| labels items or feelings | 97% (75) | 96% (66) | 83% (5) | 67% (2) |
| comments on the child's action | 99% (76) | 93% (64) | 100% (6) | 67% (2) |
| interprets their child's behaviour or language | 88% (68) | 94% (65) | 83% (5) | 67% (2) |
| adds 1 or 2 new words/signs | 99% (76) | 94% (65) | 83% (5) | 67% (2) |
| recasts their child's utterance into question form | 53% (41) | 78% (54) | 50% (3) | 67% (2) |
| uses praise or encouragement | 94% (72) | 97% (67) | 83% (5) | 100% (3) |
| rephrases the child's utterance with correct grammar | 90% (69) | 84% (58) | 33% (2) | 67% (2) |
| rejects or ignores their child's communication | 69% (53) | 71% (49) | 67% (4) | 100% (3) |
| corrects their child's communication | 74% (57) | 68% (47) | 67% (4) | 67% (2) |
| prohibits or reprimands the child / ceases the child's action | 57% (44) | 59% (41) | 67% (4) | 100% (3) |
| **Q39 Other parent skills assessed linked to parent-child interaction that are not mentioned in this survey**<br>Free text box responses:<br>parent and child mutual face watching,<br>parent staying still or silent when the child looks away, | | | | |

parent being aware of reducing background noise,
parent alerting the child to environmental sounds,
parent using appropriate voice volume,
parent positioning themselves at the child's level,
parent using a range of different word types,
parent using repetition,
parent talking ahead of events,
parent offering choices,
parent pausing or waiting to give time for the child to initiate,
parent using mental state talk,
parent modelling making mistakes,
parent's level of self-confidence (with interacting, equipment and/or using sign language),
parent's acceptance of deafness,
parent's self-awareness of skills,
parent awareness of their child's level of skill,
parent over-testing the child with questions,
parent talking for, or talking over the child.

### 8.2.4 Appendix D – Most important parent behaviours to assess in PCI where the deaf child is aged 0-3 (n=155)

| **Parent Behaviour Assessed** | **%** | **n** |
|---|---|---|
| Parent waits for the child to look | 82.6% | 128 |
| Parent is contingent and responsive, follow's their child's lead and responds with on-topic behaviours or language | 69.0% | 107 |
| Parent uses multi-modal strategies to gain the child's attention | 59.4% | 92 |
| Parent ensures they are face to face with their child | 58.1% | 90 |
| Parent is stimulating and can provide appropriate pace, play, and language structures | 54.2% | 84 |
| Parent is available to the child, genuinely interested and involved | 53.5% | 83 |
| Parent expands their child's language by adding 1 or 2 new words/signs | 50.3% | 78 |
| Parent uses child-directed language (spoken or signed) to raise child's interest | 49.7% | 77 |
| Parent interprets their child's behaviour with language (spoken or signed) | 45.2% | 70 |
| Parent comments on, or describes the child's action | 41.9% | 65 |
| Parent has positive regard, showing enthusiasm and warmth. | 39.4% | 61 |
| Parent and child are jointly engaged with one another's language | 38.7% | 60 |
| Parent is within 1-2m of amplification device(s) | 38.1% | 59 |
| Parent is emotionally sensitive, attuned, and adaptive. | 34.2% | 53 |
| Counting the number of connected turns between parent and child (joint engagement) | 34.2% | 53 |
| Parent and child are jointly engaged in one another's visual behaviours | 32.3% | 50 |
| Parent uses praise / encouragement | 31.0% | 48 |
| Parent uses auditory strategies to gain the child's attention | 29.7% | 46 |
| Noting the length of time that parent and child are in joint engagement | 21.3% | 33 |
| Parent uses visual strategies to gain the child's attention | 19.4% | 30 |
| Parent conducts the Ling Sounds with their child | 15.5% | 24 |
| Parent is consistent and strives for a positive interaction | 13.5% | 21 |
| Counting the number of words or signs a parent uses with their child | 13.5% | 21 |
| Parent labels items | 13.5% | 21 |
| Parent makes accompanying sounds alongside the child's action | 12.9% | 20 |
| Parent rephrases the child's utterance with correct grammar. | 11.6% | 18 |
| Parent rejects or ignore their child's communication | 9.7% | 15 |
| Noting the parent's proficiency in sign language | 7.1% | 11 |
| Parent uses tactile strategies to gain the child's attention | 5.8% | 9 |

|  |  |  |
|---|---|---|
| Noting the frequency of parent's touch and its purpose | 5.2% | 8 |
| Language-based behaviour: parent prohibits / disciplines their child's behaviour | 3.9% | 6 |
| Language-based behaviour: parent re-casts their child's language into a question | 3.2% | 5 |
| Language-based behaviour: parent corrects their child's communication | 2.6% | 4 |

## 8.2.5 Appendix E – Top ten most important parent behaviours to assess in PCI where the deaf child is aged 0-3 (per group)

| **Speech and Language Therapists (n=77)** | **% (n)** |
|---|---|
| Parent waits for the child to look | 84% (65) |
| Parent is contingent and responsive | 74% (57) |
| Parent uses multi-modal strategies to gain attention | 69% (53) |
| Parent ensures they are face to face | 62% (48) |
| Parent is stimulating and can provide appropriate pace, play, and language structures | 60% (46) |
| Parent expands language by adding 1 or 2 new words/signs | 52% (40) |
| Parent interprets their child's behaviour with language (spoken or signed) | 52% (40) |
| Parent comments on, or describes the child's action | 51% (39) |
| Parent uses child-directed language (spoken or signed) | 49% (38) |
| Parent is available to the child, genuinely interested | 48% (37) |

| **Qualified Teachers of the Deaf (n=69)** | **% (n)** |
|---|---|
| Parent waits for the child to look | 87% (60) |
| Parent is contingent and responsive | 64% (44) |
| Parent is available to the child, genuinely interested | 58% (40) |
| Parent expands language by adding 1 or 2 new words/signs | 55% (38) |
| Parent uses child-directed language (spoken or signed) | 54% (37) |
| Parent uses multi-modal strategies to gain attention | 52% (36) |
| Parent ensures they are face to face | 52% (36) |
| Parent is within 1-2m of amplification device | 52% (36) |
| Parent has positive regard, showing enthusiasm, warmth. | 48% (33) |

| | |
|---|---|
| Parent is stimulating and can provide appropriate pace, play, and language structures | 46% (32) |

| **Deaf CAMHS Professionals (n=6)** | **% (n)** |
|---|---|
| Parent uses visual strategies to gain attention | 83% (5) |
| Parent ensures they are face to face | 67% (4) |
| Parent is stimulating and can provide appropriate pace, play, and language structures | 67% (4) |
| Parent is available to the child, genuinely interested | 67% (4) |
| Parent and child are jointly engaged with one another’s language | 67% (4) |
| Parent and child are jointly engaged in one another’s visual behaviours | 67% (4) |
| Parent waits for the child to look | 50% (3) |
| Parent is contingent and responsive | 50% (3) |
| Parent has positive regard, showing enthusiasm, warmth | 50% (3) |
| Parent is emotionally sensitive, attuned and adaptive. | 50% (3) |

| **Psychologists / Psychiatrists (n=3)** | **% (n)** |
|---|---|
| Parent is contingent and responsive | 100% (3) |
| Parent is emotionally sensitive, attuned, and adaptive. | 100% (3) |
| Parent uses praise / encouragement | 100% (3) |
| Language-based behaviour: parent prohibits / disciplines their child’s behaviour | 100% (3) |
| Parent ensures they are face to face | 67% (2) |
| Parent is stimulating and can provide appropriate pace, play, and language structures | 67% (2) |
| Parent is available to the child, genuinely interested | 67% (2) |
| Parent and child are jointly engaged in one another’s visual behaviours | 67% (2) |
| Parent has positive regard, showing enthusiasm, warmth | 67% (2) |
| Parent is consistent and strives for a positive interaction | 67% (2) |

## 8.3 Supporting Information (Appendices A – C) for Chapter Five:

Curtin, M., Wakefield, T., Herman, R., Morgan, G., & Cruice, M. (2024a). “It doesn’t matter if we’re the most amazing professionals in the world…” A qualitative study of professionals’ perspectives on parent-child interaction assessment with deaf infants. *Frontiers in Psychology*, *15*, 1315220.

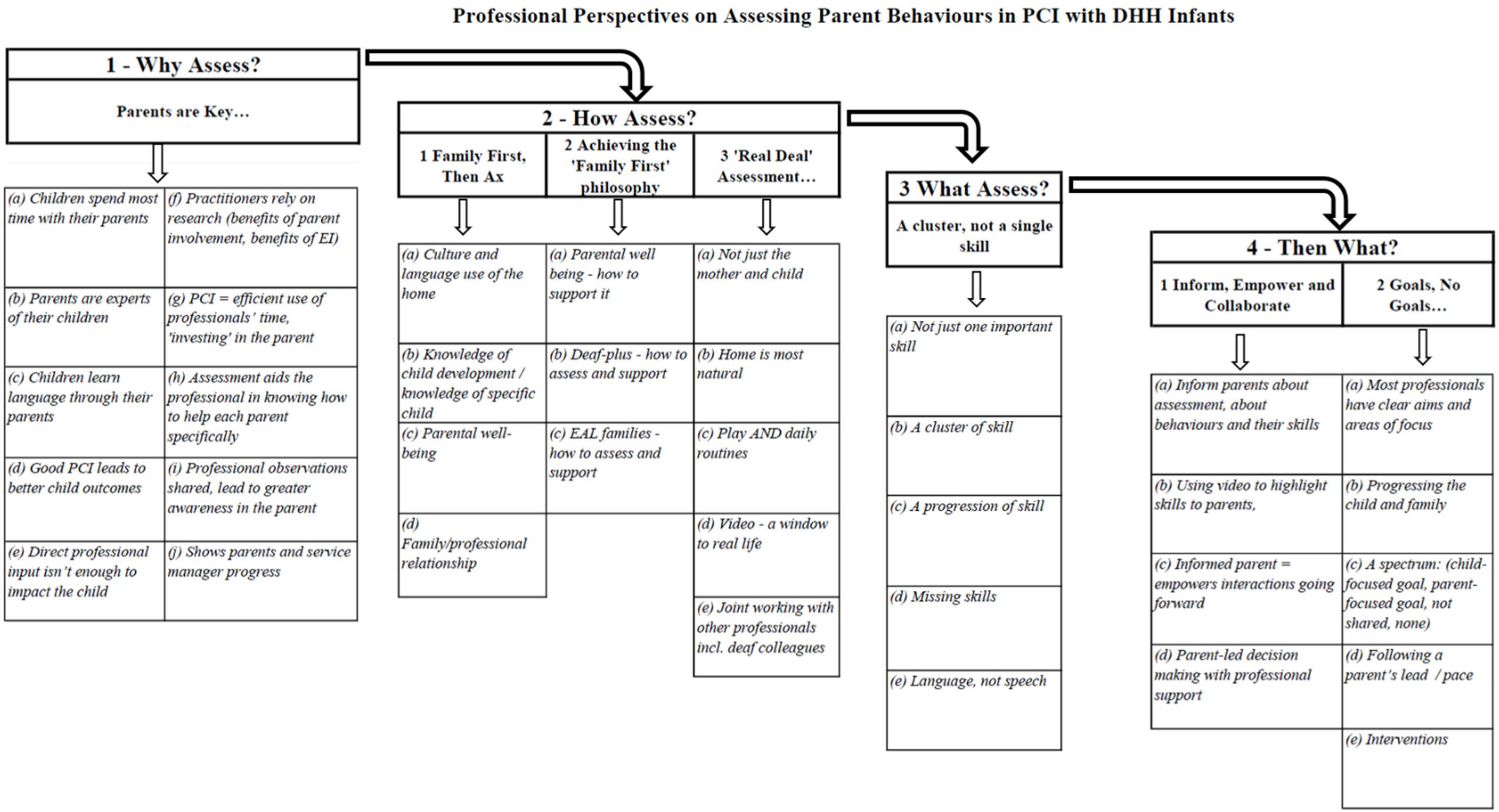
### 8.3.1 Appendix A: Focus Group Topic Guide

1 Why do so many professionals assess or observe PCI?
2 Based on the top ten parent-child behaviours professionals assess (Curtin et al., 2023), is there a most important skill? Is there a cluster?
3 Which skills are fundamental to any language/modality?
4 Which behaviours are missing from the top 10?
5 Can you describe a best practice way of assessing parent-child interaction?
6 What adaptations are needed for families who use a language other than English? For families with children with additional needs?
7 In which ways do you monitor parents’ acceptance of deafness, parental well-being, self-efficacy with parenting a deaf child?
8 Describe how you decide on a goal.
9 Beyond goals, what do you do with the information from your PCI assessments?

### 8.3.2 Appendix B: Top Ten Parent Behaviours Assessed in PCI (n=155) from Curtin et al., 2023

| **Parent Behaviour Assessed** | **%** | **(n)** |
|---|---|---|
| Parent waits for the child to look | 82.6% | 128 |
| Parent is contingent and responsive, follows their child’s lead and responds with on-topic behaviours or language | 69.0% | 107 |
| Parent uses multi-modal strategies to gain the child’s attention | 59.4% | 92 |
| Parent ensures they are face to face with their child | 58.1% | 90 |
| Parent is stimulating and can provide appropriate pace, play, and language structures | 54.2% | 84 |
| Parent is available to the child, genuinely interested and involved | 53.5% | 83 |
| Parent expands their child’s language by adding 1 or 2 new words/signs | 50.3% | 78 |
| Parent uses child-directed language (spoken or signed) to raise child's interest | 49.7% | 77 |
| Parent interprets their child’s behaviour with language (spoken or signed) | 45.2% | 70 |
| Parent comments on, or describes the child’s action | 41.9% | 65 |

## 8.3.3 Appendix C – Coding Tree



**Professional Perspectives on Assessing Parent Behaviours in PCI with DHH Infants**

**1 - Why Assess?**

**Parents are Key…**

- *(a) Children spend most time with their parents*
- *(b) Parents are experts of their children*
- *(c) Children learn language through their parents*
- *(d) Good PCI leads to better child outcomes*
- *(e) Direct professional input isn't enough to impact the child*
- *(f) Practitioners rely on research (benefits of parent involvement, benefits of EI)*
- *(g) PCI = efficient use of professionals' time, 'investing' in the parent*
- *(h) Assessment aids the professional in knowing how to help each parent specifically*
- *(i) Professional observations shared, lead to greater awareness in the parent*
- *(j) Shows parents and service manager progress*

**2 - How Assess?**

**1 Family First, Then Ax**

- *(a) Culture and language use of the home*
- *(b) Knowledge of child development / knowledge of specific child*
- *(c) Parental well-being*
- *(d) Family/professional relationship*

**2 Achieving the 'Family First' philosophy**

- *(a) Parental well being - how to support it*
- *(b) Deaf-plus - how to assess and support*
- *(c) EAL families - how to assess and support*

**3 'Real Deal' Assessment…**

- *(a) Not just the mother and child*
- *(b) Home is most natural*
- *(c) Play AND daily routines*
- *(d) Video - a window to real life*
- *(e) Joint working with other professionals incl. deaf colleagues*

**3 What Assess?**

**A cluster, not a single skill**

- *(a) Not just one important skill*
- *(b) A cluster of skill*
- *(c) A progression of skill*
- *(d) Missing skills*
- *(e) Language, not speech*

**4 - Then What?**

**1 Inform, Empower and Collaborate**

- *(a) Inform parents about assessment, about behaviours and their skills*
- *(b) Using video to highlight skills to parents,*
- *(c) Informed parent = empowers interactions going forward*
- *(d) Parent-led decision making with professional support*

**2 Goals, No Goals…**

- *(a) Most professionals have clear aims and areas of focus*
- *(b) Progressing the child and family*
- *(c) A spectrum: (child-focused goal, parent-focused goal, not shared, none)*
- *(d) Following a parent's lead / pace*
- *(e) Interventions*

## 8.4 Supporting Information (S1 and S2 Tables and S1 and S2 Files) for Chapter Six:

Curtin, M., Cruice, M., Morgan, G., & Herman, R. (2024b). Assessing parent-child interaction with deaf and hard of hearing infants aged 0–3 years: An international multi-professional e-Delphi. *PloS one*, *19*(4), e0301722.

### 8.4.1 S1 Table: Reworded statements from Round 1 used in Round 2

For uniformity, statements have been edited into the third person, i.e. 'Parent using visual attention-getting strategies' to 'Parent uses visual….'

| **Parent Behaviours: Round 1 Statements** | **Reworded statements used in Round 2** |
|---|---|
| | **These behaviours had the following statement before them:*<br>This parent behaviour may be particularly relevant for children who are visually motivated and/or benefit from access to lip patterns / facial expressions. The use of these parent behaviours will be influenced by the child's hearing status, their access to spoken language (over distance/noise), use of audiological devices, and/or the chosen language(s) used by the family. |
| PB1 Parent uses visual attention-getting strategies (i.e., waving). | *PB1: Parent uses visual attention-getting strategies (e.g., moving into the child's visual field). |
| PB3 Parent uses tactile attention-getting strategies (i.e., tapping the floor). | *PB3: Parent uses tactile attention-getting strategies (e.g., tapping). |
| PB4 Parent uses multi-modal attention-getting strategies (i.e., tapping the child and saying 'look'). | *PB4: Parent uses multiple strategies at one time to gain the child's attention (e.g., moves into the child's visual field and says 'wow', taps and says the child's name). |
| PB5 Parent actively waits or pauses their communication until their child looks at them. | *PB5: Where the child benefits from access to lip patterns, facial expressions, and/or visual perception of sound, parent actively waits or pauses their communication until their child looks at them. |
| | + *These behaviours had the following statement before them:* This parent behaviour may be particularly relevant for children who have access to sound and the potential to understand and use spoken language. |

| | |
|---|---|
| PB2 Parent uses auditory attention-getting strategies (i.e., saying 'wow') | +PB2: Parent uses auditory attention-getting strategies (e.g., using the child's name). |
| PB21 Parent uses appropriate voice volume. | +PB21: Where the child is using/developing skills in spoken language, parent uses appropriate voice volume. |
| PB22 Parent is mostly within 1 to 2 meters of amplification device(s). | +PB22 Where the child is using/developing spoken language, parent is mostly within 1 to 2 meters of the child's amplification device(s) where possible. |
| PB23 Parent makes accompanying sounds to the child's action / toys / items. | +PB23 In earlier stages of development, where the deaf child has access to spoken language, parent makes accompanying sounds to the child's actions / toys / items. |
| | *The below final statements were introduced with the following sentence:*<br>The following statements are to be considered no matter the family's choice in spoken and/or signed languages. |
| PB7 Parent stays still or silent when the child looks away. | PB7 Parent watches and waits when the child looks away, to allow the child to explore, to take a rest from interacting, to allow the child to take a turn in initiating. |
| PB12 Parent spends time observing their child's behaviours and initiations, before using language. | PB12 Within the interaction, parent waits and watches their child's behaviours and gaze, using the child's cues to tailor the language they will use. |
| PB28 Parent uses mental state verbs (i.e., 'like', 'know', 'think') within the interaction. | PB 28 Where contextually and pragmatically appropriate (developmental stage / relevant moment), parent uses mental state verbs (i.e., 'like', 'know', 'think') within the interaction. |
| PB29 Parent describes actions or events ahead of doing them. | PB29 Parent informs the child of an action or event ahead of doing it, using a range of visual cues if appropriate for the child's understanding. |
| PB30 Parent reduces questions and increases on-topic comments. | PB30 Parent uses open questions in favour of closed questions. |
| PB32 Parent rephrases the child's language with correct grammar. | PB32 Within the interaction, parent supportively rephrases the deaf child's language with correct grammar (where contextually and pragmatically appropriate, i.e., developmental stage, a natural moment). |
| PB33 Parent rephrases their child's language into a question. | PB33 Parent rephrases their child's language into a question, i.e., the child says/signs "cake" and the parent rephrases into "Can I have cake, daddy?' |
| PB34 Parent uses open questions. | PB34 Parent balances open questioning with on-topic comments. |
| PB37 Parent models mistakes in their own language use. | PB37 Parent models mistakes in their own language if/when they arise, i.e., 'The fireman is crying... I mean climbing! I used the wrong word/sign'. |

| | |
|---|---|
| PB39 Parents’ average number of signs / words used in interactions to be noted. | PB39 Parent provides language input (i.e., average number of signs/ words) that is appropriate to child’s developmental stage. |
| PB40 Parent's frequency and use of touch. | PB40 Parent uses touch as a tactile way of highlighting speech / tone / rhythm in their language (e.g., parent says ‘Hel-lo Ma-ya’ with taps for each syllable). |
| **Approaches to Assessment: Round 1 Statements** | **How They Were Reworded in Round 2** |
| AA41 Joint engagement should be evaluated by number of interactive turns between parent and child. | AA41 Evaluating joint engagement could be observing the connected turns between parent and child. In some cases, it may be appropriate to count these turns. |
| AA42 Joint engagement should be measured by total length of time engaged. | AA42: Joint engagement could be observed by noting how long a parent and child remain connected. In some cases, it may be appropriate to estimate this, particularly for the purpose of reviewing progress. |
| AA43 The parent-child interaction assessment should be recorded on video. | AA43 To accurately capture and then reflect on parent-child interaction, a video recording is recommended at least once in parent/professional partnership work. Timing of when this formal measure is taken will depend on parental well-being, parental personality and the strength and trust within the parent/professional relationship. |
| AA44 Video recordings should be less than 10 minutes in length. | AA44 Though a video recording of 10 minutes of interaction should provide enough material for watch back and reflection, the length of a video recording should be discussed with parents as they may request more or less time. |
| AA45 Parents should be encouraged to send videos to an early intervention provider for review of more natural interaction, where the professional is not present (especially if the child has additional needs). | AA45 Parents could be encouraged to send videos to an early intervention provider for review, where the professional is not present (especially if the child has additional needs, the child does not engage, or parents require support within a particular context). |
| AA47 Assessments should take place in the child and parents’ most natural setting. | AA47 Where possible, assessments of parent-child interaction should take place in the child and parents’ most natural, most familiar settings. |
| AA48 Parents should be asked where they would prefer to be assessed. | AA48: Where possible, parents should be asked where they would prefer to be observed. |
| AA49 As well as play, parent-child interaction should be assessed within daily routines (i.e., dressing, mealtimes). | AA49: As well as observing interaction in play, professionals could sample interactions within daily routines (e.g., mealtimes, dressing) where parents are willing. |
| AA50 For children with additional or complex medical needs, assessments may need to focus more on everyday routines and care, compared to play. | AA50 For some children, e.g., those with additional or complex medical needs, the activities within parent-child interaction assessments may need to be more flexible and varied, i.e., whenever the child is most interactive within their daily routines. |
| AA52 The entire review of the assessment should be strength-based. | AA52: The review of the parent-child interaction assessment should be largely strength-based, i.e., identifying what is working well. There could also be scope to sensitively |

| | |
|---|---|
| | highlight behaviours with potential to improve, as long as the overall review is positive and encouraging. |
| AA54 Scales should be used to observe each parent behaviour (i.e., not observed, emerging, present). | AA54: Parents and professionals could reflect on each parent behaviour together using scales. Professionals could describe each parent behaviour before the parent reflects on their interactions. The wording of the scale to be parent-centred and positively framed. |
| AA56 Parents should be sent a copy of the assessment video, following the assessment session with the professional. | AA56: Where possible, the parent should be offered the choice of receiving a copy of the parent-child interaction recording, following the assessment session with the professional. |
| AA57 All main caregivers (i.e., mothers, fathers, grandparents) should be given the opportunity to have their interaction skills reviewed. | AA57: If the family requests or the context deems it necessary, all main caregivers (i.e., mothers, fathers, grandparents, older siblings) should be given the opportunity to have their interaction skills observed and reflected upon. |
| AA60 Professionals (i.e., Early Interventionists, Family Support Workers, Teachers of the Deaf and / or Speech and Language Therapists) should conduct joint assessments of parent-child interaction where possible. | AA60: Where a family has more than one professional involved, the assessing professional should share information from the assessment with the rest of the team. This will reduce duplication of assessment and allow quicker access to intervention / support. |
| AA61 Families who do not share the same language as the assessor require bilingual co-workers or interpreters for the assessment, but the parent behaviours being assessed do not require adaptations. | AA61a Families should have their parent-child interaction observed in the language of the home, with assessors using interpreters or bilingual co-workers to understand the language used. |
| | AA61b The culture of the family should be acknowledged when observing parent-child interaction, to prevent the professional misinterpreting assessment results. |
| | AA61c All parents, even where there may be cultural differences at play, may benefit from adapting their communication behaviours if unhelpful for the language development of the deaf child. The review of an assessment video can assist with these discussions. |
| AA64 Goals should be focused on a parent's current strengths in the assessment. | AA64: Goals should be mostly focused on a parent's current strengths in the assessment. The parent may also wish to pick an important behaviour they would like to practice / become more confident with. |

## 8.4.2 S1 File: Participants' Feedback for Round 2 Open Text Question: When observing PCI with deaf children with additional needs, are there any methods that you have found useful?

All non-identifiable contributions have been added here, grouped into similar points.

**Consulting with parents:**

- Using parents to make and send their own videos through to the professional
- Listening to parent/carer about what the child particularly likes or engages with.
- Spending time getting to know the family first. Finding out background information maybe through an interpreter so you know the child's routine and language community.
- Professional taking carer advice on time of day, duration, activity, and location where most interaction happens.
- Check when the best time to do the session would be. For these sessions I would say home visits can work better.
- Important to work from where the parents are. Seek their advice on which routines or activities they believe will work best rather than setting the activity. Incredibly important to address it using the key principles of appropriate support.
- Really knowing the child and asking parents for their thoughts
- Making sure to seek parental insights and input about what works, what doesn't work -- even if the professional doesn't agree, it's good to respect the parents as the "experts" about their own child.
- Asking the parent where they feel communication is strongest and where they could use more support in determining best ways to communicate successfully and then observing both situations
- You've touched on it in how you've worded AA50 - work with parents to discern what time of day/what type of interaction is best for them and their child.
- Negotiating with parents the best time of day. Joint visits with other professionals as they often have so many involved.
- Find out when the child is happy and record that.
- No one method works for all. I have found it's best to work co-operatively and collaboratively with parents, trying a range of approaches that fit best into their daily lives and take account of their child's needs. In my view the 'best' approach is the one that the family feels the most comfortable with and that works best to yield the maximum information to inform support. EI practitioners need to try any and all approaches to find, with the family, what works best for them. Diaries, videos (especially when the child is enjoying an activity) and at different times of day can all work

**General adaptations (or none):**

- Shorter interactions
- Observing during daily routines
- Observe their natural interactions
- No, PCIT principles are the same regardless
- Child in their home environment
- Observe in group sessions e.g., during a coffee morning when child is relaxed.
- I have used a number of systems - I have found making a video at home and sending in for joint review over MS teams has been a positive move forward

- If processing time and eye contact is not offered then other methods of PCI will need to be established as 'normal behaviour'. This may need to be observed over a much longer period of time and may not be evident or captured in 10 minutes.
- Encouraging the carers to do what the child likes best e.g., people games, intensive interaction, sensory play etc
- Being flexible is key, observing PCI in different scenarios such as nursery, hospital, home and even outdoors.
- Finding activities that the parent and child truly both enjoy. Get away from 'setting up a learning situation' - just both have fun -emphasis on enjoying each other's company.
- Using online sessions has proved to be beneficial as the parent can have their phone set up anywhere in the house where they would prefer the observation to take place.
- Observing over a longer time frame (within session as well as on more frequent visits) and taking care to acknowledge more subtle responses. A variety of settings. Agree that daily routines are key here.
- Although it isn't popular now, we found lots of good info with dyadic toy play. Home based activities like preparing for dinner, hygiene, also good. Need some observation with objects, others without object focus.
- Looking at anticipating each other within familiar routines e.g., both how the parent interprets the child's subtle signals such as change in breathing, muscle tone - and also how the child anticipates/responds to next steps within familiar routines e.g., tilting chin up towards spoon during feeding

**Physical factors to consider:**

- Encouraging the parent to consider positioning of the child i.e., on the floor or in adapted seating/standing frame etc.
- Think about child's mobility - ensure they are comfortable
- Having the child sat in a chair with a tray for toys/books to be placed on helps to contain the child while interacting if the child finds it hard to sit still for less than a few minutes.
- Parent at same level, up close and personal
- Consider any support resources e.g., seating, splints, light or sound management that may be needed. Depending on additional need, interaction with a range of carers may be helpful

**Resources and Assessments:**

- Triple-C-Checklist; observing the milestones of prelinguistic interaction like (pre-)intentionality and (pre-)symbolic play; additionally try out of methods of augmented and alternative communication
- Video interaction guidance and It Takes Two to Talk (HANEN)
- I have used the Affective Communication assessment and the Behavioral Observation of Hearing, to look at very complex children and to ascertain if we are getting responses to sound or interaction
- Approaches by Jan van Dijk (not only for deafblind children)
- The ES Developmental Journal done with the parents only using the relevant section/pages.
- Observations by other professionals
- Having an accompanying person/professional to observe session

## 8.4.3 S2 File: Participants' Feedback for Round 2 Open Text Question: Please describe how to successfully manage assessments with families who use their home language to communicate with their deaf child (a language different from that of the country they reside in).

All non-identifiable contributions have been added here, grouped into similar points.

### Interpretation / Translation

- In children 0-3 a monolingual professional can observe a lot, even, if he/she does not speak the language, especially the preverbal aspects of communication development. This can serve as a base. If translation is additionally available, this would be better, but not essential. In addition questionnaires in the families language can be helpful!
- As with many of these questions, it is important to keep sessions as straightforward and uncomplicated as possible in order to be realistic regarding how they will work in a range of work settings. If an interpreter is already present for parents, it makes sense to ask them about the language used. However, caution should be taken that an interpreter communicates exactly what has been said/type of language and vocabulary used so time needed to explain this. If parents also speak English, may not feel appropriate to book an interpreter. If there is a bilingual colleague available, that's great but might not be general practice depending if a variety of languages are used among parents. Some behaviours, e.g., length of connected turn, way parents gain attention can still be observed in another language
- By getting the free play recording translated
- I think the interpreter needs careful briefing and if possible be attached to the team so they understand the whole aim of doing observations about language and interaction in the home. I have done this once or twice with spoken language interpreters with deaf / deafblind children aged 0 - 5. I think it would be better to have the bilingual professional lead - but an interpreter is not an early years language worker. Training time would need to be built in. They may have preconceived ideas about language development just as parents do too and other support staff.
- Including researchers/professionals fluent in the language observed.
- I have only been able to use interpreters and we have carried assessments out together with a lot of guidance. It is very challenging and time consuming to get it right.
- We use bi-lingual therapists but are lucky to have them in our center; they speak English and Spanish
- I have delivered a 3 month video intervention through an interpreter (spoken language) the outcomes were very successful for the family
- Have experienced difficulties when I've had to use a foreign language interpreter when an ESL teacher has not been available, it did not work as well, the teacher understood the purpose in a way the interpreter did not and they became too involved in the assessment.
- We have done meetings/sessions with an interpreter taking the lead who has been prepared by the professional regarding expectations of the interaction. The interpreter has then used their skills to help the monolingual professional.
- If the parent is confident in a language that the assessor is using then the parent can report back on what was being said. The actual content of the language used is only a fraction of PCI
- Interpreter in the session F2F or joining remotely
- Discuss with parents with help from the interpreter present - they would have to be part of the reflection of what had been noted in the video

- ’Supporting deaf children who speak English’ as an additional language document. Look at section on use of interpreters.
- I often watch it back with the parent and get them to tell me what they have said if their English is good enough. If not, I have had the interpreter tell me what was said. It takes longer of course.
- I find this challenging. In my experience, you need an appropriately trained co-worker to facilitate this - it doesn't always work well with interpreters.
- Working alongside a sign communicator to assess the video after the event
- Involving family members, from time to time online professional interpretation works, helps a lot when it is possible to have some time for explanations with the interpreter and when the same interpreter is used again and again
- I’ve used student SLTs who speak the family language to join me on appointments.
- Sharing the lead depending on the language levels of the child and parent. If child pre-linguistic, bilingual co-worker explains activities to parent as co-worker completes non-linguistic tasks - a mixture of these approaches
- We have used interpreters. this can be incredibly successful, but we also have had situations which have been difficult due to the level of understanding of the work by the interpreter, and also the familiarity of the interpreter. Where the family have a choice and can request a specific interpreter they feel comfortable with then this has also worked well. This has built up professional understanding and mutual respect between all parties which is so important
- Provide bilingual assessors as a first preference, or interpreters as a second tier option
- Training/discussion on PCIT with interpreter so they are aware of goals and aims & translate accordingly
- Sometimes the parents can speak English. Otherwise we also tried digital translator tools. Or we invite other families with the same language who can help to translate. Our experience is that professionals are very good at assessing language behaviour, whether they understand the language or not. It is only necessary for the subsequent counselling.

**Other**

- Encourage home language interactions through songs and home books
- Interaction is generally language and cultural independent. I will only ask if a certain action is considered appropriate in their language and culture.

## 8.4.4 S2 Table: Number of statements per category achieving consensus across the E-Delphi study

The tables below show how many statements from each category achieved consensus in rounds 1 and rounds 2. Following round 2, a further six skills were included following data analysis and review.

Parent Behaviour Categories

| Category of Parent Behaviour (number of PB statements) | Achieved Consensus in Round 1 | Achieved Consensus in Round 2 | From final review discussion | Included Statements | No Consensus (i.e., discarded) |
|---|---|---|---|---|---|

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| Attention Getting (n=5) | 0 | 3 | 0 | 3/5 | 2 |
| Joint Engagement (n=4) | 4 | N/A | N/A | 4/4 | - |
| Parental Sensitivity (n=8) | 8 | N/A | N/A | 8/8 | - |
| Access to Language (n=4) | 1 | 2 +1 added | 0 | 4/5 | 1 |
| Language Enrichment (n=19) | 8 | 7 | 2 | 17/19 | 2 |
| **Total** | **21** | **13** | **2** | **36/41 (88%)** | **5/41 (12%)** |

Approaches to Assessment Categories

| **Category (number of AA statements)** | **Achieved Consensus in Round 1** | **Achieved Consensus in Round 2** | **From final review discussion** | **Included Statements** | **No Consensus (discarded)** |
|---|---|---|---|---|---|
| Assessment Set Up (n=3) | 0 | 0 | 2 | 2/3 | 1 |
| Measuring Skills (n=4) | 0 | 0 | 0 | 0/4 | 4 |
| An Informed Parent (n=4) | 2 | 2 | N/A | 4/4 |  |
| An Empowered Parent (n=4) | 1 | 3 | N/A | 4/4 |  |
| Collaborating with Parents (n=3) | 0 | 1 | 2 | 3/3 |  |
| Goal setting (n=4) | 4 | N/A | N/A | 4/4 |  |
| Multi-Professional Joint Working (n=2) | 0 | 1 | N/A | 1/2 | 1 |
| Cultural Diversity (n=1) | 0 | 1+2 added | N/A | 3/3 |  |
| Deaf-Plus (n=1) | 0 | 1 | N/A | 1/1 |  |
| **Total** | **7** | **11** | **4** | **22/28 (79%)** | **6/28 (21%)** |

## 8.5 Co-Author Declarations

An official City co-author declaration will follow for each publication.

**STATEMENT OF CO-AUTHORS of JOINT PUBLICATIONS**

**TO WHOM IT MAY CONCERN**

**Title of publication:** Assessing parent–child interaction in infant deafness.

**Ref:** Curtin, M., Herman, R., Cruice, M., & Morgan, G. (2021a). Assessing parent–child interaction in infant deafness. *Current Opinion in Otolaryngology & Head and Neck Surgery*, 29(3), pp. 200-203.

**Name of candidate:** Martina Curtin

**Title of research thesis:** Developing the EPID Tool (Early Parent Interaction in Deafness)

**Name of first supervisor:** Prof Ros Herman

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

*Paste*
Name: Martina Curtin
Date: 28.05.24

Name: Prof Madeline Cruice
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*Paste*
Name: Prof Ros Herman
Date: 28.05.24

*Paste* Gary Morgan.
Name: Prof Gary Morgan
Date: 27.05.24

| Author Order | Contributions | Estimated % of the work |
|---|---|---|
| Curtin, Martina | Conceptualization; Investigation; Writing – original draft; Writing -review and editing; | 70% |
| Herman, Rosalind | Conceptualization; Writing -review and editing; Supervision | 10% |
| Cruice, Madeline | Conceptualization; Writing -review and editing; Supervision | 10% |
| Morgan, Gary | Conceptualization; Writing -review and editing; Supervision | 10% |

## STATEMENT OF CO-AUTHORS of JOINT PUBLICATIONS

TO WHOM IT MAY CONCERN

**Title of publication:** Assessing Parent Behaviours in Parent–Child Interactions with Deaf and Hard of Hearing Infants Aged 0–3 Years: A Systematic Review

**Ref:** Curtin, M., Dirks, E., Cruice, M., Herman, R., Newman, L., Rodgers, L., & Morgan, G. (2021b). Assessing parent behaviours in parent–child interactions with deaf and hard of hearing infants aged 0–3 years: A systematic review. *Journal of Clinical Medicine*, 10(15), pp. 3345-3375.

**Name of candidate:** Martina Curtin

**Title of research thesis:** Developing the EPID Tool (Early Parent Interaction in Deafness)

**Name of first supervisor:** Prof Ros Herman

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

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Name: Martina Curtin
Date: 27.05.24

Name: Dr Evelien Dirks
Date: 28.05.2024

Name: Prof Madeline Cruice
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Name: Prof Ros Herman
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Name: Lauren Newman
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L.A.Rodgers
Name: Lucy Rodgers
Date: 22/5/24

Gary Morgan.
Name: Prof Gary Morgan
Date: 27.05.24

**Statement indicating the candidate's contribution to the publication**
The work was published in the Journal of Clinical Medicine by PhD candidate Martina Curtin, collaborator Dr Evelien Dirks, co-authors and supervisors Prof Ros Herman, Prof Madeline Cruice and Prof Gary Morgan and co-authors and mentees Lucy Rodgers and Lauren Newman. Contributions of all authors are presented in the table below.

| Author Order | Contributions | Estimated % of the work |
|---|---|---|
| Curtin, Martina | Conceptualization; Project Administration; Methodology; Resources – Software; Data Collection; Validation; Formal Analysis; Writing-Original Draft; Writing—review and editing; Funding acquisition | 40% |
| Dirks, Evelien | Methodology; Data Collection; Validation; Writing—review and editing | 20% |

| | | |
|---|---|---|
| Cruice, Madeline | Conceptualization; Methodology; Data Collection; Validation; Writing—review and editing; Supervision | 10% |
| Herman, Rosalind | Conceptualization; Methodology; Data Collection; Validation; Writing—review and editing; Supervision | 10% |
| Newman, Lauren | Data Collection; Validation; | 5% |
| Rodgers, Lucy | Data Collection; Validation; | 5% |
| Morgan, Gary | Conceptualization; Methodology; Data Collection; Validation; Writing—review and editing; Supervision | 10% |

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**STATEMENT OF CO-AUTHORS of JOINT PUBLICATIONS**

**TO WHOM IT MAY CONCERN**

**Title of publication:** Assessing parent interaction with deaf infants: A quantitative survey of UK professional practice.

**Ref:** Curtin, M., Morgan, G., Cruice, M., & Herman, R. (2023). Assessing parent interaction with deaf infants: A quantitative survey of UK professional practice. *International Journal of Language & Communication Disorders*, *58*(4), pp. 1148-1167.

**Name of candidate:** Martina Curtin

**Title of research thesis:** Developing the EPID Tool (Early Parent Interaction in Deafness)

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We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

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Name: Martina Curtin
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| Author Order | Contributions | Estimated % of the work |
|---|---|---|
| Curtin, Martina | Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Validation; Writing - original draft; Writing - review & editing | 60% |
| Morgan, Gary | Conceptualization; Writing -review and editing; Supervision | 10% |
| Cruice, Madeline | Conceptualization; Writing -review and editing; Supervision | 10% |
| Herman, Rosalind | Conceptualization; Validation; Writing -review and editing; Supervision | 20% |

**STATEMENT OF CO-AUTHORS of JOINT PUBLICATIONS**

**TO WHOM IT MAY CONCERN**

**Title of publication:** It doesn't matter if we're the most amazing professionals in the world...' - A qualitative study of professionals' perspectives on parent-child interaction assessment with deaf infants'

Ref:
Curtin, M., Wakefield, T., Herman, R., Morgan, G., & Cruice, M. (2024a). "It doesn't matter if we're the most amazing professionals in the world…" A qualitative study of professionals' perspectives on parent-child interaction assessment with deaf infants. *Frontiers in Psychology*, 15, 1315220.

**Name of candidate:** Martina Curtin

**Title of research thesis:** Developing the EPID Tool (Early Parent Interaction in Deafness)

**Name of first supervisor:** Prof Ros Herman

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Name: Martina Curtin
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The work was published in Frontiers in Psychology by PhD candidate Martina Curtin, collaborator Tina Wakefield, and supervisors Prof Ros Herman, Prof Gary Morgan and Prof Madeline Cruice. Contributions of all authors are presented in the table below.

| **Author Order** | **Contributions** | **Estimated % of the work** |
|---|---|---|
| Curtin, Martina | Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, Writing—original draft, Writing—review and editing. | 55% |
| Wakefield Tina | Data curation, Validation. | 5% |
| Herman, Rosalind | Conceptualization, Methodology, Supervision, Validation, Writing—review and editing. | 10% |
| Morgan, Gary | Supervision, Writing—review and editing. | 10% |
| Cruice, Madeline | Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing—review and editing, Project administration. | 20% |

# STATEMENT OF CO-AUTHORS of JOINT PUBLICATIONS

**TO WHOM IT MAY CONCERN**

**Title of publication:** Assessing parent-child interaction with deaf and hard of hearing infants aged 0–3 years: An international multi-professional e-Delphi.

**Ref:** Curtin, M., Cruice, M., Morgan, G., & Herman, R. (2024b). Assessing parent-child interaction with deaf and hard of hearing infants aged 0–3 years: An international multi-professional e-Delphi. *PLoS ONE*, 19(4), e0301722.

**Name of candidate:** Martina Curtin

**Title of research thesis:** Developing the EPID Tool (Early Parent Interaction in Deafness)

**Name of first supervisor:** Prof Ros Herman

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

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| Author Order | Contributions | Estimated % of the work |
|---|---|---|
| Curtin, Martina | Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing – original draft, Writing – review & editing | 60% |
| Cruice, Madeline | Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – review & editing | 15% |
| Morgan, Gary | Funding acquisition, Supervision, Writing – review & editing | 10% |
| Herman, Rosalind | Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing – review & editing | 15% |

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