**Characteristics of parent-child interactions: A systematic review of studies comparing children with primary language impairment (PLI) and their typically developing peers**

Anna K. M. Blackwell1, 2, Sam A. Harding1, 2, Selma Babayiğit1 and Sue Roulstone1, 2

1.          The University of the West of England (UWE), Bristol

2.          Bristol Speech and Language Therapy Research Unit

Anna K M Blackwell (BSc) Bristol Speech and Language Therapy Research Unit, Frenchay Hospital, Bristol, BS16 1LE. Email: Anna.Blackwell@uwe.ac.uk

Sam Harding (MPhil) Bristol Speech and Language Therapy Research Unit, Frenchay Hospital, Bristol, BS16 1LE. Email: Sam.Harding@speech-therapy.org.uk

Selma Babayiğit (PhD) Department of Psychology, Faculty of Health and Life Sciences, Coldharbour Lane, Bristol, BS16 1QY. Email: Selma.Babayigit@uwe.ac.uk

Sue Roulstone (PhD) Bristol Speech and Language Therapy Research Unit, Frenchay Hospital, Bristol, BS16 1LE. Email: Susan.Roulstone@uwe.ac.uk

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**Abstract**

The importance of parent-child interaction (PCI) for language development has been well established. This has led many speech and language therapy (SLT) interventions to focus on modifying PCI as a means to improving children's early language delay. However, the success of such programmes is mixed. The current review compares PCI, observed in naturally occurring contexts, with preschool children with language delay and age- or language-matched typically developing (TD) controls. A systematic review of the literature searched 10 databases for studies using a case-control design and extracted data concerning participants, matching, selection, design, assessments, measures, findings, statistics and bias. Quality appraisal used the Critical Appraisal Skills Programme (CASP, 2012) case-control checklist. The search identified 17824 papers, which were reviewed against exclusion criteria. The final review included nine studies, which were diverse in terms of matching, delay criteria and PCI measure. A narrative synthesis was conducted. The evidence for PCI differences between children with language delay and TD peers was limited and any suggestion that parents were less responsive could be attributed to limited language skills of children with language delay. The findings question the assumption that communicative environments of children with language delay are different, although the evidence is from a small sample of children from middle class families. Children with language delay may instead be less able to learn from their environment. The review highlights the gap in understanding the relationship between parent and child language use during PCI. The need for further, longitudinal research is emphasised, including children ranging in type and severity of delay, across diverse socioeconomic backgrounds.

## Background

Approaches to speech and language therapy (SLT) interventions can be divided into 'child-focused' and 'environmental' methods; the latter are based on working with the people who interact with the child (Pickstone, Goldbart, Marshall, Rees & Roulstone, 2009). Environmental approaches include interventions that aim to modify parent-child interaction (PCI), based on the assumption that changing the behaviour of parents who interact with children can produce improvements in their language (Baxendale & Hesketh, 2003; Gibbard, 1994; Girolametto, Pearce & Weitzman, 1996). A systematic review of the effectiveness of SLT interventions found that including parents in interventions could have beneficial effects (Law, Garrett, & Nye, 2003). However, the review found that parental response to PCI interventions was varied. For example, Fey, Cleave and Long (1997) found that following training, parents' use of recasting could be categorised according to the frequency with which the parents subsequently used recasts. Using more recasts was related to greater language gains for their children. Interventions that involve parent training may be more appropriate for certain families  (Gibbard, 1994). An individualised approach would ensure that families enrolled in PCI interventions are those best suited to this type of programme.

Approaches that modify PCI are derived from factors found to be positively related to typically developing (TD) language (Pickstone et al., 2009). There is an abundance of research investigating features of parent language that influence the language development of TD children. Research has found striking differences in children's vocabulary skills related to parental language input: the number, diversity and sophistication of words parents direct at their children (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Rowe, 2012). Differences in children's vocabulary sizes have also been found between high and low socioeconomic status (SES) groups, which appear to be mediated by the characteristics of parent speech (Hart & Risley, 1995; Hoff, 2003). In a longitudinal study of language development, the

effects of adult language input on children's development was partially mediated by adult-child conversations, which were found to be significantly associated with language development (Zimmerman et al., 2009). These findings highlight the value of engaging children in conversation, talking directly to them and responding to their interests, beyond providing rich linguistic input (Zimmerman et al., 2009).

However, PCI strategies that support TD language skills may not be sufficient for children with delayed language development. Research has suggested that the language input that children with delayed language receive, as well as the interactions that they partake in, is different to that of TD peers, which may impact on their language development (Whitehurst, Novak, & Zorn, 1972). However, the relationship between PCI and child language development has been recognised as reciprocal (Gibbard, 1994). There is a need for a better understanding of parent and child characteristics that are related to delayed language development that can inform SLT interventions.

The current systematic review therefore focused on research that aims to identify differences in PCI with TD and language delayed children. The review concentrated on studies with preschool children as improved PCI has been shown to be an important outcome target of therapy with children aged two to three years for speech and language therapists (Roulstone, Wren, Bakopoulou, Goodlad & Lindsay, 2012). The review is focused on children who have an isolated difficulty with the acquisition of language, despite otherwise typical development. There is a range of terminology used by researchers and clinicians to describe these children, including 'language-delayed' (Cunningham, Siegel, van der Spuy, Clark, & Bow, 1985), 'specific language impairment (SLI)' (Fey, Krulik, Loeb, & Proctor-Williams, 1999), 'slow expressive language development' (Paul & Elwood, 1991), and 'late-talking' (Rescorla & Fechnay, 1996).

The diversity of terms suggests a heterogeneous condition, without commonly recognised criteria or definition (Law, Boyle, Harris, Harkness, & Nye, 2000). The choice of term may be partly mediated by the age of the children and whether or not they have received a formal diagnosis. Children identified as having delayed language development may have only transient language difficulties and will not necessarily receive a later diagnosis of language impairment. Around half of children with language delay have been shown to 'catch up' to their TD peers by four years old (Dale, Price, Bishop, & Plomin, 2003). However, it may not be possible to separate delayed or impaired children into two clear groups, even though this approach might be preferable because it could help interpret the results of intervention studies. Many studies use the same language inclusion criteria within a wide age range of 12 months or more (e.g. Baxendale & Hesketh, 2003; Conti-Ramsden, 1990; Paul & Elwood, 1991; Proctor-Williams, Fey, & Loeb, 2001). In these samples, the older children may be more clearly recognisable as language impaired (Paul & Elwood, 1991), or demonstrate more severe impairment than the younger children in the group. The term 'primary language impairment (PLI)' was used for this review to include all of these descriptions and refers to children identified through diagnosis or study assessment as having a difficulty or delay with language, where there is no overt diagnosis of general developmental delay or, sensory or neurological disorder. Prevalence of PLI is around 6% (Law et al., 2000) and is associated with poor literacy skills and later academic, social and behavioural problems (Beitchman et al., 2008; Conti-Ramsden, Mok, Pickles, & Durkin, 2013; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011; Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998).

The current review aimed to identify whether there were differences in the characteristics of PCI with preschool children with PLI compared to their TD peers, in studies that used naturalistic observations of PCI. The extent of PCI differences between

these groups has implications for the use of PCI interventions and for research into the

relationship between children's communicative environment and their language development.

## Methods

The systematic review was guided by the principles outlined in the Cochrane

Collaboration methodology (Higgins & Green, 2011), as far as they could be applied to case-

control studies.

### Criteria for Including Studies

Population: Preschool children (aged 0;00-5;11) only. Studies were required to

include a group of children with TD language and a group with PLI, with no other suspected

disorders, e.g. autism or hearing impairment, and age appropriate nonverbal/developmental

skills. Children had to be from monolingual English speaking homes, with no reported parent

mental health problems or child maltreatment.

Variable measured: Observations of dyadic PCI during play. Studies had to examine

interactional characteristics of communication rather than acoustic properties of speech.

Type of study: Case-control studies only were included in the review. This decision

was made to ensure at least within-study group comparisons were possible, as different

characteristics of PCI were measured across studies. A separate systematic review

investigating the effectiveness of interventions regarding PCI is in process as part of the

Child Talk programme (http://www.speech-therapy.org.uk/projects/child-talk); therefore, this

review did not consider intervention studies.

### Search Methods for Identification of Studies

Ten electronic databases were identified from their use in other systematic reviews in

the field and searched (April 2012) with no date limits: MEDLINE; EMBASE; CINAHL

Plus; PsycINFO; SocINDEX; PsycARTICLES; Cochrane Database of Systematic Reviews;

CENTRAL; Cochrane Methodology Register; ERIC. The MEDLINE search strategy (Appendix A) comprised subject headings and textwords, which described the elements of the population and variable measured (outlined above) as well as exclusionary criteria. The strategy was reviewed by expert academics in the fields of language development and speech and language therapy and adapted for each database. Electronic searches were supplemented by checking references of relevant publications and included journal articles, book chapters and doctoral dissertations ($\leq$ 5 years old). Papers published in languages other than English were excluded due to time and resource constraints (*n*=89).

**Data Collection**

The first author excluded irrelevant papers by screening titles and abstracts (Figure 1). The remaining abstracts were fully reviewed by the first author and 10% independently checked by the second author against inclusion criteria. Any disagreements were resolved through discussion and in any case of doubt the paper was included in the next stage. Full text articles were then retrieved and further considered against inclusion criteria by the first author. The full text papers that were retained had relevant data extracted by the first author, using a standardised form which recorded details on participant groups and matching criteria, selection, study design, assessment tools, variables measured, main findings, statistics and sources of bias. Questions were developed with reference to Tager-Flusberg's (2005) paper on designing studies with language-disordered populations and related methodological issues. Papers were also subjected to quality assessment by the first author using the Critical Appraisal Skills Programme (CASP, 2012) case-control checklist to determine study quality, reliability and application of findings. Studies were rated low, medium or high quality according to the answers to CASP questions (Table 1: Y, yes; CT, cannot tell; N, no). Quality appraisal identified six low, seven medium and two high score studies. The low quality papers were excluded. The process was 10% independently checked by the third and fourth

authors; any disagreements were discussed to establish consensus on issues of data extraction and quality appraisal.

Included studies were mixed in terms of how PLI and TD groups were matched (four chronological age and five language stage); the method for determining PLI status (clinically referred or determined by study assessment, with various criteria); the severity of children's delay; and the PCI characteristics of interest. Heterogeneity precluded meta-analysis; therefore, a narrative synthesis was used which summarised findings descriptively. To maximise the clarity of the review, Gough's (2007) 'mapping stage' was implemented, by which the review area was first viewed as a whole and then in sub-sections. Grouping the findings according to PCI characteristics and matching helped to guide the synthesis.

**[INSERT TABLE 1]    [INSERT FIGURE 1]**

**Results**

**Results of the Search**

After removing duplicates, 17824 papers were identified (Figure 1). Almost 90% were excluded as irrelevant by title and abstract. The remaining abstracts (*n*=1903) were reviewed against inclusion criteria. For the 10% reviewed by the second author, there was agreement about the inclusion of 92% of these references. Full text papers were retrieved (*n*=1236) for more detailed review against inclusion criteria. Further papers were excluded because they did not include preschool children only (*n*=5); did not assess interactional characteristics of PCI (*n*=87); did not include the clinical population of interest (*n*=648); or met other exclusion criteria, e.g. studies of parent mental health, child maltreatment or bilingual language learners (*n*=457). Thirty-nine papers remained. Those without appropriately matched comparison groups (*n*=12), observations of PCI that were not in a dyadic play context (*n*=3), or those without clearly determined PLI (*n*=9) were also excluded, which resulted in 15 papers. These papers used a case-controlled observational design to

analyse differences in dyadic PCI, in semi-structured or unstructured play settings, with

preschool children with PLI and matched TD controls. Following the quality appraisal, six

were excluded on the grounds of low methodological quality.

**Included Studies**

Nine studies were retained for inclusion in this review (Table 2). Most studies used

cross-sectional case-control designs although two collected data longitudinally. All studies

included in the final review were carried out in English-speaking countries, using English-

speaking samples. Seven papers presented analyses of the same full or partial data sets that

were used in other included studies (Conti-Ramsden, 1990; Conti-Ramsden & Friel-Patti,

1983; 1984; Fey et al., 1999; Proctor-Williams, Fey, & Loeb, 2001; Rescorla, Bascome,

Lampard, & Feeny, 2001; Rescorla & Fechnay, 1996). Overall the review findings are based

on five completely separate samples with a collective size of fewer than 150 children with

PLI, and fewer than 250 children in total. Studies were published between 1983 and 2001. No

studies meeting the inclusion and quality criteria were identified after 2001.

**[INSERT TABLE 2]**

**Risk of Bias**

The potential for bias in the studies was related to limited details of the characteristics

of the child participants and selection processes as well as parent involvement in SLT. The

groups often varied in the severity of their language delay or had only mild delay. There was

also concern for how accurately TD children had been matched on necessary variables.

Selecting the most appropriate comparison groups for preschool children is difficult

because of their rapid development during this stage. When using TD age-matched

comparisons it is important to bear in mind that the language skills of children with PLI will

be considerably below their age-matched peers. Differences in PCI between groups may

therefore not be surprising and any differences could be attributed to parents adjusting to their

child's language level. On the other hand, when using TD language-matched groups there is an issue about comparing more developmentally advanced children with PLI with their younger language-matched peers. No studies included in the review used both age- and language-matched comparison groups.  Conclusions about study findings are therefore dependent on whether comparison groups are age- or language-matched and the synthesis of findings was grouped accordingly.

Five of the nine papers stated that children with PLI had received SLT but that these interventions did not focus on parent training (Conti-Ramsden, 1990; Conti-Ramsden & Friel-Patti, 1983; 1984, Fey et al., 1999; Proctor-Williams et al., 2001). In the remaining four papers it was not possible to determine whether children in the PLI groups had received SLT. If parents had received training then this could exaggerate or reduce PCI differences between groups. Furthermore, parents receiving SLT sessions could have changed their interaction techniques simply from observing or discussing SLT sessions. Fey et al. (1999) raised this possibility but considered it unlikely. Parents in their study had been keen observers of SLT and yet their style of interaction was reportedly stable over time. Nonetheless, it could not be ruled out that these groups had external influences on their language behaviour.

**Characteristics of Parent-Child Interaction**

Broadly, the measures of PCI fell into five main categories:

1. *Quantity of language* e.g. number and rate of verbal/nonverbal acts

2. *Complexity of language* e.g. mean length of utterance (MLU)

3. *Dialogue participation* – Proportion of conversational turns and initiations

4. *Purpose of communicative act* e.g. share meaning, demonstrate intentions, maintain conversation

5. *Responsiveness* – Type and appropriateness of conversational reply in relation to previous turn, e.g. elaboration and recasts

**Quantity and complexity of language.** Findings regarding quantity and complexity of language came from the four studies that used age-matched controls. These studies demonstrated some differences in the amount of talk used by mothers and their children with PLI. For example Rescorla et al. (2001) found that mothers in PLI dyads talked more than controls, while there was no group difference in the amount children communicated, in terms of total utterances, despite children with PLI having a shorter MLU. However, Paul and Elwood (1991) found that children with PLI produced fewer utterances than age-matched controls. A greater discrepancy between mother and child language complexity (MLU) was found in PLI dyads compared to control dyads (Paul & Elwood, 1991). Group differences in the language use of children with PLI are not necessarily surprising as they were recruited precisely due to lower language abilities than age expectations. Cunningham et al. (1985) found that this discrepancy in language complexity between mother and child increased with greater delay and as children interacted less. They also found that mothers in PLI dyads adjusted their language complexity to children's receptive (comprehension), rather than expressive (production) skills, which they suggested might result in parent language models that are too advanced for children to imitate.

**Dialogue participation.** Two studies using age-matched controls analysed participation. They provided some evidence for group differences in child initiations. Cunningham et al. (1985) found that children with PLI initiated less following maternal non-interaction and they were more likely to ignore mothers. The study also found that younger children with PLI engaged less in interaction compared to older children with PLI and TD peers. Interaction frequency was also negatively correlated with receptive delay, as were children's initiations and responsiveness. Topic initiations on the other hand were found to be similar for children in both groups, with children introducing more topics than mothers (Rescorla et al., 2001).

Three language-matched control studies analysed participation. They found no group difference in the number of conversational turns in dyads. However, children with PLI initiated less conversation than peers (Conti-Ramsden & Friel-Patti, 1983; 1984) while mothers initiated more in PLI dyads compared to controls (Conti-Ramsden, 1990). There were no differences in the form or complexity of mother initiations between groups (Conti-Ramsden & Friel-Patti, 1984). Overall, there was a greater discrepancy in participation between partners in PLI dyads compared to control dyads. Although generally more topics were introduced in TD dyads, children in both groups were again found in these studies to introduce more topics than mothers (Conti-Ramsden & Friel-Patti, 1984).

**Purpose and responsiveness of communicative acts.** There were various group differences found among the four age-matched studies. Rescorla et al. (2001) found that parents of children with PLI used more questions, while their children asked less than controls. Stronger patterns of relationships were also found between variables in PLI dyads. For example, mothers' control was negatively related to synchrony and child compliance. However, there was evidence among these studies for no group differences in maternal responsiveness or synchrony (Cunningham et al., 1985; Rescorla & Fechnay, 1996). Children were also very similar across groups and although children with PLI used fewer clear verbal cues, they were as communicative as controls. Paul and Elwood (1991) highlighted the need for caution when interpreting group differences in parental responsiveness. Their study demonstrated that apparent differences in parents' expansion and extension use were no longer significant when measures were examined in relation to the proportion of child utterances.

There were some discrepancies among the five language-matched studies regarding group differences in purpose and responsiveness of utterances in dyadic interactions. Conti-Ramsden and Friel-Patti (1984) found that mothers most often responded adequately to their

children across groups and all children were also found to most often respond adequately (i.e. provide clear appropriate responses when required). However, when reacting to comments, which do not require a response, children with PLI were found to be more ambiguous than peers. Mothers in PLI dyads were found to use some responsive utterances less often than mothers of TD children (Conti-Ramsden & Friel-Patti, 1983). Further analysis of this dataset found a group difference in maternal contingent replies but only for complex recasts, which were used less frequently in PLI dyads (Conti-Ramsden, 1990). While there were no group differences in the use of simple recasts, when they were used, PLI group mothers used more meaning illocutions (sharing information) and less cohesion illocutions (maintaining conversational flow). There is some contention here as other studies attempting to replicate these findings demonstrated evidence for no differences in simple or complex recasts, over an eight month period (Fey et al., 1999). Additional analysis of this eight month dataset demonstrated a relationship between parent copula (*am, is, are, was*) recasts and child copula production in TD, but not PLI dyads (Proctor-Williams et al., 2001).

### Discussion

**Summary of Main Findings**

Heterogeneity of findings prevented clear conclusions from being drawn regarding specific PCI differences between PLI and TD dyads. However, there were some emerging trends. In particular the findings suggested difference in dialogue participation. Children with PLI were found to initiate fewer conversational turns than their TD peers in interaction with parents. Parents in PLI dyads may consequently appear more controlling. However, children in both groups were found to introduce more topics than parents suggesting that they are allowed to guide the content. Generally, parental differences during PCI were suggested to reflect parents adjusting to the children's communicative abilities (Conti-Ramsden & Friel-

Patti, 1983; 1984; Paul & Elwood, 1991), although other developmental factors such as attention (Conti-Ramsden & Friel-Patti, 1984) and behaviour could also play a role.

The evidence for group differences in responsiveness was mixed. There was some evidence for group differences in recast use and the possibility that joint focus may be less common in PLI dyads (Conti-Ramsden, 1990). One study highlighted that differences in parents' responsive utterances between groups were proportional to the opportunities available to respond to the child, which were often reduced in PLI dyads (Paul & Elwood, 1991). PCI may play a role in maintaining delay. However, group differences in PCI were generally considered to be child driven. Differences in children's communicative ability may lead to the use of conversational strategies to maintain conversation (Rescorla et al., 2001). The evidence highlights the reciprocal nature of the relationship between parent and child language use. Other studies found evidence for no difference between the PLI and TD dyads. They proposed instead that the linguistic input that children with PLI receive is no less facilitative, at least in terms of recasts, but they make less efficient use of it than TD children (Fey et al., 1999; Proctor-Williams et al., 2001).

## Quality of the Evidence

The systematic review highlighted a number of issues, which question the appropriateness and strength of the methodology of the included studies. Furthermore, the review did not identify recent research from the last decade that fit the inclusion and quality criteria.

**Child language measures.** One problem in the study of children with PLI is the appropriate definition and assessment of this population. In general, studies all sampled children with expressive language delay, which was most often measured by MLU while the use of standardised assessments varied. Both within and between studies, the children were heterogeneous in terms of their language abilities that complicated the comparison of findings

between groups as well as studies. The severity of language difficulties ranged from around

six months to over two years delay. Some of the studies that found evidence for limited or no

group differences had among the most lenient inclusion criteria (Fey et al., 1999; Proctor-

Williams et al., 2001; Rescorla et al., 2001; Rescorla & Fechnay, 1996). It is possible that

these studies included children who had language skills better described as at the lower end

of the TD spectrum, or had delayed language development but were not language impaired.

This possibility was supported by the fact that some of the children in the longitudinal study

later 'caught up', who may be better described as 'late talkers' (Fey et al., 1999), which

highlights the variation in children's developmental trajectories in the early years. It is

important not to use null findings to negate potentially important PCI differences for children

with more severe delay or language impairment.

It is necessary to ascertain whether the children in the included studies had receptive

language delay in addition to their expressive language delay. Persistence rates for children

with expressive and receptive delay have been shown to be almost twice (75.6%) that of

expressive only delay (40%) (Law et al., 2000). There is also less evidence that children with

receptive language difficulties will respond positively to SLT interventions (Law, Garrett, &

Nye, 2003). Five studies in the review stated that children's receptive language was normal,

although it was not always formally assessed. Only one study clearly included children with

receptive delay, which examined the influences of delay severity and found that children with

more severe receptive delay were less interactive (Cunningham et al., 1985). However, three

studies (Fey et al., 1999; Paul & Elwood, 1991; Proctor-Williams et al., 2001) did not

mention children's receptive language ability. The lack of detail regarding children's

receptive language makes it difficult to determine the extent to which PCI may be different

for children with receptive language delay.

**Matched comparison groups.** There is a common problem in child language research regarding how best to match control groups on the variables of interest and confounders (Tager-Flusberg, 2005). The present review only considered variables to be adequately matched across groups if relevant assessment scores were provided as evidence. Accordingly, two papers (Paul & Elwood, 1991; Rescorla et al., 2001) provided sufficient evidence that groups were matched on all four variables considered: matching variable (language or age), SES, gender and nonverbal ability. Two papers (Rescorla et al., 2001; Rescorla & Fechnay, 1996) outlined alpha levels used ($p<.05$ or $p<.001$), while the remaining papers did not mention statistical differences. Many studies assume that if assessment scores are not significantly different between groups, then variables can be considered to be the same for each group (fail to reject null hypothesis). However, there is concern for Type II errors (fail to reject null hypothesis when in fact groups do differ). Mervis and Klein-Tasman (2004) have consequently proposed that much higher alpha levels ($p>.5$ vs. standard $p>.05$ for non-significance) are used for adequate matching. Exact alpha levels for nonsignificant language differences between groups were given for one data set ($p=.62$ and .52 at each time point) (Fey et al., 1999), which suggested appropriate matching for MLU.

It is important to recognise that language is a multidimensional skill. Plante and Swisher (1993) warned that matching language on only one or a few measures, such as MLU, may undermine construct validity. Matching groups on external factors, such as SES, is also important. All papers used predominantly middle class samples. There is a dearth of research with lower SES samples, yet these children may be at greater risk of delayed language development (Locke, Ginsborg, & Peers, 2002). Research with TD populations has highlighted a gap in children's vocabularies between higher and lower SES groups, which has been linked to less parent speech in lower SES families (Hart & Risley, 1995).

**Study design.**  A criterion for inclusion in this review was that studies used case-control designs, which were pertinent in order to compare groups on a variable (PCI) that is naturally occurring. However, case-control designs can be problematic. Firstly, there can be difficulties selecting appropriate control groups; age-matched TD controls would be expected to have greater verbal abilities, while language-matched controls would be expected to have less advanced non-verbal skills compared to PLI cases. No studies included in the review used both age- and language-matched controls, which is of critical importance as this approach could have helped to clarify whether any differences were related to children's age or language level. Secondly, children's TD or PLI group status precedes their involvement in the studies, most of which were cross-sectional, measuring variables at the same time point. It is therefore difficult to conclusively determine the direction of the relationship between parent and child language. According to the NICE (2004, updated 2005) guidelines, case-control studies  "with a high risk of confounding bias, or chance and a significant risk that the relationship is not causal" should not be considered for making recommendations. Although these guidelines are for medical research, they highlight design limitations. While included studies were considered high or medium quality it should be noted that this is only within the confines of their design. The relevant issues outlined caution the evaluation of these findings as robust evidence for the existence, or lack, of PCI differences between groups or the direction of influence between parent and child.

**Effect size and power.** No studies mentioned power; therefore, retrospective calculations were performed using Minitab® Version 16 (Minitab Inc., 2013). Effect sizes were calculated using Cohen's *d*. As shown in Table 3, some studies demonstrate large effect sizes, above 0.8, supporting the existence of group differences. However, they often had low power, below the 0.8 standard, which means that caution should be taken applying these findings to a wider clinical population. Cohen's *d* will be greater among studies with smaller

sample sizes, whereas studies using larger samples will be more likely to converge around smaller effect sizes.

[INSERT TABLE 3]

**Conclusions**

The current review found issues across studies with the criteria used to define PLI, discrepancies in the severity of delay, presence of receptive delay, the level of study detail. Methodological considerations were highlighted regarding the use of matched groups and case-control designs. Caution needs to be taken when considering the implications of results. They come from only a small number of studies, with a small cumulative number of subjects, representing predominantly middle class families in English speaking countries, and no included studies were reported after 2001. Although some children had been referred to SLT services, they ranged in delay severity and often demonstrated expressive-only delay. These children may represent, in part, some clinical caseloads. However, children with receptive delays, or those from lower SES backgrounds, may be at greater risk of language difficulties. **There is a dearth of literature** with these particular subgroups, which require special attention in future research.

The review findings should be considered only as preliminary descriptive accounts. However, the review suggests that differences in the characteristics of PCI with children with PLI compared to TD peers are limited, which challenges the idea that these two groups of children experience different communicative environments. Furthermore, differences found were generally attributed to language differences in the children, and those with PLI may learn less effectively from their environments. Examining the relationship between parent and child language behaviour over time could permit analysis of factors that influence children's developmental trajectories (Tager-Flusberg, 2005), which suggests that longitudinal studies would develop understanding of the relationship between PCI and child language

development. Although two studies in the review used longitudinal designs, they did not

consider how parents' language changed in relation to children's developing language skills.

The influence of certain interactional characteristics may be specific to particular language or

cognitive levels, which change over time (Nelson, Denninger, Bonvillian, Kaplan, & Baker,

1984; Rowe, 2012). Huttenlocher, Waterfall, Vasilyeva, Vevea and Hedges (2010) measured

parent and child language at multiple time points with TD preschoolers. More longitudinal

research with children with PLI is recommended for the future to determine predictive

relationships and the direction of influence between parent and child in this clinical

population.

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**Table 1. Methodological quality assessment using CASP**

| Author (year) | 3 Case recruitment acceptable? | 4 Controls acceptable? | 5 Variables measured accurately? | 6b. Confounders considered? | 9 Results believable? | 10 Can results be applied? | Quality |
|---|---|---|---|---|---|---|---|
| Conti-Ramsden & Friel-Patti (1983) | Y/CT | Y/CT | Y | Y/CT | Y/CT | Y/CT | Medium |
| Conti-Ramsden & Friel-Patti (1984) | as above | as above | Y | as above | Y/CT | as above | Medium |
| Conti-Ramsden (1990) | as above | as above | Y | as above | Y/CT | as above | Medium |
| Cunningham et al. (1985) | Y/CT | Y/CT | Y | Y | Y/CT | Y/CT | Medium |
| Fey et al. (1999) | Y/CT | Y | Y | Y | Y | Y/CT | High |
| Protor-Williams et al. (2001) | as above | as above | Y | as above | Y | as above | High |
| Paul & Elwood (1991) | Y/CT | Y | Y | Y | Y | CT | Medium |
| Rescorla & Fechnay (1996) | CT | Y | Y | Y | Y | CT | Medium |
| Rescorla et al. (2001) | CT | Y | Y | as above | Y | as above | Medium |

**Table 2. Characteristics of included studies**

| Author | Child participants | Setting | PCI variables | Findings |
|---|---|---|---|---|
| Conti-Ramsden & Friel-Patti (1983) | 28: 14 PLI and 14 language-matched TD | 15 minutes play videotaped in a specially designed playroom. | Meaning illocutions Cohesion illocutions Dialogue participation | Group differences: children with PLI initiate less turns. Mothers in PLI dyads used less responsive utterances. No difference: no. of conversational turns; type of meaning illocutions used by mothers. |
| Conti-Ramsden & Friel-Patti (1984) | as above | as above | Dialogue analysis - initiating role and responding role | Group differences: interaction between initiations and child language status. More topics in TD dyads. No difference: no. of conversational turns. Children all introduced more topics than mothers. All mothers initiate more than children and no difference in form or complexity. |
| Conti-Ramsden (1990) | as above | as above | Dialogue Participation Mothers' Contingency Coding Scheme Mothers' Speech Acts Coding System | Group differences: mothers in PLI dyads initiated more, used less complex recasts and less cohesion illocutions when replying to their children with simple recasts or with continuations. No difference: no. of turns. |
| Cunningham et al. (1985) | 60: 33 PLI and 27 age-matched TD | 15 minutes free play and structured play videotaped in playroom. | 1: Mothers responses, informal play, conversational interactions, control and reward and child compliance 2: Total no. of utterances, language complexity | Group differences: children with PLI less likely to initiate following maternal non-interaction, increased with lower receptive scores. Mothers adjust language complexity to child's comprehension not production. Discrepancy in complexity for dyads increased with greater delay No difference: Responsiveness of mothers. |
| Fey et al. (1999) | 20: 10 PLI and 10 language-matched TD | 2 X 30 minutes play videotaped eight months apart, at homes. | Reformulations Recasts: simple or complex | No difference: parents use of simple, complex or total recasts and recast use was stable over time. |

**Table 2. Characteristics of included studies**

| *Author* | *Child participants* | *Setting* | *PCI variables* | *Findings* |
|---|---|---|---|---|
| Proctor-Williams et al. (2001) | as above | 3 X 30 minutes play videotaped four months apart, at homes. | Parental recasts - target-specific copula and/or article recasts. | Group differences: Relationship between parent copula recasts (not articles) and child copula production in TD dyads only. Children with PLI produced fewer copulas than peers. No difference: rate of recasts. |
| Paul & Elwood (1991) | 56: 28 PLI and 28 age-matched TD | 10 minutes free play videotaped in designed playroom. | Mother's utterances: syntax, pragmatic function, topic management and lexical contingency | Group differences: fewer utterances by children and greater mother/child MLU discrepancy in PLI dyads. Mothers in TD dyads provided more expansions/extensions. No difference: *proportion* of child utterances that received expansion/extension |
| Rescorla & Fechnay (1996) | 36: 18 PLI and 18 age-matched TD | 10 minutes free play videotaped with mother. | Utterance type, child compliance and communicative gestures. Coded for social cues and synchrony. | Group differences: PLI dyads showed stronger patterns of relationships between variables, e.g., mother's control negatively related to synchrony and child compliance. No difference: mother's synchrony children very similar (fewer clear verbal cues but they as 'communicative'). |
| Rescorla et al. (2001) | 53: 32 PLI and 21 age-matched TD outcomes at 36 months | 10 minutes free play videotaped with mother. | Topic focus - synchronous and asynchronous codes Utterance function | Group differences: mothers in PLI dyads talked more, and asked more questions. Children with PLI asked fewer questions. No difference: children with PLI spoke as often as TD (despite lower MLU). No difference in child topic initiations. |

**Table 3. Retrospective statistical calculations**

| Author | Variable (test, alpha level) | PLI mean (SD) | Comparison mean (SD) | Cohen's d | Power (group sample size) |
|---|---|---|---|---|---|
| Conti-Ramsden & Friel-Patti (1983) | Cohesion illocutions:<br>Choice answers (t-test, $p<.05$)<br>Child initiations (t-test, $p<.005$) | 0.29 (0.61)<br>34% (8.2%) | 1.57 (1.74)<br>42% (6.2%) | 0.98<br>N/A | 0.47 (14)<br>N/A |
| Conti-Ramsden & Friel-Patti (1984) | Mother initiations (ANOVA, $p<.01$)<br>Child initiations (ANOVA, $p<.01$) | 0.94 (0.07)<br>0.49 (0.14) | 0.86 (0.09)<br>0.61 (0.15) | 0.99<br>0.83 | 0.62 (14)<br>0.53 (14) |
| Conti-Ramsden (1990) | Mother initiations (Wilcoxon rank sum, $p<.01$)<br>Complex recasts (Wilcoxon rank sum, $p<.025$)<br>Cohesion illocutions (Wilcoxon rank sum, $p<.01$) | 66%<br>3.6%<br>52.6% | 58%<br>7.8%<br>94.3% | No SD given | No SD given |
| Cunningham et al. (1985) | Child interaction (ANOVA, $p<.05$) (younger group)<br>Child initiations (after non-interaction; ANOVA, $p<.001$) | 56.2<br>23.8 | 71.2<br>55.2 | No SD given | No SD given |
| Fey et al. (1999) | Complex recasts (t-test, NS) | 0.75 (0.36) | 0.66 (0.35) | 0.25 | 0.08 (10) |
| Proctor-Williams et al. (2001) | Copula recasts at Time 1 and 3 (MANOVA, NS) | 0.15 (0.12)<br>0.16 (0.12) | 0.13 (0.13)<br>0.12 (0.11) | 0.16<br>0.35 | 0.06 (10)<br>0.09 (10) |
| Paul and Elwood (1991) | Mother expansions a) percentage (t-test, $p.05$)<br>b) in proportion to child utterances (t-test, NS) | 1.1 (2.3)<br>6.2 (11.4) | 4.2 (3.4)<br>8.9 (6.7) | 1.07<br>0.24 | 0.93 (28)<br>0.14 (28) |
| Rescorla & Fechnay (1996) | Mother total synchrony (t-test, NS)<br>Child clear verbal cues (t-test, $p<.001$) | 0.79 (0.10)<br>0.13 (0.13) | 0.84 (0.13)<br>0.50 (0.19) | 0.43<br>2.27 | 0.20 (18)<br>0.999897 (18) |
| Rescorla et al. (2001) | Mother total utterances (t-test, $p<.01$)<br>Child percentage asynchronous (t-test, $p<.05$) | 166.91 (53.10)<br>22.11 (9.8) | 126.86 (34.45)<br>27.48 (9.9) | 0.89<br>0.55 | 0.84 (32) 0.66 (21)<br>0.57 (32) 0.40 (21) |

**Appendix A: MEDLINE search strategy**

| | |
|---|---|
| 1. Child, Preschool/<br>2. exp Infant/<br>3. (child* or infant* or toddler* or boy* or girl* or preschool age or pre-school age or infancy).ti,ab.<br>4. Language Development Disorders/<br>5. Language Disorders/<br>6. Language Therapy/<br>7. ((speech or language or communicat*) adj (delay* or disorder* or patholog* or impair*)).tw.<br>8. (language develop* disorder* or late talk* or specific language impair* or SLI).tw.<br>9. #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 | 29. vocabulary/<br>30. exp Language Development/<br>31. ((vocab* or language or lexic* or linguist* or verbal) adj (grow* or develop* or chang* or acquisition or size or spurt or explo* or abilit*)).ti,ab.<br>32. ((word* adj learn*) or (early adj language)).ti,ab.<br>33. ((speech or language or vocab*) adj (express* or receptive or produc* or comprehen*)).ti,ab.<br>34. #29 or #30 or #31 or #32 or #33<br>35. #9 and #28 and #34 |
| 10. exp Parent-Child Relations/<br>11. (((maternal or parent*) adj respons*) or responsiveness).ti,ab.<br>12. interact* style*.ti,ab.<br>13. ((maternal or parent* or mother or father) adj speech).ti,ab.<br>14. exposure.ti,ab.<br>15. language adj input.ti,ab.<br>16. scaffold*.ti,ab.<br>17. ((child-direct* or child* direct* or infant-direct* or infant* direct*) adj speech).ti,ab.<br>18. motherese.ti,ab.<br>19. (parent* adj (attitude* or charact?r* or invest* or involve* or skill* or style* or behavio?r* or personalit*)).ti,ab.<br>20. Language/<br>21. exp Nonverbal Communication/<br>22. exp Verbal behaviour/<br>23. non?verbal adj communicat*.ti,ab.<br>24. joint attention.ti,ab.<br>25. (play behavio?r* or symbolic interact* or intention read* or intention*).ti,ab.<br>26. ((theory adj mind) or social* cognit*).ti,ab.<br>27. ((social* or environment*) adj (influenc* or interact*or language or context*)).ti,ab.<br>28. #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 | 36. exp Hearing Disorders/<br>37. ((loss or impair) adj hear*).tw.<br>38. (sign* language or deaf*).tw.<br>39. exp Intellectual Disability/<br>40. mental retard*.tw.<br>41. alternative augmentative communicat*.tw.<br>42. Autistic Disorder/ or Asperger Syndrome/<br>43. Cleft Palate/<br>44. Otitis Media/ or exp Otitis/ or Otitis Externa/ or Otitis Media with Effusion/ or Otitis Media, Suppurative/<br>45. Exp Blindness/<br>46. speech disorders/ or aphasia/ or articulation disorders/ or echolalia/ or mutism/ or stuttering/<br>47. exp Dyslexia/<br>48. exp Brain Damage, Chronic/<br>49. multilingualism/<br>50. (bilingual* or second language).tw.<br>51. #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49 or #50<br>52. #35 and #51<br>53. #35 not #52 |
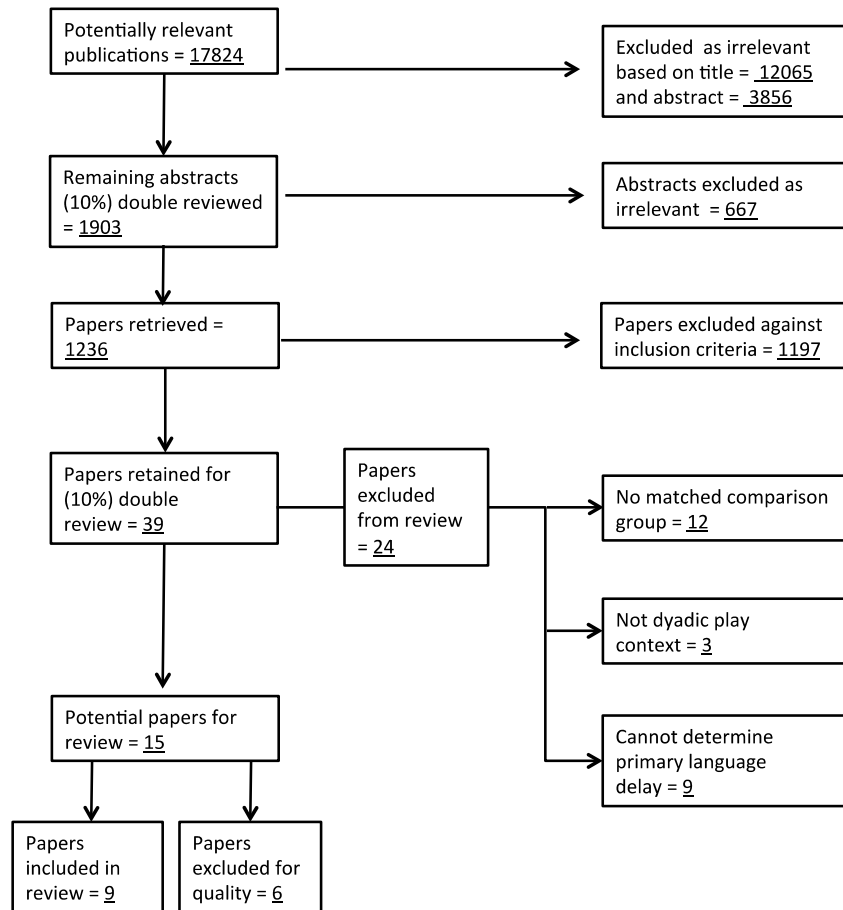
**Figure 1.** Flowchart of review process