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Research Report

Associations between early maternal behaviours and child language at 36 months in a cohort experiencing adversity

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Abstract

Background: Variations in parenting, more specifically less responsive and more directive parenting, contribute to language difficulties for children experiencing adversity. Further investigation of associations between specific responsive and directive behaviours and child language is required to understand how behaviours shape language over time within different populations. As language is dyadic, further exploration of how mother–child interactions moderate associations is also important.

Aims: To investigate associations between specific responsive and directive maternal behaviours, the quality of mother–child interaction (fluency and connectedness) and child language in a cohort experiencing adversity.

Methods & Procedures: Pregnant women experiencing adversity were recruited from maternity hospitals in Australia. At 12 months, videos of mother–infant free play were collected. Videos were coded for maternal behaviours and fluency and connectedness (*n* = 249). At 36 months, child language was measured using a standardized language test. Linear regression models were used to examine associations and the moderating role of fluency and connectedness was explored.

Outcomes & Results: Responsive yes/no questions were positively associated with language scores. Unsuccessful redirectives were negatively associated with language scores. The moderation effect of fluency and connectedness was equivocal in the current data.

Conclusions & Implications: Findings reproduce and extend previous research highlighting key features of mother–child interactions associated with child language trajectories. Findings also augment knowledge of risk and protective factors related to language for children experiencing adversity and highlight where targeted interventions might be successful.

Keywords: language development, responsiveness, parents

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<A>**What this paper adds**

<B>*What is already known on the subject*

In previous research with this cohort, associations between responsive and directive maternal behaviours at 12 months were explored in relation to observational language outcomes at 12 and 24 months. Maternal imitations at 12 months were positively associated with vocalizations and words at 12 and 24 months. Maternal successful redirectives at 12 months were negatively associated with children's mean length of turn at 24 months.

<B>*What this paper adds to existing knowledge*

At 36 months, children were followed up and language was directly assessed using a standardized language test. This paper reports on how maternal behaviours at 12 months continued to shape language skills over time. Child language skills may be more stable at 36 months than at the earlier ages previously investigated. Hence, this paper provides more robust data in which to explore mother–child associations.

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

Including responsive yes/no questions in parent-implemented language promotion activities for families experiencing adversity may be beneficial in later infancy. Findings also suggest directive maternal behaviours (i.e., unsuccessful redirectives) could be used alongside other child, familial and parental factors to support early identification of children at risk of language difficulties.

<A>**Introduction**

Developmental language difficulties disproportionately affect children from disadvantaged backgrounds, most notably those from low socioeconomic status (SES) families (Pan *et al.* 2004). Prevalence estimates in the general population range from 7% to 13% (McLeod and McKinnon 2007), but are substantially higher in at-risk populations, with estimates rising to around 30–50% (Locke *et al.* 2002). A broader range of environmental risk factors for language difficulties has been identified, including teen parenthood, lone parenthood and poor parental mental health (Pan *et al.* 2005, Scottish Executive Education Department, 2008, Keown *et al.* 2001). For the purpose of this study, the term *adversity* will be used to encompass this broader range of factors associated with lower language trajectories, beyond just SES measures. Parenting has the potential to mediate the

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impact of such risk factors on early language development (Lugo-Gil and Tamis-LeMonda 2008), with increasing parental responsivity typically the focus of early language interventions (Kong and Carta 2011). However, it is unclear what the association is between parenting behaviours targeted in these interventions and language outcomes over time for children from backgrounds of adversity. This study addresses this gap by exploring parenting behaviours in relation to child language within a large cohort of Australian children experiencing adversity.

Encouragingly, there is increasing international interest in the development of programmes to support language acquisition for children at risk of poorer language (Lindsay *et al.* 2012). As mentioned, these programmes typically focus on promoting parental responsivity, that is, provision of expeditious, semantically contingent and appropriate responses to what a child has said or done (Tamis-LeMonda *et al.* 2001). The focus on parental responsivity is primarily due to an association between responsiveness and better developmental outcomes, particularly cognition and language (Eshel *et al.* 2006). For at-risk parents, the focus on parental responsivity is also important because, for a variety of reasons, these parents may be less responsive and more directive with their children; a contributory factor in poorer language outcomes (Keown *et al.* 2001). Moreover, there is promising evidence that when at-risk parents are supported, they can modify interactions with their children which, in turn, encourages language learning (McGillion *et al.* 2017). Differences in parent–child interactions contribute to variations in child language development and are experienced by children in their day-to-day lives. Thus, motivation for promoting parental responsivity to facilitate early child language is sound.

<B>*Developmental, cultural and socioeconomic considerations*

Although responsive parenting behaviours are considered optimal for early language development, it is probable that directive behaviours (such as prohibitions and redirectives) may also play a role. At younger ages, or during earlier developmental stages, *successful* redirection (i.e., when an adult shifts the child's attention from what they are focused on to what the adult wants them to focus on), whilst not responsive, can be appropriate for a child's level and engagement (Lloyd and Masur 2014). In particular, younger infants may benefit from successful redirection in order to acquire early word–object associations (Matatyaho and Gogate 2008). Furthermore, beliefs about children and child-rearing vary with cultural background, with directive parenting practices typical in many cultures (Vigil and Hwa-Froelich 2004). Feasibly the direction or strength of associations between directives and child language outcomes may differ by cultural group. For example, a positive association has been found between directive parenting and child language in cohorts of African-American children (Shimpi *et al.* 2012, Dyer *et al.* 2014), whilst a negative association has been established between directives and language in cohorts that are predominantly European-American (e.g., Masur *et al.* 2005) or Australian (Conway *et al.* 2017). Additionally, associations between directive behaviours and child language may also vary with SES. For example, in lower SES families directive behaviours have been negatively related to language (Hart and Risley 1995, Pan *et al.* 2004), whilst in higher SES families there is limited evidence of this negative association (Bornstein

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and Tamis-LeMonda 1990, Baumwell *et al.* 1997). Purely viewing adult directiveness as a negative construct may limit our understanding of directiveness and how it relates to child language (Pine 1992).

<B>*Current research on parental behaviours and child language*

To identify aspects of parent–child interactions that may facilitate or hinder language acquisition, examination of *specific* maternal behaviours encompassed within responsive and directive parenting is required (Hirsh-Pasek *et al.* 2015). As stated, studies exploring directive behaviours have reported equivocal findings depending on child age and familial or environmental characteristics. Various studies have also identified responsive behaviours associated with child language. Responsive imitations, expansions and questions are often positively associated with child language in middle-income cohorts (Tamis-LeMonda *et al.* 2001, Levickis *et al.* 2014, Paavola *et al.* 2005). Positive associations between responsive labelling/descriptives and child language have also been reported (Paavola *et al.* 2005, Masur *et al.* 2005), however, not universally. For instance, descriptives at 9 months predicted when infants would start imitating and using first words, but no associations were found at 13 months (Tamis-LeMonda *et al.* 2001). Furthermore, a negative association between 24-month labels and 36-month language has also been reported (Levickis *et al.* 2014). To date, associations have only been described in mid to high SES families. Moreover, aside from the Levickis *et al.* (2014) study, research has been limited by smaller samples and potential selection bias due to recruitment methods (Webb and Bain 2015).

<B>*Extending the research*

Research demonstrates that exposure to directive behaviours does not necessarily equate to poorer child language; exposure to responsive behaviours does not necessarily equate to better child language. Yet, parent-led language interventions primarily focus only on responsivity (Kong and Carta 2011, Roberts and Kaiser 2011). Further exploration of associations between specific directive and responsive behaviours in relation to child language, in different populations, across developmental stages, is necessary. Focusing on cohorts experiencing adversity who are at greater risk of language difficulties, but underrepresented in the research, is especially important. Furthermore, mother–child interactions do not occur in isolation, but are socially shaped (Gros-Louis *et al.* 2014). Therefore, the mother–child dynamic is an important piece of this puzzle. Inclusion of a measure of the mother–child interactional dynamic within this type of research is also warranted.

Considering the mother–child dynamic, the fluency and connectedness of mother–child interactions (i.e., the conversational or interactional balance between the mother and child, their negotiation and sharing of turns and smooth transitioning between topics) may be particularly important for both adult language facilitation and child language learning (Adamson *et al.* 2012; Hirsh-Pasek *et al.* 2015). The fluency and connectedness of mother–child interactions at 12 months

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has already been explored in relation to 12- and 24-month language with this cohort (Smith *et al.* 2017, 2018). Fluency and connectedness was coded from mother–child free-play videos. Seven responsive and directive behaviours were also coded from the videos. Maternal imitations used at 12 months were positively associated with child vocalizations and words at 12 and 24 months. These associations were stronger in more fluent and connected mother–child interactions. By 24 months, successful redirectives (i.e., when a mother successfully shifted her child's attention from what they were focused on to what the mother wanted them to focus on) were also negatively associated with children's mean length of turn at 24 months; an association which was ameliorated in fluent and connected interactions. Responsive labels, responsive questions, prohibitions and unsuccessful redirectives were unrelated to 12- or 24-month language.

<B>*The current study*

The current study reports on associations between seven responsive and directive maternal behaviours coded at 12 months and child language assessed using a standardized measure at 36 months. The moderating role of fluency and connectedness was also explored. Findings augment and extend our knowledge of how different dimensions of maternal behaviours continue to shape language trajectories over time. Findings also have the potential to inform targeted language promotion programmes for children experiencing adversity.

<A>**Methods**

<B>*Study design and participants*

This study is nested within [AQ2] the XXX trial. The trial is a prospective, longitudinal, randomized controlled trial exploring the effectiveness of sustained nurse home visiting provided to women experiencing adversity. The current study comprises data from the control arm only to eliminate intervention effects. Pregnant women experiencing adversity were recruited from Australian maternity hospitals in 2013–14 (*n* = 722). Indicators of adversity were two or more of the following: current smoking, young pregnancy (< 23 years), no support during pregnancy, poor/fair/good health (versus very good/excellent general health), anxious mood, not finishing high school, not having a household income, a long-term illness, not living with another adult and/or never having a job. Indicators were chosen following a pilot screening and data linkage where a statistician examined algorithms to identify which criteria would best capture women experiencing adversity. Women without sufficient English to answer verbally presented questions were excluded. Following the baseline assessment, participants were randomized to intervention (*n* = 363) and control (*n* = 359) arms. Women in both arms completed face-to-face assessments at child age 12 months. As part of this assessment mothers and children were videoed during free play. Participants in the control arm for whom we had videos were included in this study (*n* = 249, 80.1%). Women were followed up

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when their child was 24 and 36 months. At 36 months the CELF-P2 was administered to 180 children (72.3%).

Table 1 presents baseline participant characteristics. Women were on average 28.4 years, chiefly born in Australia (*n* = 204; 81.9%), followed by India (*n* = 12; 4.8%) and New Zealand (*n* = 5; 2.0%). Twenty-five women (10.3%) used a main language other than English at home, including Malayalam, Tamil, Hindi, Telugu, Filipino and Arabic. According to the Australian Socioeconomic Index for Areas (SEIFA) over one-third of women lived in the most disadvantaged quintile (35.3%). Most women had two (92/249, 37%) or three risk factors (86/249, 34.5%). Thirty-two women had five or more risk factors (12.9%). Just over half the children were male (55.4%) and around one-third were firstborn (31.3%). At the 36-month visit, mothers were asked to report on diagnosed medical conditions including hearing impairment; no children were diagnosed with hearing impairment. At the 36-month visit, proportionally more women were living with their husbands/partners than at baseline (32.3% versus 25.3%).

<tab 1>

<B>*Ethics*

Ethical approval was gained [AQ2] from XXXX (HREC Number: 32296A) for the XXX study. Site-specific approvals were also gained from study locations. Ethical approval was also gained [AQ2] from XX, Human Research Ethics Committee for the current study (Ethics Application ID 1545222.1).

<B>*Procedures*

[AQ2] The XXX researchers conducted all face-to-face assessments in the home. At the 12-month assessments, mother and child were video recorded during 8 min of free play. Women were provided with an identical set of age-appropriate toys and encouraged to play with their children as they usually would. Data for the current study come from analysis of 5 min of footage from the middle of each video. The middle section was chosen to allow for warm-up and fatigue.

<B>*Maternal behaviours (predictor variables)*

Four maternal responsive behaviours were coded at 12 months: verbal imitations, responsive labels, responsive wh-questions and responsive yes/no questions. Behaviours needed to be relatively frequent and easily observable to be coded from free-play videos at 12 months. Questions were divided into 'wh' and yes/no as there may be a different language learning benefit dependent on the question type. Behaviours were only counted as responsive if the mother acted within 5 s of the child's preceding action (Baumwell *et al.* 1997). Redirectives and prohibitions were selected as directive behaviours. Redirectives were delineated into successful and unsuccessful due to ambiguity

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about the language learning benefit when a child is successfully versus unsuccessfully redirected (Shimpi and Huttenlocher 2007). Detailed descriptions of maternal behaviours can be found in table 2. Maternal behaviours were coded using Observer® XT software by the first author. Maternal behaviours were mutually exclusive but not exhaustive, thus maternal language that did not fit into one of the aforementioned categories was not coded.

<tab 2>

<B>*Fluency and connectedness (moderator variable)*

Fluency and connectedness of mother–child interaction was also measured at 12 months. The scale was implemented with guidance from Professor Lauren Adamson (who co-authored the scale) and by referring to the Communication Foundation Rating Items technical report (Adamson *et al.* 2012). Fluency and connectedness was rated on a Likert scale from 1 to 7. Descriptors and behaviours of scores of 1, 4 and 7 were detailed in the report. There were originally no behavioural descriptors for remaining scores. The first and fifth authors used training videos to standardize coding for scores of 1, 4 and 7, and to assign behaviours to scores of 2, 3, 5 and 6. Interrater reliability was then conducted until reliable agreement could be met. Behavioural descriptors for all scores were documented for reference during implementation. Fluency and connectedness was measured during the same 5 min of 12-month footage used to code maternal behaviours. Owing to the young age of the children, no child achieved 6 or 7 so the maximum fluency and connectedness rating obtained was 5. Table 3 details behavioural descriptors for fluency and connectedness scores.

<tab 3>

Table 4 presents correlations between maternal behaviours and fluency and connectedness. Fluency and connectedness and labels were positively correlated with all other responsive behaviours. Fluency and connectedness was negatively correlated with unsuccessful redirectives. Yes/no and wh-questions were positively correlated. All three directive behaviours were positively correlated.

<tab 4>

<B>*Thirty-six-month language (outcome measure)*

Three subtests of the CELF-P2 were administered at 36 months: Sentence Structure (SS), Word Structure (WS) and Expressive Vocabulary (EV). The three subtests scores combine to achieve the [AQ3] CL score.

<B>*Interrater reliability*

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For all measures collected at 12 months, interrater reliability was conducted on 10% of the sample. Videos were randomly selected and coded by a second coder (fifth author). Intraclass correlation coefficients (ICC) were used to assess interrater reliability. Reliability was excellent with the following coefficients: imitations (.95), labels (.97), responsive questions (.94), yes/no questions (.92), prohibitions (1.0), successful redirectives (.92) and unsuccessful redirectives (.96). For fluency and connectedness, the weighted kappa statistic (*k*) was used to measure interrater agreement; agreement was met when both raters achieved the same score or one score apart. Substantial agreement was met between raters (*k* = 0.80). Regarding 36-month CELF-P2 assessments, subtests were initially scored and entered into [AQ2] the XXX database by the administering researcher. All data were then cross-scored and checked by a colleague.

<B>*Statistical analysis*

To explore associations, a correlation matrix of predictor (maternal behaviours) and outcome (CELF-P2 CL scores) variables was generated. Significant associations were investigated using linear regression models. Maternal behaviours were included individually in unadjusted linear regression models as predictors of CELF-P2 CL scores. Analyses were then extended to adjust for potential confounders: child age at assessments, gender, maternal education, family history of speech, language and literacy difficulties, birth order and main language spoken at home. As maternal behaviours do not occur in isolation, six child communicative behaviours were coded from the 12-month videos and controlled for in the analysis (vocalizations, words, looks to mother's face, pointing, pretend play and showing/giving mother an object). See Smith *et al.* (2017) for more information about 12-month communicative behaviours. A sensitivity analysis was conducted to examine the effect of including/excluding women who spoke a main language other than English at baseline in regression models; no significant differences were found so data is presented for the whole sample.

As language interventions often treat responsive language facilitation strategies (such as imitations and labels) as separate from the quality of the mother–child turn-taking (Roberts and Kaiser 2011), fluency and connectedness was treated as a moderator rather than a predictor. Subsequent exploratory analysis modelled fluency and connectedness as a moderator of the statistically significant maternal behaviour and child language associations in adjusted regression models. This explored whether the associations differed by the dyad's level of fluency and connectedness. Simple slopes were plotted to estimate the change in child language score associated with a one-unit increase in each maternal behaviour, whilst keeping fluency and connectedness constant at different values between 1 and 5.

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<A>**Results**

<B>*Descriptive statistics*

Eleven videos were under 5 min (208–274 s), so results are presented in the rate of maternal behaviours per minute. Labelling was the most common responsive behaviour (85%; mean =1.21, standard deviation (SD) = 1.10, range = 0–6), followed by responsive questions (78%; mean =0.65, SD = 0.64, range = 0–3.2), yes/no questions (70%; mean =0.48, SD = 0.57, range = 0–3.2) and imitations (60%; mean =0.40, SD = 0.46, range = 0–2.2). Regarding directive behaviours, 82% of mothers used successful redirectives (mean =0.55, SD = 0.47, range = 0–2.2), 62% used unsuccessful redirectives (mean =0.58, SD = 0.92 range = 0–5.6) and 43% used prohibitions (mean =0.34, SD = 0.71, range = 0–6.2). The average CELF-P2 CL score was 0.6 SDs below the Australian population mean of 100 (mean = 91.29, range = 59–124, SD = 14.68). Average scores for the individual CELF-P2 subtest were also below population means (10) at 8.92 for SS (*n* = 178; range = 4–15, SD = 2.83), 7.86 for WS (*n* = 176; range = 3–15, SD = 2.99) and 8.31 for EV (*n* = 176; range = 2–14, SD = 3.04).

<B>*Cultural differences in maternal behaviours*

Two-sample *t*-tests were used to compare maternal behaviours for women whose main language was English (MLE) at baseline versus women who spoke another main language, that is, had English as an additional language (EAL). For imitations, there was a significant difference in scores for MLE (mean = .35, SD = .46) versus EAL speakers (mean = .57, SD = .52); $t(242) = -2.26$, $p = .025$. For responsive questions, there was a significant difference in scores for MLE (mean = .70, SD = .65) versus EAL speakers (mean = .29, SD = .45); $t(242) = 3.07$, $p = .002$. For labels, there was a significant difference in scores for MLE (mean =1.25, SD = .1.07) versus EAL speakers (mean = .74, SD = .87); $t(242) = 2.33$, $p = .021$. For yes/no questions, there was a significant difference in scores for MLE (mean = .52, SD = .57) versus EAL speakers (mean = .22, SD = .49); $t(242) = 2.53$, $p = .012$. For unsuccessful redirectives, there was a significant difference in scores for MLE (mean = .47, SD = .73) versus EAL speakers (mean =1.57, SD = 1.67); $t(242) = -5.96$, $p = .000$. There were no significant differences for prohibitions or successful redirectives.

<B>*Adversity indicators and maternal and child variables*

Correlations between adversity indicators and maternal behaviours have previously been reported (Smith *et al.* 2018). For reference, imitations were negatively correlated with current smoking (–.15, $p = .018$) and not finishing high school (–.14, $p = .024$). Yes/no questions were negatively correlated with never having a job (–.14, $p = .023$). Fluency and connectedness was negatively correlated with not finishing high school (–.16, $p = .013$) and never having a job (–.15, $p = .022$). Prohibitions were positively correlated with young mothers (.12, $p = .044$), health issues (.13, $p = .046$), no support (.13, $p = .049$) and never having a job (.13, $p = .042$). Unsuccessful redirectives were positively correlated with no support (.23, $p = .000$) and no household income (.13, $p = .047$). Correlations

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between CELF-P2 CL scores and adversity indicators were also explored for the current study: no correlations were significant.

<B>*Maternal behaviour–child language associations*

To examine associations between specific responsive and directive maternal behaviours at 12 months and child language skills at 36 months, a correlation matrix of maternal behaviours and CELF-P2 CL scores was derived (table 5). Only two correlations were statistically significant with small (.1) to moderate effect sizes (.3). Yes/no questions were positively correlated with CELF-P2 CL scores (.19) and unsuccessful redirectives were negatively correlated with CELF-P2 CL scores (–.22).

<tab 5>

<B>*Adjusted linear regression models*

The two significant correlations were explored in linear regression models. Yes/no questions positively predicted CELF-P2 CL scores (coefficient = 4.57, 95% confidence interval (CI) = [.26, 8.88], p = .038). Unsuccessful redirectives negatively predicted CELF-P2 CL scores (coefficient = –4.15, 95% CI = [–6.95, –1.35], p = .004). Table 6 presents adjusted associations.

<tab 6>

<B>*Moderation by fluency and connectedness*

Associations between yes/no questions and CELF-P2 CL scores and unsuccessful redirectives and CELF-P2 CL scores were explored using fluency and connectedness as a moderator (table 7). There was no significant interaction between yes/no questions and fluency and connectedness (F(16,124) = 2.83, p = .208). There was no significant interaction between unsuccessful redirectives and fluency and connectedness (F(16,124) = 3.02, p = .959). Subtle effects can be missed in standard tests of interaction [AQ4] (Kirkwood and Sterne 2005) so although interactions were not significant, simple slopes were still computed.

Simple slopes for yes/no questions and CELF-P2 CL scores were significant when fluency and connectedness was held at two (coefficient = 6.73, 95% CI = [.52, 12.93], p = .034) and approached significance when held at one (coefficient = 9.57, 95% CI = [–.27, 19.41], p = .057). Simple slopes for unsuccessful redirectives and CELF-P2 CL were significant when fluency and connectedness was held at two (coefficient = –3.82, 95% CI = [–6.73, –.92], p = .010) and three (coefficient = –3.90, 95% CI = [–7.61, –.19], p = .040). See figures 1 and 2 for simple slopes.

<tab 7, fig 1, 2>

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<A>**Discussion**

This prospective, longitudinal study of women facing adversity and their children has shown that maternal responsive yes/no questions and unsuccessful directives used during free play at child age 12 months were associated with their children's language scores at 36 months. This has extended previous research within this cohort by identifying that, whilst imitations and successful redirectives at 12 months were associated with expressive language at 12 and/or 24 months (e.g., vocalizations, words, mean length of turn), different maternal behaviours were associated with language scores at 36 months assessed using the CELF-P2. This could suggest that different dimensions of maternal linguistic behaviour shape language trajectories over time. The moderating role of the fluency and connectedness of mother–child interaction was less evident than at earlier ages with results difficult to interpret. Findings are discussed below.

<B>*Successful versus unsuccessful redirectives*

Differences in associations between language outcomes and successful and unsuccessful redirectives in this cohort over time provides further evidence that not all directives are comparable (Pine 1992). Our findings suggest that child age, developmental level and/or attention skills play a role in the association. We found no evidence that successful redirectives were associated with CELF-P2 CL scores at 36 months, in contrast to the negative association discovered with children's mean length of turn at 24 months in this cohort (Smith *et al.* 2018). This finding is also contrary to the positive association reported between successful redirectives and child vocabulary during infancy in Shimpi and Huttenlocher (2007).

Regarding unsuccessful redirectives, we observed a stronger negative association with language at 36 than at 12 or 24 months. At these earlier ages, unsuccessful redirectives were negatively correlated with child language but they were not significantly predictive in adjusted models (Smith *et al.* 2017, 2018). This finding aligns with previous research in suggesting that directive behaviours may not impact early language outcomes, but continued exposure to these types of directive behaviours may be detrimental to later language (Matatyaho and Gogate 2008). Unsuccessful redirectives, in particular, may be more disadvantageous for language learning during toddlerhood as only they were associated with 36-month language. Theoretically, children who consistently miss out on potential word learning opportunities may be at greater risk of poorer language (Shimpi and Huttenlocher 2007).

A confounding factor regarding successful and unsuccessful redirection in infancy is that successful redirection may reflect more advanced early attention skills; an important foundation for language learning (Tomasello and Todd 1983). Unsuccessful redirection might have occurred less frequently with infants who were more capable of shifting their attention. Additionally, mothers who were able to redirect their child's focus may have employed different strategies or provided more appropriate materials when compared with mothers who were unable to redirect their child (Hart and Risley 1995). Additionally, poor early language may drive increased use of redirective

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behaviours, such as interruptions and topic reintroductions (van Balkom *et al.* 2010). Redirectives may therefore have been used during communication breakdowns with children who had poorer language. Disentangling these explanations remains difficult within the current study design.

<B>*Responsive behaviours*

A surprising finding was the positive association between responsive yes/no questions and CELF-P2 CL scores at 36 months, when no associations were discovered at 12 or 24 months. One earlier small study found maternal yes/no questions at 10 months predicted vocabulary 2 months later (Paavola *et al.* 2005). Paavola *et al.* (2005) propose that yes/no questions help scaffold early conversation with prelinguistic infants who are unable to answer more abstract questions. Plus, yes/no questions also often function as a label or descriptive (e.g., 'Is that a cat?' or 'Are you hungry?'). Feasibly, exposure to early yes/no questions in the current study provided infants with linguistic input *and* allowed them to partake in early conversations; opportunities other responsive behaviours may not have provided to the same extent. This is a novel finding as it is the first time that this association has been reported in a large cohort of women and children experiencing adversity.

If yes/no questions play a labelling role, it is noteworthy that maternal responsive labels were not associated with language outcomes. Possibly the narrow definition of labels, as operationalized in the current study, may have influenced findings. However, associations between labels/descriptives and early language are ambiguous (Tamis-LeMonda *et al.* 2001, Levickis *et al.* 2014) so findings may reflect the equivocal association between labels and early language. Maternal wh-questions have also been related to child language (Tamis-LeMonda *et al.* 2001, Levickis *et al.* 2014) but no associations were discovered in the current study. Different question types may be more apposite for specific periods of linguistic development, therefore yes/no questions may have been more suitable than wh-questions at 12 months of age (Rowe *et al.* 2004). Also, as the CELF-P2 is a summative assessment, it may not have captured features of early language promoted by maternal wh-questions, for example, use of language to talk about the past (Tamis-LeMonda *et al.* 2001). Imitations were positively associated with 12- and 24-month language in this cohort (Smith *et al.* 2017, 2018). The absence of an association at 36 months might indicate that imitations are more effective at shaping early words. Or, as Levickis *et al.* (2014) found imitations at 24 months predicted 36-month language, it could be that imitation have a more proximal impact on word learning i.e., imitations facilitate the next linguistic stage.

<B>*Fluency and connectedness*

How fluency and connectedness acted as a moderator in this data set is difficult to interpret. At earlier waves, a more fluent and connected interaction strengthened positive maternal–child associations (i.e., between imitations and child words) and ameliorated negative associations (i.e., between successful redirectives and the child's length of turn). There were no such clear trends in

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this data. As the 36-month findings do not align with earlier findings, perhaps moderation effects reduce with child age or a longer/more representative play sample at 12 months may be required to explore associations fully. This exploratory work suggests how a more nuanced approach can be taken to explore early language learning. However, to investigate these issues further, repeated and extended measures of interactional quality and maternal behaviours are needed.

<B>*Culture and maternal behaviours*

There were no differences in the regression analyses when women who spoke a main language were included/excluded from the sample. Yet, compared with women whose main language was English at baseline, women who spoke a main language other than English were significantly less likely to use responsive wh-questions, yes/no questions and labels, but more likely to imitate and unsuccessfully redirect. Findings align with past research suggesting that directive, less responsive parenting practices may be typical in different cultures (Vigil and Hwa-Froelich 2004). However, the higher rates of imitations for mothers who spoke a home language other than English also suggests that they were more responsive to their child's vocalizations. Importantly, maternal behaviours that echo their child's language (i.e., imitations and expansions) seem particularly important for early language acquisition (Masur *et al.* 2005, Levickis *et al.* 2014, Tamis-LeMonda *et al.* 2001), including for children in this cohort (Smith *et al.* 2017, 2018). Furthermore, the negative association between unsuccessful redirectives and child language has been found to weaken when adjustments were made for maternal expansions of child language (Conway *et al.* 2017). Thus, although directive styles of parenting are considered disadvantageous when compared with responsive styles, mothers who speak a main language other than English may have different profiles of behaviours; profiles which may not be reflected in the current literature. Professionals should therefore consider parental behaviours within the context of cultural norms and views on language facilitation (Lieven 1994).

<B>*Adversity and maternal behaviours*

The Family Stress Model (Conger *et al.* 1997) suggests that parents with fewer financial resources experience increased stress managing their own basic needs and those of their child which, in turn, leads to poorer maternal mental health giving rise to less effective parenting; these parenting differences then indirectly impact child outcomes. Current findings appear to align with this model in demonstrating positive correlations between directive behaviours and adversity indicators related to financial resources, when there were no correlations between adversity indicators and child language. Feasibly, the direct impact of adversity on child language is mediated by parental behaviours (Lugo-Gil and Tamis-LeMonda 2008). However, the absence of a correlation between adversity indicators and child language could also be linked to the assessment tool. As there are inherent cultural and linguistic biases attached to standardized language tests (Lidz and Peña 2009), the CELF-P2 may not have accurately reflected the children's language skills.

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<B>*Implications*

One main study implication is that of identification of explicit responsive behaviours associated with later language skills in a cohort of children at risk of poorer language. Importantly, different aspects of child-directed speech may not be equally important at different stages of child development (Rowe 2008). Earlier research with this cohort identified positive associations between maternal imitations and infant language. In the current study maternal yes/no questions were positively associated with 36-month language. Imitations and yes/no questions may be beneficial to include in programmes supporting early language for children experiencing adversity, with specific behaviours potentially more valuable at different stages of development.

A further clinical implication of this study is that of identifying specific maternal behaviours which could be used as additional factors for predicting early language trajectories. Current knowledge of population level risks (such as male gender, family history of speech and language difficulties and lower maternal education) has not been converted into a means of dependably estimating an individual's risk of language difficulties (McKean *et al.* 2016). To identify better individual risk, there is growing interest in multifactorial risk modelling which combines child, familial and parental characteristics (McKean *et al.* 2016). Current study findings could augment knowledge of early parenting behaviours or characteristics which are protective of, or a barrier to, optimal language learning.

<B>*Limitations*

Five minutes of free play at 12 months may have been insufficient to capture fully the frequency and range of maternal behaviours used by participants. Additionally, parental behaviours may change depending on interaction type; only one interaction was coded that may not have represented the most typical nor frequent interaction in a child's day (Flynn and Masur 2007). Also, from a research perspective, being videoed using unfamiliar toys can be difficult for all participants, but particularly for minority groups (Ipsa *et al.* 2004). Consideration of different ways of measuring maternal behaviours in a more culturally sensitive manner will be important for future research. Additionally, not controlling for the amount or quality of maternal linguistic input is a limitation. A final limitation is that maternal behaviours were not exhaustive so some maternal language was therefore not coded.

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<A>**Conclusions**

Maternal yes/no questions at 12 months were positively associated with CELF-P2 CL scores at 36 months. Maternal unsuccessful redirectives at 12 months were negatively associated with CELF-P2 CL scores at 36 months. Findings can support with identification of children experiencing adversity who are at greater risk of language difficulties. Findings also have the potential to inform targeted language promotion programmes for these children.

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<<t/s Set names in caps and scaps as per usual style>>

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Table 1. Baseline characteristics of mothers and children in the study

	Participants (*n* = 249)
Mean maternal age at baseline: years; months (SD)	28.4 (6.2)
Mean infant age at 12 month assessment: months (SD)	12.1 (1.0)
Maternal mental health[a]	Mean (SD)
DASS Anxiety total[b]	3.4 (3.2)
DASS Depression total[c]	2.7 (2.8)
DASS Stress total[d]	5.4 (3.9)
Maternal characteristics	*n* (%)
Teen parenthood	18 (7.2)
Highest level of education	
Did not complete high school	56 (22.5)
Completed high school	14 (5.6)
Vocational training/diploma	131 (52.6)
Completed bachelor degree or higher	26 (10.4)

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Currently employed	95 (38.2)
Marital status	
Single/not living with partner	61 (24.5)
Married/living with partner, not married	183 (73.5)
Separated/divorced	5 (2.0)
Language other than English	25 (10.0)
Born overseas (total)	45 (18.1)
Born overseas (top eight)	
India	12 (4.8)
New Zealand	5 (2.0)
England	4 (1.6)
Sri Lanka	3 (1.2)
Sudan	3 (1.2)
Afghanistan	2 (0.8)
Bhutan	2 (0.8)
Pakistan	2 (0.8)
Infant characteristics	
First born	78 (31.3)
Female/male	110/139 (44.2/55.4)
Twin	5 (2.0)

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Family/household	
Family history of language and literacy difficulties	96 (38.6)
SEIFA Index of Social Disadvantage Quintile[e]	
1	88 (35.3)
2	19 (7.6)
3	100 (40.2)
4	23 (9.2)
5	9 (3.6)
Household main source of income	
Full time employment	125 (50.2)
Part time employment	26 (10.4)
Benefit/pension	95 (38.2)
Other (casual, self-employed)	3 (1.2)
Living arrangements	
Husband/partner	186 (74.7)
Parents/in-laws	29 (11.65)
Other relatives	23 (9.2)
Other	11 (4.4)

Notes: [a]Measured using the Depression Anxiety Stress Scales (DASS) [AQ14] (Lovibond and Lovibond 1995).

[b]Anxiety range: normal = 0–3, mild = 4–5, moderate = 6–7, severe = 8–9, extremely severe ≥ 10.

[c]Depression range: normal = 0–4, mild = 5–6, moderate = 7–10, severe = 11–13, extremely severe ≥ 14.

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[d]Stress range: normal = 0–7, mild = 8–9, moderate = 10–12, severe = 13–16, extremely severe ≥ 17.

[e]Lowest scoring 20% of areas receive a quintile number of 1; highest scoring 20% receive a quintile number of 5.

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Table 2. Detailed descriptions of maternal behaviours (predictor variables)

Maternal behaviour	Definition	Example	
		Infant	Adult
Verbal imitation	Mother repeats infant vocalizations or words. Imitations of words coded if developmentally and contextually appropriate	'Hi!'	'Hi!'
Responsive wh-question	Mother asks a 'wh' question (e.g., 'what', 'when', 'who'), which is immediate and dependent on the infant's preceding act	Infant drinks	'What are you drinking?'
Responsive yes/no question	Mother asks a question requiring a yes/no answer, which is immediate and dependent on the infant's preceding act	Infant drinks	'Are you thirsty?'
Label	Mother labels an object or action, which is the focus of the infant, with the label in the final position of the carrier phrase	Infant drinks	'You're drinking!'
Prohibition	Mother uses an imperative to try and prevent the infant's current behaviour or vocalization (unrelated to infant or sibling safety)	Infant sucks thumb	'Stop sucking!'
Successful redirective	Mother uses a command to shift successfully the infant's visual or physical attention	Infant plays with blocks	'Look!' Infant shifts attention from blocks
Unsuccessful redirective	Mother uses a command that is unsuccessful at shifting the infant's attention	Infant plays with blocks	'Look!'. Infant does not acknowledge command

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Table 3. Fluency and connectedness scale with anchor behaviours

Item	Anchors						
	1=	2=	3=	4=	5=	6=	7=
Fluency and connectedness: characterizes the balance and flow of the mother–child interaction	No conversation established No instances of shared smiling/laughing Child frequently off screen	Some fleeting verbal/non-verbal exchanges. Mostly mother and child playing with separate toys	Instances of child initiating and mother responding. Some turn-taking but without progression (e.g., just pressing buttons on a toy)	Conversation lacks smoothness, appears to be largely dominated by one partner, but child initiates on three or more occasions	Shared topic throughout. Both partners engaged in relatively equal turn-taking	Extension of interaction and play from both mother and child. Always on the same play theme	Fluid and balanced conversation that is often sustained

Source: Modified from Adamson *et al.* (2012).

Table 4. Correlations between maternal behaviours and fluency and connectedness variables

	1		2		3		4		5		6		7	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Fluency and connectedness	–													

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Imitations	**.37**	**.000**	–											
Wh-questions	**.22**	**.001**	.09	.162	–									
Yes/no questions	**.20**	**.002**	.04	.530	**.36**	**.000**	–							
Labels	**.30**	**.000**	**.13**	**.034**	**.22**	**.000**	**.23**	**.000**	–					
Successful redirectives	.01	.871	–.02	.800	**.22**	**.000**	.06	.366	.02	.748	–			
Unsuccessful redirectives	**–.22**	**.000**	.01	.858	.08	.226	–.10	.111	–.10	.120	**.45**	**.000**	–	
Prohibitions	–.03	.592	.05	.400	.04	.536	.07	.278	.02	.795	**.20**	**.002**	**.19**	**.002**

Note: Values shown in bold are significantly correlated.

Table 5. Correlation matrix of maternal behaviours at 12 months and CELF-P2 Core Language scores at 36 months

Language score (outcome variables)	Maternal behaviours (predictor variables)						
	Imitations	Responsive questions	Yes/no questions	Labels	Prohibitions	Successful redirectives	Unsuccessful redirectives
Core language score	.13	.06	.19*	.09	.02	–.07	–.22**

Note: *$p \leq 0.05$, **$p \leq 0.01$.

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Table 6. Adjusted associations[a] between significant maternal behaviours and child CELF-P2 scores

	Maternal behaviours					
	Yes/no questions			Unsuccessful redirectives		
Child language	Coefficient [95% CI]	Adjusted R^2 (%)	*p*	Coefficient [95% CI]	Adjusted R^2 (%)	*p*
CELF-P2 Core Language Score	4.57 [.26, 8.88]	17%	.038	–.4.15 [–6.95, –1.35]	19%	.004

Notes: [a]Figures are adjusted for the child's age at the assessments, child gender, maternal education, birth order, main language, family history of language and literacy difficulties, and 12-month communicative behaviours.

CI, confidence interval.

Table 7. Associations between maternal behaviours and CELF-P2 scores using fluency and connectedness as a moderator

Predictor variables held at …	Yes/no questions and CELF-P2 scores	Unsuccessful redirectives and CELF-P2 scores
	Coefficient [95% CI]	Coefficient [95% CI]
Fluency and connectedness = 1	9.57 [–.27, 19.41]	–3.75 [–8.07, .57]
Fluency and connectedness = 2	6.73 [.52, 12.93]*	–3.82 [–6.73, –.92]*
Fluency and connectedness = 3	3.88 [–.54, 8.31]	–3.90 [–7.61, –.19]*

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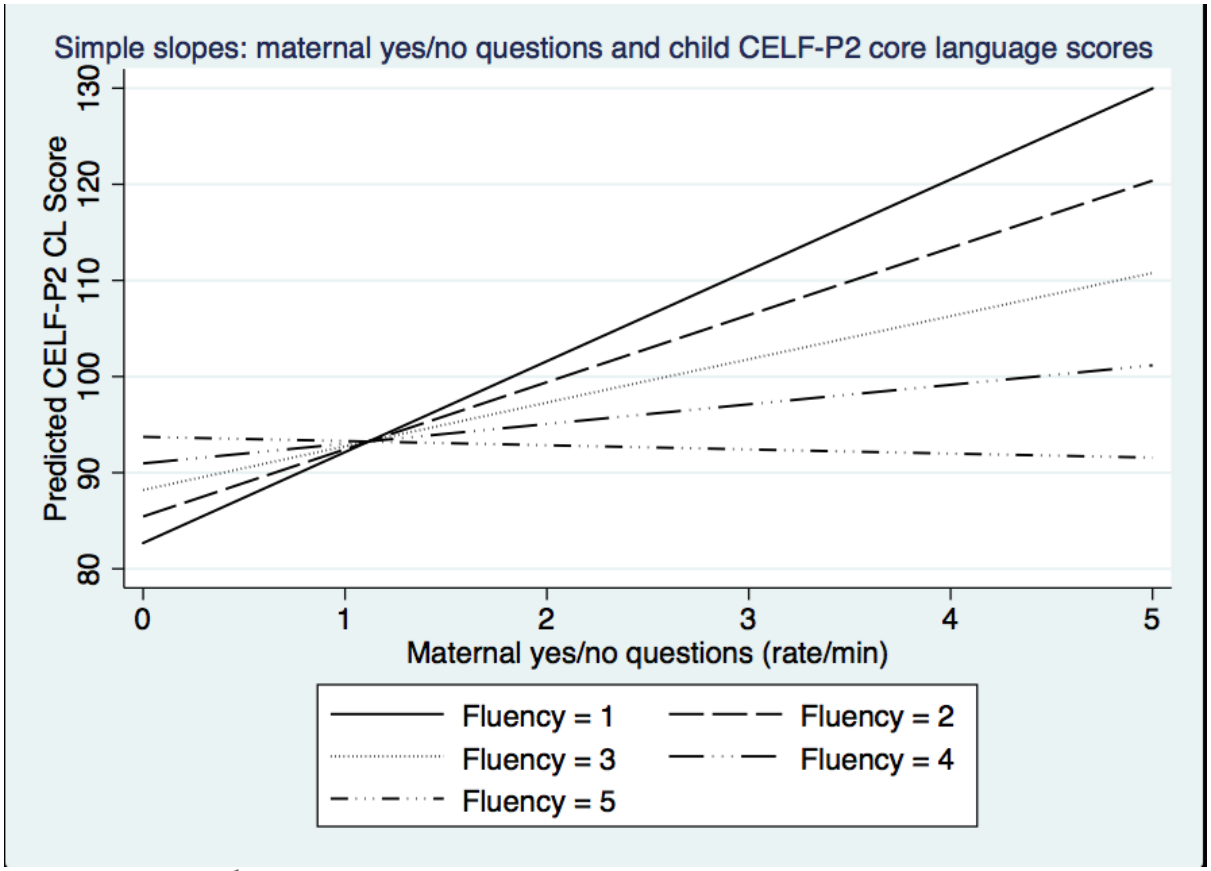
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Fluency and connectedness = 4	1.04 [–5.31, 7.39]	–3.97 [–9.87, 1.92]
Fluency and connectedness = 5	–1.80 [–11.84, 8.23]	–4.04 [–12.49, 4.40]

Notes: CI, confidence interval.

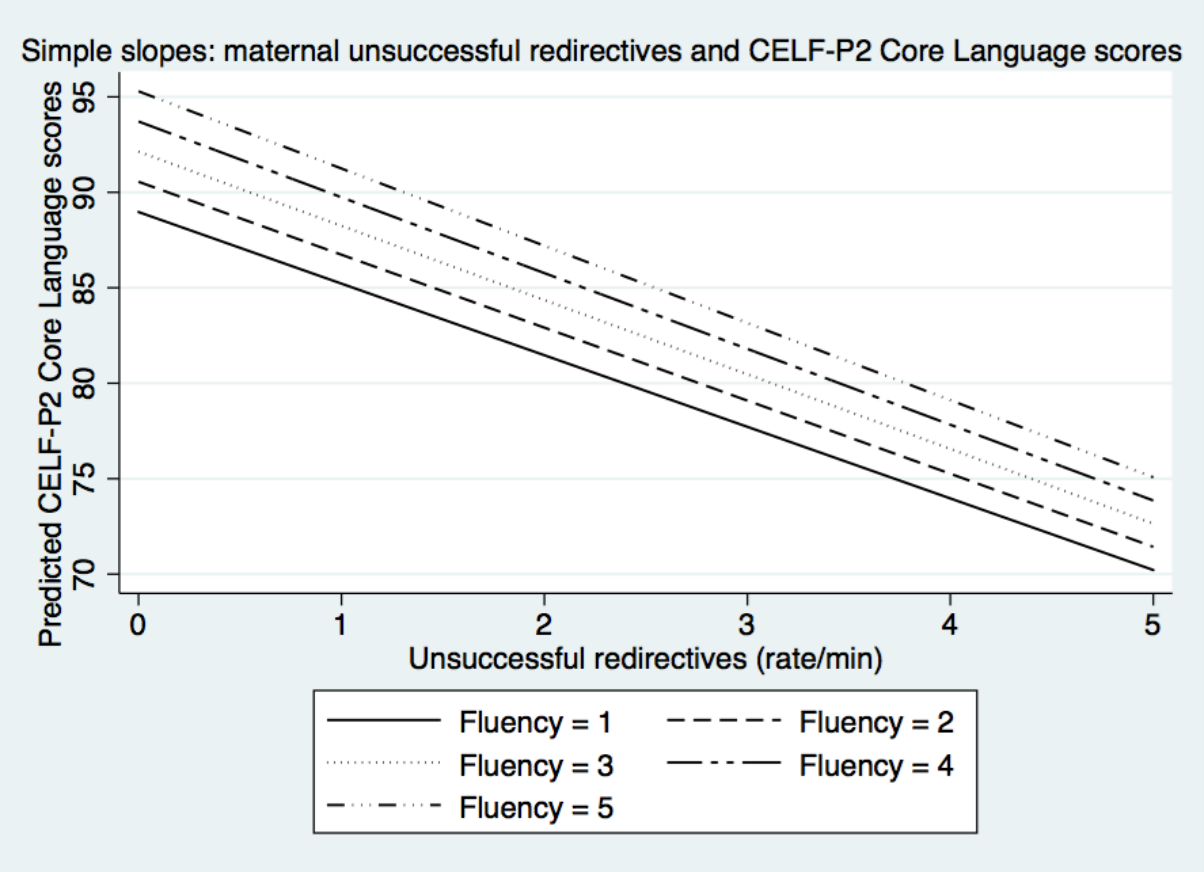
*$p \leq .05$.

Figure 1: Simple slopes predicting the amount of change in predicted CELF-P2 scores with one unit change in maternal yes/no questions whilst keeping the fluency and connectedness (fluency) constant between levels 1-5.



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Figure 2: Simple slopes predicting the amount of change in predicted CELF-P2 scores with one unit change in maternal unsuccessful redirectives whilst keeping the fluency and connectedness (fluency) constant between levels 1-5.



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