



Quality of caregiver-child play interactions with toddlers born preterm and full term: Antecedents and language outcome

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ABSTRACT

Background: Preterm birth may leave long-term effects on the interactions between caregivers and children. Language skills are sensitive to the quality of caregiver-child interactions.

Aims: Compare the quality of caregiver-child play interactions in toddlers born preterm (PT) and full term (FT) at age 22 months (corrected for degree of prematurity) and evaluate the degree of association between caregiver-child interactions, antecedent demographic and language factors, and subsequent language skill.

Study design: A longitudinal descriptive cohort study.

Subjects: 39 PT and 39 FT toddlers individually matched on sex and socioeconomic status (SES).

Outcome measures: The outcome measures were dimensions of caregiver-child interactions, rated from a videotaped play session at age 22 months in relation to receptive language assessments at ages 18 and 36 months. **Results:** Caregiver intrusiveness was greater in the PT than FT group. A composite score of child interactional behaviors was associated with a composite score of caregiver interactional behaviors. The caregiver composite measure was associated with later receptive vocabulary at 36 months. PT-FT group membership did not moderate the association between caregiver interactional behavior and later receptive vocabulary.

Conclusions: The quality of caregiver interactional behavior had similar associations with concurrent child interactional behavior and subsequent language outcome in the PT and FT groups. Greater caregiver sensitivity/responsiveness, verbal elaboration, and less intrusiveness support receptive language development in typically developing toddlers and toddlers at risk for language difficulty.

1. Introduction

Language development unfolds in the context of a child's social environment [1]. The nature of caregiver-child interactions plays a critical role in supporting and shaping children's language learning [1,2]. Understanding the factors that shape the quality of caregiver-child relation requires evaluating both the caregiver's style of interaction (e.g., sensitivity and responsiveness) as well as the child's willingness to engage with caregivers and with other aspects of the learning environment. Very and extremely preterm (PT) birth places children at risk for disruptions of early caregiver-child interaction [3,4]. PT birth is also a risk factor for long-term difficulties with language [5]. The overall aims of the current study are to (1) compare the quality of caregiver-child play interactions in toddlers born preterm (PT) and full term (FT) at age 22 months (corrected for degree of prematurity),

including identifying demographic and child factors associated with qualities of caregiver-child interactions, and (2) evaluate the degree of association between caregiver-child interactions, antecedent demographic and language factors, and subsequent language skill, including assessing whether PT status moderates the degree of association between caregiver-child interactions and language skills.

In infants and toddlers born FT, features of caregiver interactions impact children's language development. Notably, more frequent caregiver verbal engagement is a positive predictor of individual differences in children's vocabulary development [6–8]. Moreover, interactions that are higher in maternal sensitivity [9] and responsiveness [10] have been associated with faster rates of language development in the toddler period. Child expressive vocabulary has also been positively associated with maternal sensitivity [11]. In contrast, heightened caregiver intrusiveness has been associated with slower receptive

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language development between 18 and 36 months [9] and smaller receptive vocabulary at 3 years [12].

Among children born FT, many factors affect the quality of caregiver interactional behavior. Characteristics of the child influence caregivers' contributions to interactions based on bidirectional effects of parent and child on each other's behavior [13]. Two important factors are child sex and family socioeconomic status (SES). Caregivers exhibit more sensitivity with girls versus boys [14]. Lower SES is associated with more controlling maternal behavior [15].

Caregiver-child interactions in toddlers born PT have been found in some studies to be similar to caregiver-child interactions in toddlers born FT. For example, the amount of caregiver input to children, an index of verbal engagement, was found to be similar in mothers of children born PT and FT [16,17]. A recent meta-analysis found that mothers of children born PT were very similar on measures of sensitivity/responsivity to mothers of children born FT [18]. On the other hand, other studies show that when the interaction between caregiver and child is assessed at the dyad level, PT dyads have been found to demonstrate decreased levels of synchrony [19] and maternal-infant symmetric co-regulation [20], relative to FT dyads. In addition, compared to parents of children born FT, parents of children born PT have been found to exhibit lower levels of support and respect for child's autonomy, a behavior indicative of intrusiveness [21].

Factors influencing caregiver-child interaction seem to be similar in the PT and FT children. For example, in a longitudinal study of caregiver-child interactions, children born PT from families with greater SES risks tended to have caregivers who exhibited higher levels of maternal intrusiveness and insensitivity compared to children born PT from families with lower SES risks [22]. However, differences in interactional qualities may arise because PT children show decreased responsiveness with caregivers [23] and high-risk PT children show less exploration with objects, compared to children born FT [24]. Furthermore, PT boys tend to have worse developmental outcomes in comparison to PT girls [25], suggesting that sex may influence caregiver-child interactions.

Caregiver interactions influence later language development in PT as well as FT toddlers. As in FT children, high maternal responsiveness has been associated with better receptive and expressive language in children born PT at 36 months [26]. Moreover, amount of caregiver speech has been shown to predict child language skills similarly in children born PT and FT [17]. However, no studies to date have examined the moderating role of PT birth on the relation between quality of caregiver-child interactions and language ability.

1.1. The current study

The first aim of this study was to compare caregiver-child interactions in children born PT and FT during a period of rapid language development. Within this overall major aim, we sought to understand the factors associated with quality of caregiver-child interactions in PT toddlers, compared to an age-, gender- and SES-matched group of FT toddlers. Based on the extant literature, we tested the following sets of hypotheses:

1. Compared to caregivers of children born FT, caregivers of children born PT would show similar levels of sensitivity/responsiveness [18] and verbal elaboration [16,17].
2. Compared to caregivers of children born FT, caregivers of children born PT would show greater caregiver intrusiveness [21] and decreased dyad fluidity/connectedness [19].
3. PT vs. FT group membership would not moderate the associations between socioeconomic status (SES), sex, and child interactional behavior on a composite of caregiver interactional behaviors [13–15,22–25].

The second major aim was to determine the patterns of association between qualities of caregiver interaction and subsequent language

development. Within this aim, we tested whether PT status moderated the pattern of association between caregiver behaviors and child language outcomes. Based on the extant literature, we tested the following sets of hypotheses:

4. Caregiver interactional behavior would be associated with later receptive language development in PT and FT children, even after consideration of factors known to impact language development [9,12].
5. PT vs. FT group membership would not moderate the association between a composite of caregiver behaviors and child language outcomes [17].

2. Method

2.1. Participants

Children in this sample were drawn from a larger longitudinal study investigating language development in monolingual toddlers born FT and PT. Children in the FT cohort were recruited from state birth records and surrounding communities. Children in the PT cohort were recruited from the outpatient high-risk infant follow-up clinic at a major hospital, local parent groups, and surrounding communities. Inclusion criteria for the FT cohort were gestational age ≥ 37 weeks and a birth weight of ≥ 2495 g. Inclusion criteria for the PT cohort were gestational age ≤ 32 weeks and a birth weight $< 1,800$ g. Exclusion criteria for both groups were exposure to a non-English language $\geq 25\%$ of waking hours and the presence of medical conditions that might preclude participation in the study's activities. The university's Institutional Review Board approved the study's protocol, and parents provided written informed consent at the beginning of the study.

We enrolled a total of 67 FT children born between 2011 and 2013 and 97 PT children born between 2008 and 2013. We individually matched FT to PT participants to ensure that group comparisons were not the result of differences that might affect caregiver-child interactions: age corrected for the degree of prematurity, sex [14], and socioeconomic status [22]. SES was assessed using the Hollingshead Four-Factor Index [27]. After careful matching of FT and PT participants on the aforementioned criteria, we arrived at 59 unique pairs of participants. Of the 59 pairs, 39 pairs of children ($N = 78$) had complete data from 16 to 22 months of age at the time of analysis and are reported on here. Of the 78 children included, 74 children completed the measures at the 36-month time point.

2.2. Study design

Children completed the study's assessments at three age points: 18 months and 22 months (corrected for degree of prematurity in the PT group; chronological age 20 and 24 months, respectively) and 36 months (chronological age for both groups). The age of participants in the PT group was not corrected for degree of prematurity at 36 months in keeping with the standard clinical practice of correcting for degree of prematurity only up to 24 months.

At 22 months, children participated in a 15-minute play session with their caregiver in the research laboratory. 22 months was the age selected for the play session because we wanted it to be in the middle of a very dynamic period of child language development [28]. Caregivers in the sample were predominantly mothers (85.9%), though also included fathers, grandmothers, and a nanny. The proportion of mothers was similar in the PT and FT groups (84.6% and 87.2%, respectively). Each dyad was provided with one of two sets of toys. The experimenter instructed the caregiver to "play as you would at home". Each session was video-recorded and coded offline. In preparation for coding, each video was trimmed to a 10-minute continuous segment, typically beginning when the experimenter had left the room with portions deleted if the parent and/or child were not captured by the camera.

2.3. Measures

2.3.1. SES

SES was measured using the Hollingshead Index (HI) [27], which takes into account the parents' education and occupation (range: 8 to 66). We used the prescribed scoring methods when the parent in one-parent families and both parents in two-parent families were working. We modified the scoring if one parent in a two-parent family was not employed; in that case, we averaged both parents' education scores and used the working parent's occupation score.

2.3.2. Caregiver–child interaction

We used scales from two sources: (1) a study of a subset of participants in the Eunice Kennedy Shriver National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD) [29], which drew upon a coding scheme by Adamson and Bakeman [30], and (2) the 24-Month Child-Parent Interaction Rating Scales for the Three-Bag Assessment [31], which were derived from coding scales utilized in the Eunice Kennedy Shriver NICHD SECCYD [32] and the Newark Observational Study of Teenage Parent Demonstration [33,34]. One scale, Caregiver Verbal Elaboration on Topics, was developed within our research group. Each of the 6 scales was coded on a 7-point Likert scale. Higher scores reflected the more desirable pole of the construct. (We reversed the direction of the original Caregiver Intrusiveness scale so that 1 = most intrusive and 7 = least intrusive. This decision was necessary for creation of a composite score in which higher scores indicate favorable behaviors on all scales). On the basis of a preliminary analysis of videos not included in this study, we added behavioral specificities for each construct to increase inter-observer reliability. The scoring criteria of all scales are included as supplementary material.

The scales were as follows: (1) Caregiver Sensitivity/Responsiveness: The level at which the caregiver was attentive to the needs, affect, level of arousal, and capabilities of the child. Sensitive and responsive caregivers pick up on the cues of the child and adapt their behavior based on those cues, modulating their response depending on if the child is, for example, crying vs. bored vs. content. (2) Caregiver Verbal Elaboration on Topics: The quantity and sophistication of verbal statements the caregiver made to the child to engage and sustain the interaction concerning a shared topic or activity. (3) Caregiver Intrusiveness: The degree to which the caregiver allowed the child autonomy versus exerted control over the child. (4) Child Engagement of Caregiver: The child's degree of interaction with and positive affect towards the caregiver. (5) Child's Sustained Attention with Objects: The degree to which the child engaged in focused and elaborative play for the duration of the interaction. (6) Dyad Fluidity/Connectedness of Communication: The degree to which both the caregiver and child interacted and communicated about a shared goal and task.

To capture caregiver and child behaviors globally, we created two composite scores. Following the methods used in the NICHD network [35], the Caregiver Interaction Composite was a sum of the Caregiver Sensitivity/Responsiveness, Caregiver Verbal Elaboration on Topics, and Caregiver Intrusiveness scales. The Child Interaction Composite was a sum of the Child Engagement with Caregiver and Child's Sustained Attention with Objects scales.

Primary coding of the videos was conducted by a trained research assistant naïve to the study's design, hypotheses, and participants' FT-PT group membership. Another research assistant with knowledge of the children's FT-PT group membership completed secondary coding of the videos to assess inter-rater reliability. The absolute agreement intra-class correlations between the coders' scores ranged from 0.79 to 0.88. The two coders agreed within 1 point on 92.7% of all ratings. In these cases, the primary coder's scores were used for analyses. The two coders disagreed by 2 or more points on 7.26% of ratings across all scales. In these cases, the two coders re-watched the video together and came to consensus on the final score. 55.9% of these final scores were in

between the two original scores, 29.4% of these final scores matched the primary coder's original score, 11.8% of these final scores matched the secondary coder's original score, and 2.9% of the new scores were outside of the range of the original scores.

2.3.3. Language development

At 18 months (corrected age for the PT cohort), trained examiners administered the Bayley Scales of Infant and Toddler Development-Third Edition (BSID-III) [36]. In this study, we used data from the Receptive Communication Subtest because the outcome measure at 36 months of age evaluated receptive language skills. This scale assessed children on their ability to identify named objects, point at named pictures, and follow directions.

At 36 months (chronological age for all children), participants completed the Peabody Picture Vocabulary Test-Fourth Edition (PPVT-IV) [37]. In this test of receptive vocabulary, the child was asked to select the picture (of four options) named by the experimenter. Four participants (2 participants from each group) were excluded from analyses of the PPVT-IV because they did not complete the measure, either because they had moved or because their family was unable to come in for a visit.

2.4. Statistical analyses

We first present descriptive statistics on the individual scales and composite scores, and inter-correlations among the scale scores. To address Hypotheses 1 and 2, the six caregiver-child play interaction scales were assessed for birth group differences using multivariate analysis of variance (MANOVA). A discriminant function analysis was conducted afterwards to ascertain the respective contributions of each scale to the outcome of the MANOVA. We also examined the Caregiver Interaction Composite and the Child Interaction Composite in terms of birth group (FT vs. PT) differences using MANOVA. To address Hypothesis 3, multiple regression models were conducted to predict the quality of the Caregiver Interaction Composite. Measures of demographics (sex, SES, and PT vs. FT group membership), antecedent child receptive language skill (the BSID-III Receptive Communication Subtest at 18 months), and the Child Interaction Composite were included in the models as covariates. To address Hypothesis 4, multiple regression models were conducted to predict later child receptive vocabulary at 36 months. In these models, the Caregiver Interaction Composite served as an additional covariate. Both sets of regression analyses also explored whether group membership moderated relations. Power analyses conducted using G*Power [38] indicated that our sample size provided 0.70 power to detect moderation effects. The significance level was set a priori at $p < 0.05$ for all analyses. We repeated analyses restricting the sample to participants who interacted with their mothers. The results remained largely the same.

3. Results

Table 1 documents the success of the matching procedures and the gestational age and birthweight of the participants. Each group was 56.4% male. The PT group was 53.8% White, 17.9% Asian, 10.3% American Indian or Alaska Native, 5.1% Black or African American, and 12.8% more than one race. The FT group was 69.2% White, 5.1% Asian, and 25.6% more than one race. The PT group was 15.4% Hispanic or Latino, and the FT group was 5.1% Hispanic or Latino. Across both groups, family SES was relatively high (PT $M = 58.2$; FT $M = 59.7$). Within the PT cohort, the following proportions of participants had complications of preterm delivery: 15.4% were small for gestational age, 79.5% had respiratory distress syndrome, 25.6% had chronic lung disease, 23.1% had patent ductus arteriosus, 12.8% had necrotizing enterocolitis, and 28.2% had retinopathy of prematurity. In terms of neurological status, 15.4% had grades 1–2 intraventricular hemorrhage, 2.6% had grade 4 intraventricular hemorrhage, and 2.6% had

Table 1
Demographic characteristics of the preterm and full term cohorts.

Characteristic	Preterm (n = 39)		Full term (n = 39)		t or χ^2	p
	% or Mean (SD)	Range	% or Mean (SD)	Range		
% Male	56.4	–	56.4	–	0.0	1.00
% White	53.8	–	69.2	–	2.0	0.16
% Non-White	46.2	–	30.8	–		
% Asian	17.9	–	5.1	–	–	–
% American Indian or Alaska Native	10.3	–	0.0	–	–	–
% Black or African American	5.1	–	0.0	–	–	–
% More than one race	12.8	–	25.6	–	–	–
% Hispanic or Latino	15.4	–	5.1	–	–	0.263
Maternal education	16.6 (1.6)	13.0–18.0	16.7 (1.4)	12.0–18.0	– 0.3	0.76
SES (Hollingshead index) ^a	58.2 (8.5)	30.0–66.0	59.7 (8.5)	22.0–66.0	– 0.8	0.43
Mean gestational age (weeks)	29.7 (1.9)	25.3–32.9	40.0 (1.0)	37.6–42.0	– 29.7	< 0.001***
Mean birth weight (grams)	1263 (308)	670.0–1755.0	3522 (462)	2722–4649	– 25.4	< 0.001***
% Mother–child dyads	84.6	–	87.2	–	0.1	0.745
% Other caregiver–child dyads	15.4	–	12.8	–		

Bolded text signifies statistical significance.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

^a Hollingshead Four Factor Index of Socioeconomic Status (HI).

periventricular leukomalacia. While many of the participants in the PT group experienced a complication of preterm birth, one child (2.6%) had a major neurological complication (i.e., periventricular leukomalacia). We repeated analyses with children who had grade 4 intraventricular hemorrhage or PVL eliminated and the results largely did not change.

At 18 months, the mean corrected age for the PT group was 18.59 months ($SD = 0.52$; chronological age $M = 20.96$ months, $SD = 0.55$) and the mean age for the FT group was 18.71 months ($SD = 0.47$). At 22 months, the mean corrected age for the PT group was 22.17 months ($SD = 0.67$; chronological age $M = 24.53$ months, $SD = 0.54$) and the mean age for the FT group was 22.24 months ($SD = 0.71$). At 36 months, the mean chronological age for the PT group was 36.27 months ($SD = 0.55$) and the mean age for the FT group was 36.38 months ($SD = 0.62$).

Table 2 shows the mean and range of scores for the six caregiver-child dimensions in each group and Table 3 shows the zero-order correlations among all of the measures. To assess group differences on the individual scales, a MANOVA with Pillai's trace revealed a significant group difference, $F(6, 71) = 2.24$, $p = 0.049$ on the linear component derived from all six caregiver-child interaction scales. A post hoc discriminant function analysis yielded a single function, canonical $R^2 = 0.16$. The function provided further support for a significant group difference in the quality of interactions overall, $\Lambda = 0.84$, $\chi^2(6) = 12.67$, $p = 0.049$. Caregiver Intrusiveness was most highly correlated with the single function ($r = 0.61$) indicating that it provided the greatest contribution to the difference observed between the groups. In alignment with Hypotheses 1, the results of the MANOVA indicated no group difference on Caregiver Sensitivity/Responsiveness and Verbal Elaboration. In alignment with Hypothesis 2, we found a significant group difference on the scale of Caregiver Intrusiveness. However, we did not find a group difference on Dyad Fluidity/Connectedness. No significant group differences were detected on any of the other caregiver-child interaction scales.

To assess group differences on the composite scores, a MANOVA with Pillai's trace was again conducted. As shown in Table 2, the analyses revealed no significant birth group difference, $F(2, 75) = 0.73$, $p > 0.05$ on the linear component of the Caregiver Interaction Composite and Child Interaction Composite.

To address Hypothesis 3, Table 4 includes models of factors that predicted the Caregiver Interaction Composite. In Model 1, sex, and SES

Table 2

Preterm and full term cohort comparison of the caregiver-child play interaction scales.

Scale	Preterm (n = 39)		Full term (n = 39)	
	M (SD)	Range	M (SD)	Range
Caregiver				
Sensitivity/responsiveness	5.23 (1.18)	2.00–7.00	5.41 (1.35)	2.00–7.00
Verbal elaboration	4.90 (1.02)	3.00–7.00	4.87 (1.28)	1.00–7.00
Intrusiveness	5.05 (1.08)^a	2.00–7.00	5.59 (0.99)^a	3.00–7.00
Child				
Engagement of caregiver	4.85 (1.07)	3.00–7.00	5.00 (1.43)	1.00–7.00
Sustained attention with objects	5.41 (0.91)	3.00–7.00	5.69 (0.86)	2.00–7.00
Dyad				
Fluidity/connectedness	4.97 (1.14)	3.00–7.00	4.92 (1.44)	1.00–7.00
Composites				
Caregiver interaction composite	15.00	8.00–20.00	16.00	9.00–21.00
Child interaction composite	11.00	6.00–13.00	11.00	5.00–14.00

Bolded text signifies statistical significance.

^a A discriminant function analysis indicated this scale provided the greatest contribution to the group difference in interaction.

were each significantly associated with the Caregiver Interaction Composite, and the entire model significantly accounted for over 17% of the total variance in outcome, $F(3, 74) = 5.14$, $p < 0.01$. In Model 2, score on the Receptive Communication Subtest of the BSID-III was added as a predictor, but it contributed a non-significant additional 0.7% of variance to the overall model. In Model 3, the Child Interaction Composite was added as a predictor, and it significantly accounted for an additional 19.4% of variance, $p < 0.001$. A moderation of group was tested in Model 4, but the interaction term did not achieve statistical significance, $p > 0.05$. In this final model, the Child Interaction Composite remained as the only significant predictor, with the complete model accounting for nearly 40% of the overall variance, $F(6, 71) = 5.57$, $p < 0.001$. Thus, in both the PT and FT groups, children who demonstrated higher levels of engagement with their caregivers and sustained attention with objects had parents who demonstrated higher

Table 3
Zero-order correlations among all measures.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Dyad fluidity/connectedness	1							
2. Caregiver sensitivity/responsiveness	0.78***	1						
3. Caregiver verbal elaboration	0.71***	0.54***	1					
4. Caregiver intrusiveness	0.48***	0.71***	0.21	1				
5. Child engagement of caregiver	0.86***	0.70***	0.57***	0.37**	1			
6. Child sustained attention with objects	0.32**	0.16	0.23*	0.14	0.35**	1		
7. Bayley scales of Infant and toddler development receptive communication	0.26*	0.19	0.19	0.20	0.18	0.32**	1	
8. Peabody picture vocabulary test	0.29*	0.29*	0.27*	0.40***	0.16	0.28*	0.59***	1

Bolded text signifies statistical significance.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 4
Multiple linear regression models predicting to the caregiver interaction composite with demographic variables and the child interaction composite (N = 78).

	Model 1	Model 2	Model 3	Model 4
Sex	1.56 (0.60)*	1.46 (0.62)*	0.48 (0.58)	0.54 (0.58)
SES ^a	0.09 (0.04)*	0.08 (0.04)*	0.05 (0.03)	0.05 (0.03)
Preterm vs. full term	− 0.55 (0.60)	− 0.47 (0.61)	− 0.25 (0.54)	4.18 (3.21)
BSID-III ^b	−	0.06 (0.08)	0.02 (0.07)	0.02 (0.07)
Child interaction composite	−	−	0.81 (0.17)***	0.98 (0.21)***
Preterm vs. full term* Child interaction composite	−	−	−	− 0.42 (0.30)
r ² change	−	0.7%	19.4%***	1.7%
Total R ²	17.2%**	17.9%**	37.3%***	39.0%***

Bolded text signifies statistical significance.

Unstandardized B (SE).

^a Hollingshead Four Factor Index of Socioeconomic Status (HI).

^b Receptive Communication Subtest of the Bayley Scales of Infant and Toddler Development.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

levels of sensitivity/responsiveness and verbal elaboration, as well as lower levels of intrusiveness.

To address Hypothesis 4, Table 5 displays the results of multiple regression models used to explore the predictive relation between caregiver interactional behavior at 22 months and child receptive vocabulary at 36 months. The predictive value of sex, SES, and PT vs. FT group membership were evaluated first in Model 5. SES and group membership were each significant predictors of 36-month scores on the PPVT-IV, with the model accounting for over 25% of the overall variance, $F(3, 70) = 7.81$, $p < 0.001$. In Model 6, earlier performance on an assessment of receptive language (the BSID-III) was added to this set of predictors. In this model, SES, group membership, and the BSID-III emerged as significant predictors, accounting for nearly 44% of the overall variance, $p < 0.001$. In Model 7, the Child Interaction Composite was included as a predictor, but it did not account for any unique variance, $p > 0.05$. Group membership and the BSID-III continued to significantly contribute unique variance, and the overall variance accounted for remained unchanged, $p < 0.001$. In Model 8, the Caregiver Interaction Composite significantly added 5% additional variance, while group membership and the BSID-III were also significant predictors, and the entire model accounted for almost 49% of the total variance, $p < 0.001$. FT birth, stronger early receptive communication skills and higher ratings of caregiver interactional behaviors (including less intrusive behavior from the adult) were linked to a larger receptive

vocabulary at 36 months. In the final model, Model 9, a moderation effect of group was tested. The complete model accounted for nearly 49% of the variance in outcome, $F(7, 66) = 8.97$, $p < 0.001$. The interaction term was not significant, $p > 0.05$, suggesting a similar pattern of relations between caregiver interactional behavior and later receptive vocabulary in the PT and FT groups. Fig. 1, generated by the PROCESS macro for SPSS [39], depicts the parallel relation between the Caregiver Interaction Composite and performance on the PPVT-IV in PT and FT groups, covarying for the other predictors.

4. Discussion

4.1. General summary

This study assessed the quality of caregiver-child play interactions in a sample of individually-matched and relatively high-SES PT and FT toddlers at age 22 months. We confirmed Hypothesis 1; the PT and FT groups did not differ in caregiver sensitivity or verbal elaboration. We partially confirmed Hypothesis 2; caregivers of children born PT were more intrusive than caregivers of children born FT, on average, however, we did not find a group difference in dyadic fluidity/connectedness. PT-FT group membership did not contribute to variation in scores on the Caregiver Interaction Composite, but concurrent child interactional behavior was associated with caregiver interactional behavior in both groups. Consistent with Hypothesis 4, group membership, receptive language at 18 months and the composite of caregiver interactional behavior at 22 months were each unique predictors of receptive language at 36 months. These findings indicate that children who had been born FT, had performed better on the test of receptive language at 18 months and whose parents engaged in a sensitive, responsive, verbally elaborative, non-intrusive manner at 22 months achieved higher scores on the evaluation of receptive language skill at 36 months. Consistent with Hypothesis 5, PT-FT group membership did not moderate the relation between caregiver behavior and later receptive vocabulary.

Several features of this study make it distinctive. First, all children born PT were carefully and individually matched to a participant born FT on the basis of SES, sex, and the PT child's corrected and chronological ages at visit. Thus, any group differences would be unlikely to be attributable to those variables. Second, although children in this sample came from a range of SES backgrounds, the sample was predominantly of high SES. Prematurity occurs more frequently in families of low SES backgrounds [40], but low SES is associated with negative caregiver-child interactions [22]. The sample allowed us to identify associations with prematurity as separate from SES. Third, caregiver-child interactions were evaluated using multiple measures of the dyad, the caregiver, and the child. This design feature permitted an investigation of bidirectional effects on the variables of interest. Children and their parents exert a symbiotic influence on each other, such as been posited in Sameroff's Transactional Model of Development [13].

Table 5

Multiple regression models predicting to the Peabody Picture Vocabulary Test-IV with demographic variables, the Bayley Scales of Infant and Toddler Development-III (BSID-III) Receptive Communication Subtest, the Caregiver Interaction Composite, and the Child Interaction Composite (n = 74).

	Model 5	Model 6	Model 7	Model 8	Model 9
Sex	4.21 (3.96)	0.23 (3.56)	− 0.10 (3.89)	− 0.75 (3.75)	− 0.89 (3.80)
SES ^a	0.86 (0.25)**	0.49 (0.23)*	0.47 (0.25)	0.42 (0.24)	0.42 (0.24)
Preterm vs. full term	− 12.17 (3.95)**	− 8.99 (3.51)*	− 8.89 (3.56)*	− 8.45 (3.43)*	− 13.87 (19.20)
BSID-III ^b	–	2.23 (0.47)***	2.22 (0.47)***	2.17 (0.45)***	2.18 (0.46)***
Child interaction composite	–	–	0.25 (1.13)	− 1.34 (1.25)	− 1.26 (1.29)
Caregiver interaction composite	–	–	–	1.88 (0.74)*	1.69 (0.99)
Preterm vs. full term ^c	–	–	–	–	0.35 (1.22)
Caregiver interaction composite	–	–	–	–	–
r ² change	–	18.6%***	0.0%	5.0%*	0.1%
Total R ²	25.1%***	43.7%***	43.7%***	48.7%***	48.8%***

Bolded text signifies statistical significance.

Unstandardized B (SE).

^a Hollingshead Four Factor Index of Socioeconomic Status (HI).

^b Receptive Communication Subtest of the Bayley Scales of Infant and Toddler Development.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

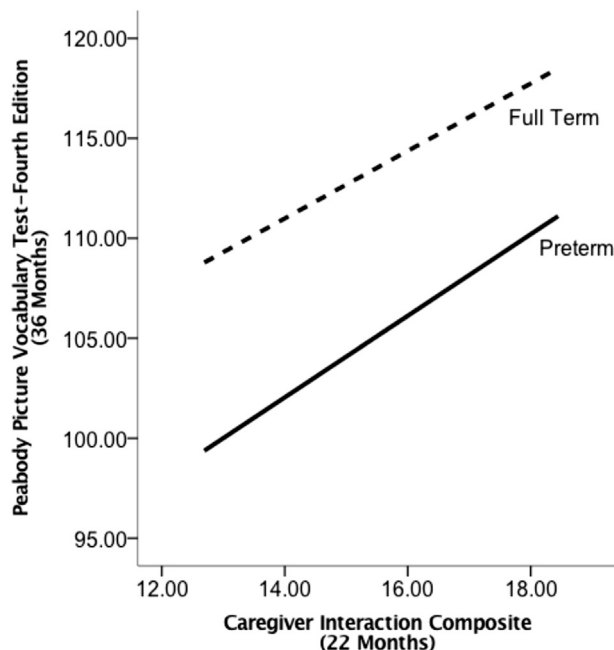


Fig. 1. Relation between the Caregiver Interaction Composite at 22 months and performance on the Peabody Picture Vocabulary Test-Fourth Edition at 36 months in preterm and full term toddlers, covarying for SES, sex, earlier performance on the Receptive Communication Subtest of the BSID-III, and the Child Interaction Composite.

We therefore compared the effects of various precursor demographic and child receptive language measures on the quality of caregiver-child interactions. We also considered the effect of caregiver-child interaction quality in relation to a later measure of child receptive vocabulary.

4.2. Group differences in caregiver-child interaction quality

Parents in both the PT and FT groups were generally soft-spoken, gentle, and attentive to their children. As hypothesized based on the extant literature [16–18], we did not find PT-FT differences in Caregiver Sensitivity/Responsiveness or in Caregiver Verbal Elaboration. This may be because this study was conducted with families of mostly the same socioeconomic stratum. The only scale on which we found PT-FT group differences was Caregiver Intrusiveness. It is important to note that even on this dimension, parents generally did not display aggression, hostility, or negativity; rather, they demonstrated subtle signs of

control over their child's play. This finding is at odds with the conclusion of a review of 15 studies, which reported that maternal intrusiveness was not a salient characteristic of interactions between children born PT and their caregivers [41]. Differences here may relate to the nature of the scales rather than the parents. It is notable that even within a largely homogenous, high-SES sample, we were able to detect a group difference on Caregiver Intrusiveness. Interestingly, we did not find PT-FT group differences in Dyad Fluidity/Connectedness. This finding might be because we also did not find significant PT-FT group differences on the scales measuring child interaction qualities (i.e., Child Engagement of Caregiver and Child Sustained Attention with Objects). We also did not detect significant differences on the Caregiver or Child Interaction composite scores.

4.3. Predictors of the caregiver interaction composite at 22 months

The longitudinal design of the study allowed for examination of factors that contributed to the quality of caregiver interactional behavior. We found that concurrent child interactional behavior was associated with the quality of caregiver interactional behavior, over and above demographic factors (sex and SES), birth group membership (PT vs. FT), and earlier child performance on an assessment of receptive language. However, birth group status did not moderate the strength of this association. We should note that a test of moderation that used birth weight and gestational age as proxies for birth group status also suggested parallel relations in the PT and FT children. This suggests that child behavior within the context of play is related to caregiver behavior, regardless of whether or not the child experienced preterm birth. Previous research has highlighted the importance of child behavior for parent behavior. For example, child responsiveness has been found to be positively associated with maternal supportive behavior [42]. Sex and SES were not associated with ratings on the Caregiver Interaction Composite after consideration of child behavior. In previous research, male toddlers born PT have been found to experience greater risk of adverse neurodevelopmental functioning compared to female toddlers born PT [25]. These findings have been attributed to biological factors, such as pro-inflammatory forces and placental lesions [43]. It is possible that sex and SES exert an influence over child play behavior, accounting for the lack of significance of these demographic variables after child play behavior had been taken into account.

In both groups, antecedent child language ability was not associated with adult interactional behavior during the caregiver-child play interaction. There are several possible explanations for the lack of a significant association with earlier child language ability. First, the

measures of the interaction may capture features of the caregiver-child relationship that are independent of the child neurodevelopmental status, as indexed by language measures. Second, the specific language measures may be insensitive to the kinds of differences that contribute to social behaviors in a play session. Third, in this small, relatively high-SES sample, we may not have sampled the full range of possible levels of caregiver behavior. Moreover, it may be that child language outcomes are most strongly linked to caregiver behavior in samples which reflect a higher incidence of scores at the extremes.

4.4. Predictors of child receptive vocabulary at 36 months

The longitudinal design also allowed us to consider predictors of the child's receptive vocabulary approximately one year after the play interaction. The most important finding was that the Caregiver Interaction Composite was a predictor of later vocabulary skill after consideration of several factors that also predicted outcomes, including PT vs. FT group membership and the child's earlier receptive language skills. Again, here, birth group status did not moderate the strength of this association. Post hoc analyses using birth weight and gestational age as proxies for birth group showed similar patterns. Among the PT and FT toddlers in this study, results revealed that more positive caregiver behavior was associated with a larger receptive vocabulary at an older age, over and above earlier child language ability, echoing the findings of previous research [12,9]. The current study contributes to the extant literature by demonstrating that the association between caregiver behavior and language difficulty can be documented even earlier in development. On the other hand, previous research on toddlers born PT has found that caregiver behavior, specifically intrusiveness, does not lead to adverse outcomes in cognition or attention [44]. These conflicting findings warrant further inquiry to elucidate the effect of parenting on child competency in the aforementioned developmental domains. Further, the child's early receptive language ability was related to later receptive vocabulary, whereas early receptive language ability was not related to caregiver interactional behavior. While the regression model that included sex, SES, PT vs. FT group membership, and child performance on a measure of receptive language at 18 months accounted for the largest amount of variance in receptive vocabulary scores at 36 months (about 44%), caregiver interactional behavior still contributed an additional 5% of variance over and above these factors. These findings indicate that caregivers who are sensitive/responsive, non-intrusive, and verbally elaborative sustain interactions that support language development.

The Caregiver Interaction composite was comprised of features of caregiver behavior that pertain to the degree to which the caregiver allows the child, rather than the caregiver, to lead the interaction. Higher scores on the Caregiver composite suggest that the caregiver was aware of the child's interests and valued the child's position as an active and independent agent in the interaction. The caregiver acted on signals from the child and provided the child with the freedom to explore, which may serve to enhance language learning. This type of enrichment appears to be important to young children with rapidly developing language sophistication at 22 months, regardless of whether they were born preterm or full term.

4.5. Limitations

The sample was relatively small ($N = 78$), which limited the power associated with the tests of moderation for Hypotheses 3 and 4. Over half of the families in the study were White and the proportion of White and non-Hispanic participants differed modestly between the PT and FT groups. We did not have sufficient numbers of participants to match on racial/ethnic characteristics and the small numbers of specific participants in specific groups precluded using race or ethnicity as a covariate. In addition, most families were of high SES backgrounds. Caregivers in the play sessions were not exclusively mothers. Furthermore, our PT

sample consisted only of children born ≤ 32 weeks and did not include children born PT between the gestational ages of 33 weeks to < 37 weeks. These characteristics of our sample may limit the generalizability of our findings to all PT children. Antecedent factors predicting to the quality of caregiver-child interactions were limited to demographic, language, and child behavior variables. Measures of parent adjustment to having a child born PT or of the home environment might have yielded more robust relations with caregiver interactional behavior. Moreover, the only outcome considered was receptive vocabulary.

5. Conclusion

In this study, caregivers of PT toddlers were similar to caregivers of FT toddlers in sensitivity/responsiveness and verbal elaboration, but different in intrusiveness. The strongest predictor of caregiver interactional quality was the child's interactional quality during the same session. PT-FT group status did not moderate the strength of this association. Caregiver interactional quality predicted performance on an assessment of receptive vocabulary a year later, even controlling for multiple variables, including the child's receptive language skills at a younger age. Again, PT-FT group status did not moderate the strength of this association. These findings suggest that parental behavior is equally influential in shaping the language development of at-risk as typically developing children. Caregivers who are able to provide a verbally enriching environment that supports and encourages a child's sense of autonomy appear to facilitate language development, irrespective of whether a child was born PT or FT.

The results support the view that the nature of caregiver-child interactions has important implications for language learning in PT as well as FT toddlers. Enriching, supportive environments help children build language competence. These findings underscore the importance of providing high quality interactions to children born PT and FT. This knowledge should guide clinicians and teachers who counsel families of young children, including children born PT. Families with or without children at risk for developmental challenges can bolster their child's language development by increasing sensitivity and responsivity, elaborating verbally on what the child is doing, and allowing the child to take the lead in play interactions.

For children at risk for language disorders on the basis of PT birth, the results of this study have the potential to inform intervention efforts in the area of caregiver-child interactions. To the extent that the interactive behaviors of caregivers can be modified, the findings of this study deepen our understanding of the types of interaction that best facilitate the optimal development of language in young children who are either typically developing or who are at risk for language difficulties. Caregiver interactional qualities, specifically sensitivity/responsiveness, verbal elaboration, and intrusiveness may be targets of intervention. Future research should aim to identify the specific underlying mechanisms that mediate the association between caregiver behavior and receptive language development. Future studies of larger samples should also aim to extend these findings to establish whether observations of caregiver-child interactions could play an important role in determining which families and children are at risk for adverse outcomes in other developmental domains.

Conflict of interest statement

None declared.

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Appendix A. Supplementary Material

Supplementary material for this article can be found online at <https://doi.org/10.1016/j.earlhumdev.2017.10.001>.

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