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ScienceDirect

Behavior Therapy 50 (2019) 544–557

Behavior Therapy

www.elsevier.com/locate/bt

# Infant Language Production and Parenting Skills: A Randomized Controlled Trial

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**The current study examined the indirect effect of the use of behavioral parenting skills following the Infant Behavior Program, a brief, home-based adaptation of the child-directed interaction phase of parent–child interaction therapy, on infant language production. Participants were 60 infants (55% male, mean age 13.47 ± 1.31 months) and their caregivers, who were recruited at a large urban pediatric primary care clinic and were included if their scores exceeded the 75th percentile on a brief screener of early behavior problems. Families were randomly assigned to receive the infant behavior program or standard pediatric primary care. Results demonstrated a significant indirect effect of caregivers' use of positive parenting skills (i.e., praise, reflections, and behavior descriptions) on the relation between group and infant total utterances at the 6-month follow-up, such that infants whose caregivers increased their use of positive parenting skills following the intervention showed greater increases in language production. These findings extend previous research examining parenting skills as a mechanism of change in infant language production, and highlight the potential for an early parenting intervention to target behavior and language simultaneously during a critical period in language development.**

*Keywords:* infancy; parent–child interaction therapy; language production; parenting skills; behavior problems

LANGUAGE ACQUISITION IS A DYNAMIC PROCESS commonly occurring between 18 and 20 months of age (McCoy, 2008), with the greatest acceleration in language learning occurring during the second year of life (McMurray, 2007). During this time, delays in language skills are especially important to identify, as they have been shown to persist well into adulthood (Brownlie et al., 2004) and to be associated with a host of negative social, emotional, and academic outcomes (e.g., internalizing and externalizing behavior problems, aggression, and academic underperformance; Beitchman, Brownlie, & Wilson, 1996; Hindman, Wasik, & Snell, 2016).

The relation between language impairments and behavior problems is undoubtedly a complex one. According to the American Academy of Pediatrics Committee on Children with Disabilities (2001), 12–16% of American children have neurodevelopmental or behavioral disorders, and a majority of these children display language delays. A review of 26 studies reported that 71% of preschool and school-age children diagnosed with an emotional or behavioral disorder also exhibited language deficits, and 57% of children diagnosed with language deficits were also diagnosed with an emotional or behavioral disorder (Benner, Nelson, & Epstein,

This work was supported by the National Institute of Mental Health career development award (K23 MH085659) to Daniel M. Bagner. This work was supported by the National Institute of Child Health and Human Devleopment training award (F31 HD088084) to Nicole E. Lorenzo.

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2002). In longitudinal research, elevated levels of externalizing behavior problems in early childhood are associated with subsequent language problems in kindergarten (Benner et al., 2002; Gremillion & Martel, 2014; Montes, Lotyczewski, Halterman, & Hightower, 2012). Therefore, intervening as early as possible, such as during the transition from infancy to toddlerhood and around the time when challenging behaviors (e.g., tantrums, aggression) are first detectible (Briggs-Gowan, Carter, Skuban, & Horwitz, 2001) and expressive language is first being used (Hawa & Spanoudis, 2014), may help reduce the risk of these associated negative behavioral and language outcomes. Understanding the interplay between language development and comorbid behavior problems is imperative in the development of appropriate interventions. This interplay is particularly true for children from economically disadvantaged and underrepresented racial and ethnic-minority families, as they are at higher risk of experiencing behavior problems (Huaqing Qi & Kaiser, 2003) and poor language development compared to their higher-income peers (Hindman et al., 2016). Furthermore, recent research suggests monolingual and bilingual children differ in their rates of single language development. However, the size of the difference between monolingual and bilingual children has been shown to be a function of the relative amount of exposure to that language (Hoff et al., 2012). Children from low socioeconomic status and language-minority homes (i.e., speak a language other than English) demonstrate lower levels of English-language skill than do children from middle-class, monolingual English-speaking homes (Hoff, 2014). Therefore, it is important to examine interventions shown to promote language development early in life, particularly with bilingual children from economically disadvantaged and underrepresented racial- and ethnic-minority families.

## Impact of Parenting Skills on Behavior Problems and Language Development

Parenting skills are an important component of early childhood behavioral interventions (Chang, Shaw, Dishion, Gardner, & Wilson, 2015). A number of evidence-based treatments for early child disruptive behavior problems, such as parent–child interaction therapy (PCIT; Zisser & Eyberg, 2010), Incredible Years (Webster-Stratton & Reid, 2004), and Triple P–Positive Parenting Program (Sanders, Markie-Dadds, Tully, & Bor, 2000), involve teaching parents how to respond to their child's challenging behaviors by using specific skills (Evans, Owens, & Bunford, 2014; Furlong et al., 2013). Research has found that these parenting skills, such as providing positive attention for appropriate child behaviors and actively ignoring negative child behaviors, are associated with positive changes in disruptive child behaviors, both in early childhood (Hanisch, Hautmann, Plück, Eichelberger, & Döpfner, 2014) and among school-age children (Andrade, Browne, & Naber, 2015).

Similarly, evidence suggests that parenting skills are associated with child language abilities (Tannock, Girolametto, & Siegel, 1992). For example, parental sensitivity, positive regard, and attention are strongly associated with increases in child receptive and expressive language abilities (Barnett, Gustafsson, Deng, Mills-Koonce, & Cox, 2012), whereas frequent use of directive and corrective statements (e.g., commands, criticisms) are associated with delays in children's language abilities (Barnes, Gutfreund, Satterly, & Wells, 1983; Delaney & Kaiser, 2001). In addition, teaching parents to use child-directed speech with their child is an effective component of early childhood speech and language interventions (Chapman, 2000; Hart & Risley, 1995; Wulz, Hall, & Klein, 1983) and has been shown to lead to improvements in child linguistic abilities (Tannock et al., 1992). Notably, teaching parents to use child-directed speech (e.g., providing praise as a form of positive attention) is also an important component of several efficacious interventions for early child disruptive behaviors (Eyberg, Nelson, & Boggs, 2008). However, speech–language and parent training interventions differ in their use of questions. While parent training interventions encourage caregivers to use child-directed speech and avoid directive statements (e.g., questions), the speech–language interventions literature suggest the use of open-ended questions—defined as questions that require more than a one-word response—is positively associated with child vocabulary development (Bond & Wasik, 2009). This is particularly relevant for American infants and their mothers, as studies have shown that American mothers tend to question their infants more than mothers from other cultures as a way of emphasizing the information components of speech (Bornstein et al., 1992). Further research is needed to examine the role of individual parenting skills in promoting language development, and how it may differ across diverse groups.

## Parenting Skills as a Mechanism of Change

Given the relation between parenting skills and both child behavior problems and language abilities, and the overlap in approaches to intervene on early childhood behavior problems and language difficulties, it is possible that the targeted changes in parenting skills may impact both of these outcomes. Although studies have examined the effect of interventions promoting positive parenting styles on either child behavior problems (Eyberg et al., 2008)

*or* language difficulties (Tabor, 2011; Tannock et al., 1992), only one study (Garcia, Bagner, Pruden, & Nichols-Lopez, 2014) has examined parenting skills as a mechanism by which parenting interventions lead to changes in language, despite research documenting the strong association (.78) between positive parenting behaviors in early childhood and subsequent child language growth (Hart & Risley, 1995). In a conceptual paper, Tempel, Wagner, and McNeil (2009) highlight the need for empirical examination of mechanisms by which parent training interventions alter both child language development and behavior by highlighting the important role of parenting skills, as well as the shared components used in both speech–language and parent training interventions (e.g., parallel talk, facilitative play, and child-directed speech style).

To date, one study examined language outcomes following PCIT and found that the frequency and quality of the parent–child interaction played an important role in later language ability among children with and at risk for developmental delay (Garcia et al., 2014). Specifically, the extent to which parents utilized positive skills learned during a behavioral parenting intervention that are common to language and behavioral interventions (Hart & Risley, 1995) had an impact on child word types, such that a higher level of parenting skill use predicted more child word types for families receiving PCIT compared to families in a wait-list control group. These findings suggest that the use of positive parenting skills plays an important role in the growth of child language.

Given the importance of infancy as a critical period for intervention, recent research has demonstrated the impact of the infant behavior program (IBP), a home-based adaptation of the child-directed interaction (CDI) phase of PCIT for high-risk infants and their families on infant behavior and language production (Bagner et al., 2015). "High-risk infant" in this previous work and in the current study is defined as infants from predominantly low-income, ethnic-minority families, who also display elevated levels of behavior problems based on a normative sample. This study demonstrated a direct effect of the intervention on infant language production such that infants who received the intervention demonstrated a significantly higher number of observed different and total utterances at the 6-month follow-up compared to infants in standard care. Furthermore, changes in infant behavior from pre- to postintervention were found to mediate the effect of the intervention on infant language production at the 3- and 6-month follow-ups (Bagner et al., 2015). However, the indirect effect of parenting skills on infant language was not examined, which can have important implications for clinical practice as mechanisms of change in behavioral parent training interventions associated with improvements in infant language remain unclear.

## Current Study

The purpose of the current study was to contribute to the small body of literature examining the effect of behavioral parenting interventions on language production. The transition into the second year of life (i.e., 12–15 months) represents an ideal opportunity to intervene as parents begin to face challenges with their infant's behavior that may become entrenched and potentially impede the infant's ability to respond to caregiver attention and engage in back-and-forth interactions that serve as the foundation for future language development (Tempel et al., 2009). To address gaps in the literature highlighted above, we extended previous findings by conducting secondary analyses of the IBP study to examine caregivers' use of positive attending skills as a mediator for increased language production in infants who received the behavioral parenting intervention.

In an effort to integrate past research examining the direct effect of the IBP on infant behavior and language production (Bagner et al., 2015; Bagner, Garcia, & Hill, 2016), we tested a model that examined the indirect effect of the IBP in which the intervention led to increases in infant language production via increases in caregivers' use of positive attending "do" skills (i.e., behavior descriptions, reflections, and praises). Specifically, we predicted that caregivers in the intervention group would use more positive attending skills compared to the standard care group and, in turn, infants of caregivers using more positive attending skills would display greater gains in language production as measured by the infant's total utterances during infant-directed play at both 3- and 6-month follow-ups. We expected the most language gains would occur at the 6-month follow-up (when infants were between the ages of 18 and 24 months), consistent with previous research on the IBP (Bagner et al., 2016) and research demonstrating a sharp increase in language acquisition during the second year of life (McMurray, 2007).

Although most research to date has focused on the role of positive attending skills on child language production, we also explored the role of negative attending skills on infant language production, which has received far less research attention. We predicted that there would be a significant indirect effect of intervention group on infant language production through mothers' use of negative attending "don't" skills (i.e., questions, commands, and negative talk). Specifically, we predicted that caregivers in the intervention group would use fewer negative

parenting skills compared to the standard care group and, in turn, infants of caregivers using fewer negative attending skills would display greater gains in language production as measured by infants' total utterances during infant-directed play at both 3- and 6-month follow-ups.

## Method

### PARTICIPANTS

Participants were 60 infants (*M* age = 13.47 months, *SD* = 1.31, 55% male) and their primary caregiver (the mother in all cases), who were recruited at a large hospital-based pediatric primary care clinic for underserved families. Research staff approached families with an infant between the ages of 12 and 15 months during well or sick visits and obtained informed consent prior to beginning the screening during the visit (approved by both university and hospital Institutional Review Boards) for families interested in participating in a study examining a brief home-based intervention for young infants with elevated levels of behavior problems. The inclusion criteria for the study were the following: (a) infants who received a score above the 75th percentile on the problem scale of the Brief Infant–Toddler Social and Emotional Assessment (Briggs-Gowan & Carter, 2006); (b) caregivers needed to speak either English or Spanish; and (c) caregivers needed to receive an estimated IQ score of 70 or above on the two-subtest (Vocabulary and Matrix Reasoning) Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1997) for caregivers speaking English, or an average scaled score ≥ 4 (2 standard deviations below the mean) on the Vocabulary and Matrix Reasoning subtests of the Escala de Inteligencia Wechsler Para Adultos—Third Edition (EIWA-III; Pons et al., 2008), the Spanish version of the WASI (Wechsler, 1997), for caregivers speaking Spanish. The exclusion criteria were any major infant sensory impairments (e.g., deafness, blindness) or current child protection services involvement. No families were excluded based on these criteria. Of the 147 parent–infant dyads participating in the screening, 60 families (41%) met inclusion criteria and were randomized (using a computer-generated random numbers list)

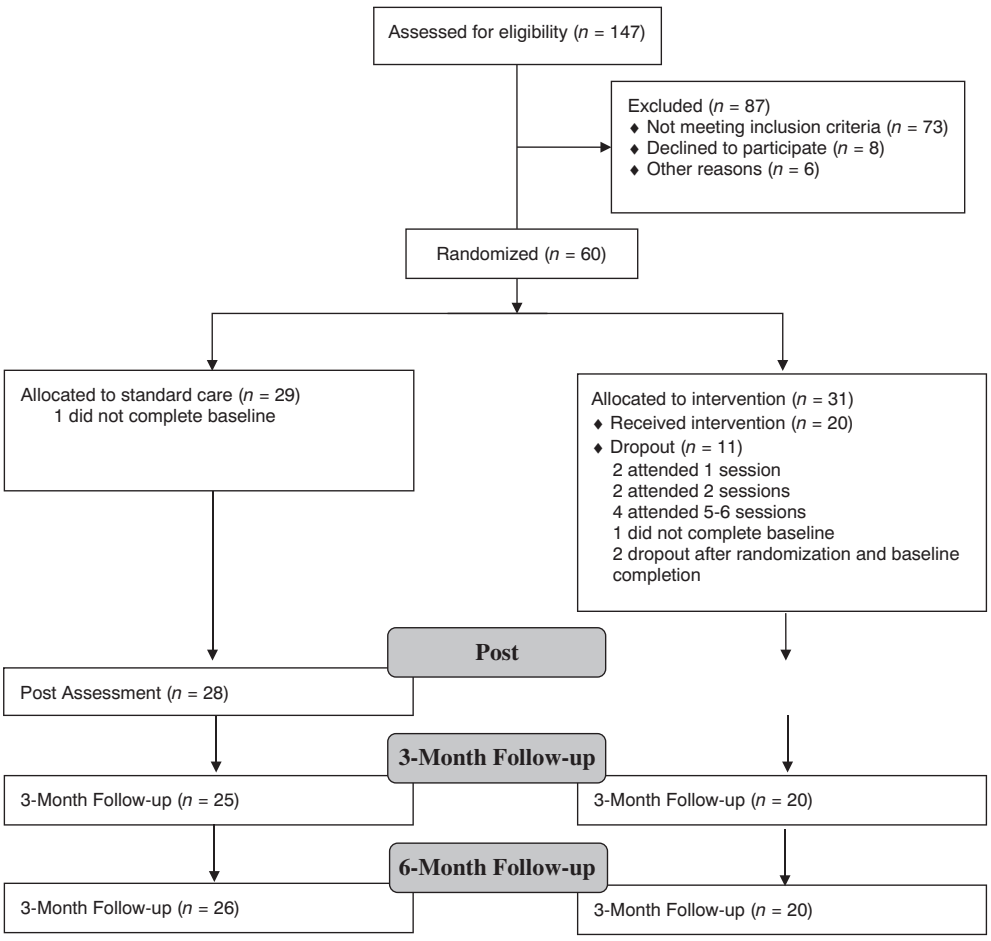


FIGURE 1 Participant flow.

Table 1
Participant Baseline Demographic Variables by Initial Intervention Assignment

| | Total sample ($n$ = 60) | | Intervention group ($n$ = 31) | | Standard care group ($n$ = 29) | | |
|---|---|---|---|---|---|---|---|
| | % | $n$ | % | $n$ | % | $n$ | $p$ |
| Child sex (male) | 55 | 33 | 58 | 18 | 52 | 15 | .622 |
| Child minority status | 98 | 59 | 97 | 30 | 100 | 29 | .697 |
| Mother minority status | 95 | 57 | 94 | 29 | 97 | 28 | .536 |
| Mother English speaking (vs. Spanish) | 43 | 26 | 55 | 17 | 31 | 9 | .074 |
| High school graduate or less | 70 | 42 | 65 | 20 | 76 | 22 | .338 |
| Below poverty line | 60 | 35 | 58 | 18 | 63 | 17 | .704 |
| | Mean | *SD* | Mean | *SD* | Mean | *SD* | $p$ |
| Child age (months) | 13.47 | 1.31 | 13.71 | 1.40 | 13.21 | 1.18 | .138 |
| Mother age (years) | 29.57 | 5.49 | 30.03 | 5.50 | 29.07 | 5.54 | .502 |

*Note.* Two caregivers did not report income, and both were in the standard care group.

to the IBP ($n$ = 31) or standard care group ($n$ = 29), in which infants continued to receive regular well and sick visits at the pediatric primary care clinic (see Figure 1).

All participating infants were accompanied by their mothers ($M$ = 29.57 years, $SD$ = 5.49), most of whom identified themselves (90%) and their infant (93%) as Hispanic and reported incomes below the poverty line (60%). Demographic characteristics for study participants are presented in Table 1, and descriptive statistics for the study variables are presented in Table 2. Families in the intervention group did not differ on any demographic or baseline variables from families in the standard care group. Following the screening, all but two families completed a baseline assessment in their home ($n$ = 58), where they were informed of their group status. The two families that did not complete the baseline could not be reached to schedule the baseline assessment. Two months after the baseline, assessors masked to group status conducted a postintervention assessment (85% retention), as well as follow-up assessments 3 and 6 months after the postintervention assessment (77% retention). The overall dropout rate for the study was 29%. Families were compensated $50 for their participation in each assessment.

## MEASURES

In addition to screening/descriptive measures, measures were grouped into two domains according to their primary purpose: parenting skills and infant language. All measures used in this study

Table 2
Means and Standard Deviations of, and Correlations Between, Model Variables

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Intervention group mean (*SD*) | Standard care group mean (*SD*) | $t$ | $p$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Group | – | | | | | | | | | | – | – | – | – |
| 2. Positive parenting skills T1 | .04 | – | | | | | | | | | 4.35 (4.10) | 4.02 (3.85) | 0.32 | .75 |
| 3. Positive parenting skills T2 | .54*** | .10 | – | | | | | | | | 12.46 (9.51) | 3.35 (3.54) | 4.90 | <.001 |
| 4. Negative parenting skills T1 | .05 | .46*** | .10 | – | | | | | | | 24.83 (19.00) | 23.02 (21.26) | 0.34 | .73 |
| 5. Negative parenting skills T2 | -.29* | .13 | -.09 | .50*** | – | | | | | | 10.09 (9.06) | 18.31 (17.30) | -2.24 | .03 |
| 6. Total utterances T1 | -.20 | .14 | .05 | .13 | .18 | – | | | | | 27.24 (17.49) | 36.54 (28.75) | -1.50 | .14 |
| 7. Total utterances T2 | -.04 | .37* | .05 | .36* | .26 | .36* | – | | | | 32.20 (35.33) | 34.71 (34.63) | .25 | .98 |
| 8. Total utterances T3 | .00 | .02 | .17 | .04 | .10 | .33* | .41** | – | | | 47.20 (47.53) | 47.23 (41.30) | -0.00 | 1.00 |
| 9. Total utterances T4 | .29* | .27* | .43** | .39** | .15 | .46** | .33* | .37** | – | | 119.86 (60.18) | 82.44 (66.60) | 2.25 | .03 |
| 10. Child age | .20 | .14 | .04 | -.05 | -.21 | -.03 | .15 | .16 | .13 | – | 13.77 (1.38) | 13.25 (1.18) | 1.53 | .13 |

*Note.* T1 = Time 1; T2 = Time 2; T4 = Time 4.
*$p$ < .05, **$p$ < .01, ***$p$ < .001.

have adequate reliability and validity in both English and Spanish. Assessments were conducted in the language in which the mother indicated she felt most comfortable (57% of assessments conducted in Spanish).

*Screening/Descriptive Measures*

The Brief Infant–Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2006) is a 42-item parent-report questionnaire used to screen for social-emotional and behavioral problems in 12- to 36-month-olds. Infants with scores at or above the 75th percentile on the BITSEA Problem scale were included in the study. The BITSEA has demonstrated excellent test–retest reliability and discriminate validity (Briggs-Gowan, Carter, Irwin, Wachtel, & Cicchetti, 2004; Karabekiroglu, Briggs-Gowan, Carter, Rodopman-Arman, & Akbas, 2010). Additionally, the BITSEA has been demonstrated to be reliable and valid in a predominantly low-income, Hispanic sample (Hungerford, Garcia, & Bagner, 2015).

The WASI (Wechsler, 1999) and the EIWA-III (Wechsler, 2008) are brief measures of intelligence. Consistent with previous PCIT research (McNeil & Hembree-Kigin, 2010) and to ensure the ability of the parent to learn the skills, two subtests from the WASI (i.e., Vocabulary and Matrix Reasoning) were used to yield a Full Scale IQ (FSIQ-2). A FSIQ-2 score $\geq 70$ was used as a cutoff for the current study. For Spanish-speaking caregivers, the same two subtests of the EIWA were administered, and an average scaled score $\geq 4$ (2 standard deviations below the mean) was used as a cutoff. The WASI and EIWA have demonstrated adequate reliability and good concurrent validity (Pons et al., 2008; Wechsler, 1999).

*Measure of Parenting Skill*

The Dyadic Parent–Child Interaction Coding System (DPICS III; Eyberg, Nelson, Bhuiyan, & Boggs, 2013) is a behavioral coding system that measures the quality of parent–child interactions, and has been used with infants with adequate reliability (Bagner et al., 2015; Bagner, Rodríguez, Blake, & Rosa-Olivares, 2013). This measure was used to code videotaped parent and infant behaviors across assessment time points by recording the frequency of their occurrence in order to examine changes in parenting skills. For the current study, a 5-min infant-directed play situation was observed across all four time points. Based on previous work (Bagner, Sheinkopf, Vohr, & Lester, 2010; Garcia et al., 2014; Graziano et al., 2015; Kimonis & Armstrong, 2012; McCabe & Yeh, 2009), two composite categories of do (i.e., behavior descriptions, reflections, and praises) and don't (i.e., questions, commands, and negative talk) skills were created to reflect positive and negative attending skills, respectively.

*Measure of Child Language Production*

The Child Language Data Exchange System (CHILDES; MacWhinney, 2000) is one of the most widely used and psychometrically valid tools to examine child language (Corrigan, 2011) and consists of three sections: (a) database of language transcripts, (b) codes for human analysis of transcripts (CHAT), and (c) computerized language analysis (CLAN). The CHAT program provides a standardized way of creating language transcripts, while the CLAN program allows users to analyze the language transcripts (Parker & Brorson, 2005). Infants' use of language was assessed using CLAN at each of the four assessments. For the current study, the number of total and different utterances spoken were calculated for each infant at each observation. Total utterances is a measure of overall utterances produced (including both words and word approximations) and was calculated by adding the total number of actual utterances the infant used during the 5-minute play. Different words is a measure of lexical diversity that refers to the number of "unique" words used and was calculated by adding the number of unique words used.

## STUDY DESIGN AND PROCEDURE

This study was part of a randomized, controlled trial with repeated outcome measures at baseline (Time 1), postintervention (Time 2), and at 3- (Time 3) and 6-month (Time 4) follow-ups. Families in the intervention group received the IBP, a brief, home-based adaptation of the CDI phase of PCIT for high-risk infants with elevated behavior problems and their families. The IBP maintained the core features of the PCIT CDI protocol (Eyberg & Funderburk, 2011), such as in vivo coaching of do and don't skill, and addressed the unique developmental needs of infants (e.g., using nonverbal praise due to lower receptive language abilities, removing parent-directed interaction (PDI) because time-out would be developmentally inappropriate for infants). Main outcomes of the IBP are presented elsewhere (Bagner et al., 2015).

PCIT is an evidence-based behavioral parent-training intervention based on both attachment and social learning theories designed to change parenting behaviors and in turn change disruptive behaviors in infants ages 2–7 years (Zisser & Eyberg, 2010). Treatment typically progresses through two distinct phases: CDI and PDI. The CDI phase focuses on strengthening the parent–infant relationship by teaching parents to use positive parenting skills (i.e., behavior descriptions, reflections, and praises)

and avoid the use of negative parenting skills (i.e., questions, commands, and negative talk), while also ignoring inappropriate behavior, during infant-led play to increase their infant's prosocial behavior and decrease negative behavior.

Intervention sessions were conducted weekly in the families' homes and lasted approximately 1–1.5 hours for an average of 6.1 sessions (range from five to seven sessions). Intervention sessions were conducted in the language in which the mother indicated she felt most comfortable (48% of families in the IBP group received the intervention in Spanish). Advanced doctoral students in clinical psychology, trained and supervised by a PCIT master trainer (D.G.), provided the intervention. Following an initial CDI teaching session, where CDI skills are taught to caregivers, subsequent sessions involve in vivo coaching of caregivers to follow their infant's lead in play by using positive parenting skills (i.e., praising, reflecting, imitating, describing, enjoyment) and avoiding negative parenting skills. Caregivers also were expected to practice the skills daily in a 5-minute infant-led play in between sessions and complete weekly homework logs to document their practice.

## Data Analysis

Data analyses were conducted using SPSS 21. Missing data analyses revealed that only 9.14% of data were missing, and data were found to be missing at random (MAR), Little's MCAR test: $\chi^2(43) = 50.43$, $p = .20$. Expectation maximization was used to account for missing data. Prior to analyses, data were examined for outliers using leverage indices, studentized residuals, and *df* betas. Only one case was identified as a statistical outlier. Given that results remained consistent with and without the outlier, results presented included the outlier to better estimate the sample.

The conceptual model, depicted in Figure 2, was used to examine the effect of the IBP on the number of infant total utterances separately at Time 3 and Time 4, both directly and indirectly through maternal do and negative parenting skills. Two mediation models were analyzed using the PROCESS macro for SPSS (Hayes, 2012), with Time 3 and Time 4 infant total utterances as the outcomes. The macro for multiple mediation utilizes ordinary least squares regression to calculate direct, indirect, and total effects for single or multiple mediators while controlling for possible covariates. It calculates bootstrapped 95% bias corrected and accelerated confidence intervals (CIs) for the indirect effects based on an a priori specified number of bootstrap draws (5,000 for the present analysis; Hayes, 2012). CIs that did not overlap with zero were significant.

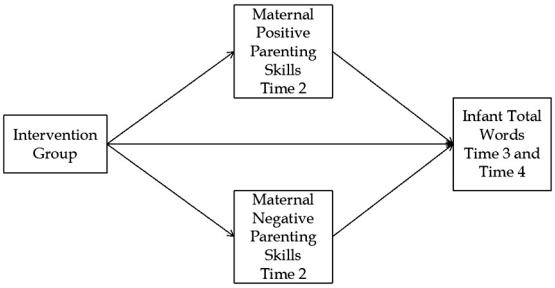


FIGURE 2 Proposed indirect effects of maternal positive and negative parenting skills on effect of intervention group on infant language production.

Maternal positive parenting skills, maternal negative parenting skills, infant total utterances, and infant age at Time 1 were all included as covariates to control for variations of Time 1 scores and reflect the effect of the intervention on covariate-adjusted change in infant total utterances (from Time 1 to Times 3 and 4) as mediated by change in maternal do and negative parenting skills (from Time 1 to Time 2).

## Results

Means and standard deviations of model variables, as well as correlations between them, are presented in Tables 2 and 3 and Figure 3. As expected, the intervention group was not significantly associated with any Time 1 variables. The intervention group was significantly correlated with Time 2 maternal use of both do and negative parenting skills and with infant total utterances at Time 4 but not Time 3, consistent with the outcome study on infant language from this randomized controlled trial (Bagner et al., 2015). Further, maternal use of positive parenting skills at Times 1 and 2 and negative parenting skills at Time 1 were significantly correlated with infant total utterances at Time 4. Additionally, correlations between individual do and negative parenting skills and total utterances were examined for the intervention group. Total utterances at Time 4 correlated significantly with unlabeled praise and reflective statements at Time 2. Additional analyses were conducted using different infant utterances at Times 3 and 4 as the primary outcome. These analyses did not yield significant effects ($p > .05$).

### INDIRECT EFFECTS OF PARENTING SKILLS ON TIME 3 LANGUAGE OUTCOMES

The hypothesized model examining the indirect effects of maternal do and negative parenting skills at Time 2 on the effect between group and infant total language at Time 3 was evaluated and accounted for 30.8% of the variance in maternal positive parenting skills at Time 2, 38.0% of the

Table 3
Correlations of DPICS Codes and Total Utterances

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Negative talk T2 | – | | | | | | | | | | | | |
| 2. Direct command T2 | .21 | – | | | | | | | | | | | |
| 3. Indirect command T2 | .43** | .51** | – | | | | | | | | | | |
| 4. Labeled praise T2 | -.20 | -.26 | -.18 | – | | | | | | | | | |
| 5. Unlabeled praise T2 | -.09 | -.10 | .06 | .31* | – | | | | | | | | |
| 6. Information question T2 | .12 | .22 | .30* | .24 | .04 | – | | | | | | | |
| 7. Descriptive question T2 | .05 | .14 | .13 | .09 | .75** | .12 | – | | | | | | |
| 8. Reflective statement T2 | .01 | .02 | .01 | .41** | -.05 | .07 | .01 | – | | | | | |
| 9. Behavioral description T2 | -.17 | -.23 | -.07 | .69** | .32 | -.09 | .07 | .41** | – | | | | |
| 10. Total utterances T3 | .10. | -.12 | .04 | .14 | -.26 | .11 | -.16 | .24 | .12 | – | | | |
| 11. Total utterances T4 | -.05 | .01 | .11 | -.05 | -.31* | -.01 | -.21 | .33* | -.02 | .64** | – | | |

*Note.* DPICS = Dyadic Parent–Child Interaction Coding System; T2 = Time 2; T3 = Time 3; T4 = Time 4.
*$p < .05$, **$p < .01$, ***$p < .001$.

variance in maternal negative parenting skills at Time 2, and 21.8% of the variance in infant total utterances at Time 3. Estimates of the individual mediation paths and the indirect effects are provided in Table 4.

The path predicting maternal positive parenting skills at Time 2 was significant, $F(5, 52) = 4.62$, $p = .001$, $R^2 = .308$. Results indicated intervention group significantly predicted maternal positive parenting skills at Time 2 (controlling for maternal do and negative parenting skills at Time 1, infant total utterances at Time 1, and infant age), such that the intervention group was associated with higher levels of positive parenting skills at Time 2. The path predicting maternal negative parenting skills at Time 2 was also significant, $F(5, 52) = 6.38$, $p < .001$, $R^2 = .380$. Results indicated intervention group significantly predicted maternal negative parenting skills at Time 2 (controlling for maternal positive parenting skills and negative parenting skills at Time 1, infant total utterances at Time 1, and infant age), such that intervention group was associated with lower levels of negative parenting skills at Time 2. The path predicting infant total utterances at Time 3 was not statistically significant, $F(7, 50) = 1.99$, $p = .07$, $R^2 = .218$. The results also indicated that the hypothesized indirect effects of intervention group on infant total utterances at Time 3 via maternal positive parenting skills and negative parenting skills at Time 2 was not significant.

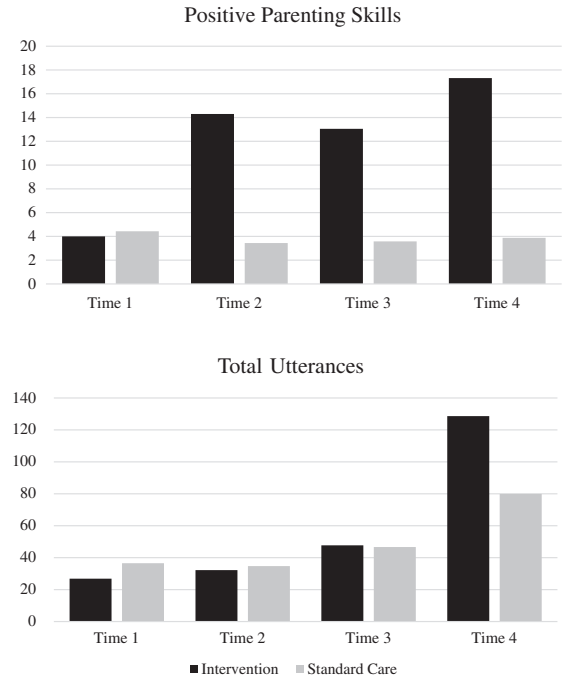


FIGURE 3 Mean number of total utterances and total positive parenting skills by group over time.

## INDIRECT EFFECTS OF PARENTING SKILLS ON TIME 4 LANGUAGE OUTCOMES

The hypothesized model was evaluated and accounted for 30.8% of the variance in maternal positive parenting skills at Time 2, 38.0% of the variance in maternal negative parenting skills at Time 2, and 44.6% of the variance in infant total utterances at Time 4. Estimates of the individual mediation paths and the indirect effects are provided in Table 5.

The path predicting maternal positive parenting skills at Time 2 was significant, $F(5, 52) = 4.62$, $p = .001$, $R^2 = .308$. Results indicated intervention group significantly predicted maternal positive parenting skills at Time 2 (controlling for maternal do and negative parenting skills at Time 1, infant total utterances at Time 1, and infant age), such that the intervention group was associated with higher levels of positive parenting skills at Time 2. The path predicting maternal negative parenting skills at

Table 4
Ninety-Five Percent Bias Corrected and Accelerated Bootstrap Confidence Intervals for Time 3 Model

| Outcome/predictor | Coefficient | 95% BC bootstrap CI |
|---|---|---|
| Maternal positive parenting skills at T2 | | |
| Group | 9.35 | [5.15, 13.55] |
| Maternal positive parenting skills at T1 | 0.04 | [-0.55, 0.63] |
| Maternal negative parenting skills at T1 | 0.05 | [-0.07, 0.16] |
| Infant total utterances at T1 | -0.05 | [-0.09, 0.09] |
| Child age | -0.46 | [-2.10, 1.18] |
| Maternal negative parenting skills at T2 | | |
| Group | -7.49 | [-13.97, -1.01] |
| Maternal positive parenting skills at T1 | -0.41 | [-1.32, 0.50] |
| Maternal negative parenting skills at T1 | 0.38 | [0.21, 0.56] |
| Infant total utterances at T1 | 0.06 | [-0.08, 0.20] |
| Child age | -1.44 | [-3.96, 1.08] |
| Infant total utterances at T3 | | |
| Group | -5.02 | [-33.22, 23.19] |
| Maternal positive parenting skills at T1 | -0.81 | [-4.07, 2.44] |
| Maternal positive parenting skills at T2 | 1.32 | [-0.20, 2,85] |
| Maternal negative parenting skills at T1 | -0.18 | [-0.92, 0.56] |
| Maternal negative parenting skills at T2 | 0.30 | [-0.69, 1.29] |
| Infant total utterances at T1 | 0.71 | [0.22, 1.20] |
| Child age | 3.95 | [-5.15, 13.06] |
| Indirect effects | | |
| Group to maternal positive parenting skills at T2 to total utterances at T3 | 12.37 | [-4.81, 36.85] |
| Group to maternal negative parenting skills at T2 to total utterances at T3 | -2.24 | [-10.26, 3.22] |

*Note.* 95% BC bootstrap CI = 95% bias corrected bootstrapped confidence interval. Confidence intervals that do not include 0 are significant. BC = bias corrected; CI = confidence interval; T1 = Time 1; T2 = Time 2; T3 = Time 3.

Table 5
Ninety-Five Percent Bias Corrected and Accelerated Bootstrap Confidence Intervals for Time 4 Model

| Outcome/predictor | Coefficient | 95% BC bootstrap CI |
|---|---|---|
| Maternal positive parenting skills at T2 | | |
| Group | 9.35 | [5.15, 13.55] |
| Maternal positive parenting skills at T1 | 0.04 | [-0.55, 0.63] |
| Maternal negative parenting skills at T1 | 0.05 | [-0.07, 0.16] |
| Infant total utterances at T1 | -0.05 | [-0.09, 0.09] |
| Child age | -0.46 | [-2.10, 1.18] |
| Maternal negative parenting skills at T2 | | |
| Group | -7.49 | [-13.97, -1.01] |
| Maternal positive parenting skills at T1 | -0.41 | [-1.32, 0.50] |
| Maternal negative parenting skills at T1 | 0.38 | [0.21, 0.56] |
| Infant total utterances at T1 | 0.06 | [-0.08, 0.20] |
| Child age | -1.44 | [-3.96, 1.08] |
| Infant total utterances at T4 | | |
| Group | 18.77 | [-17.19, 54.72] |
| Maternal positive parenting skills at T1 | 0.28 | [-3.87, 4.42] |
| Maternal positive parenting skills at T2 | 2.78 | [0.84, 4.73] |
| Maternal negative parenting skills at T1 | 0.93 | [-0.01, 1.87] |
| Maternal negative parenting skills at T2 | 0.15 | [-1.11, 1.41] |
| Infant total utterances at T1 | 0.96 | [0.33, 1.59] |
| Child age | 2.44 | [-9.16, 14.04] |
| Indirect effects | | |
| Group to maternal positive parenting skills at T2 to total utterances at T4 | 26.01 | [0.48, 58.42] |
| Group to maternal negative parenting skills at T2 to total utterances at T4 | -1.10 | [-12.48, 14.12] |
| Direct effect | | |
| Group to total utterances at T4 | 18.77 | [-17.19, 54.72] |
| Total effect | | |
| Group to total utterances at T4 | 43.67 | [12.62, 74.73] |

*Note.* 95% BC bootstrap CI = 95% bias corrected bootstrapped confidence interval. Confidence intervals that do not include 0 are significant. BC = bias corrected; CI = confidence interval; T1 = Time 1; T2 = Time 2; T4 = Time 4.

Time 2 was also significant, $F(5, 52) = 6.38$, $p < .001$, $R^2 = .380$. Results indicated intervention group significantly predicted maternal negative parenting skills at Time 2 (controlling for maternal positive parenting skills and negative parenting skills at Time 1, infant total utterances at Time 1, and infant age), such that the intervention group was associated with lower levels of negative parenting skills at Time 2.

The path predicting infant total utterances at Time 4 was significant, $F(7, 50) = 5.74$, $p = .001$, $R^2 = .446$. Results indicated maternal positive parenting skills at Time 2 significantly predicted infant total utterances at Time 4 (controlling for maternal do and negative parenting skills at Times 1 and 2, infant total utterances at Time 1, intervention group, and infant age).

The results indicated a total effect of intervention group on infant total utterances at Time 4 of 43.67.

The indirect effect of intervention group on infant total utterances at Time 4 via maternal positive parenting skills at Time 2 was statistically significant. The intervention was associated with an increase in language production at Time 4 via an increase in maternal positive parenting skills at Time 2 of approximately 26.0 utterances, as compared with the control group. The indirect effect of intervention group on infant total utterances at Time 4 via maternal negative parenting skills at Time 2 was not significant, even when removing questions from the negative parenting skills composite. The direct effect of intervention group on infant language production at Time 4, after controlling for both indirect effects, was not statistically significant.

## Discussion

In this study, we examined the indirect effect of a brief, home-based parenting intervention on infant language production via changes in parenting skills among caregivers of infants with elevated behavior problems from predominantly low-income, Hispanic families. Findings revealed a significant indirect effect of positive parenting skills on the relation between group and total infant utterances at the 6-month follow-up, such that infants whose caregivers increased their use of positive parenting skills between Time 1 and Time 2 showed greater increases in language production at Time 4 even after controlling for maternal positive parenting skills and negative parenting skills at Time 1, infant total utterances at Time 1, and infant age. These findings suggest that caregivers in the intervention group who used more positive parenting skills following the intervention were more likely to have an infant displaying greater gains in language production as measured by the infant's total utterances spoken during infant-directed play.

The current findings extend previous research examining parenting skills as a mechanism of change in child language production in young children with or at risk for developmental delay (Garcia et al., 2014), as well as previous research demonstrating positive effects of the IBP on infant behavior and language production, as well as an indirect effect of improved infant behavior on infant language production (Bagner et al., 2016). Taken together with these previous findings, the present study highlights the potential for a brief and low-cost intervention to target infant behavior and language simultaneously through parenting skills during a critical period in language development. Further, these results suggest targeting parenting skills could be an important step in closing the "30 million word gap" demonstrated between low-income children and their higher-income peers (Hindman et al., 2016). When results from the 5-minute play situations are extrapolated over the course of a 10-hour day, they equate to approximately 2 million more utterances per year for infants in the intervention group relative to infants in the control group. Although speculative, the magnitude of these extrapolated results become clear and offer new insights into the essential role of parenting skills and the potential for the IBP to improve both behavior and language outcomes for at-risk infants.

We did not find a significant indirect effect through positive parenting skills on infant total utterances at the 3-month follow-up, which may have been due to the age of the infants at the time of the 3-month follow-up (17–20 months). It is possible that the effect of positive parenting skills on infant language may not be adequately captured until later in development (closer to the second year of life), when infants typically display an increase in expressive language (McMurray, 2007). Alternatively, positive parenting skills may produce a delayed effect on infant language that follows more immediate changes in infant behavior and extended exposure to an enriched home environment, as behavior change is the primary aim of the intervention. It is also possible a group effect through positive parenting skills on infant total utterances at 3-month follow-up was not detected due to relatively low power in the current sample. Future work should examine the timing of the intervention (relative to infant's age) to determine whether there is an ideal time to deliver the intervention that would lead to the greatest language gains. The current findings have important clinical implications for service providers, such as integrating positive parenting skills into other interventions (early intervention, rehabilitative therapy) and settings as a brief and cost-effective method of promoting language development. Although the current intervention shares components utilized across rehabilitative interventions (e.g., speech-language therapy, occupational therapy) shown to be effective in increasing language and communicative behaviors (Paul, 2008), it will be important for future work to examine the parallels across interventions in order to develop a common language and approach to targeting behavior and language changes across diverse groups. Given that the current sample consisted of infants with elevated behavior problems, future work should examine the effect of do and negative parenting skills on language production among diverse groups, including children with and without language deficits, as findings may differ and suggest that an adaptation or modification to effectively target both behavioral and language deficits may be warranted.

Additionally, we did not find a significant indirect effect through positive parenting skills on infant different utterances at the 3- and 6-month follow-ups. It is possible that these findings may be associated with the bilingual nature of the sample. Recent research suggests monolingual children display significantly more advanced vocabulary and grammatical development than bilingual children. However, both monolingual and bilingual children were comparable on a measure of total vocabulary (Hoff et al., 2012). Consistent with these findings, it is possible that the current study did not find an effect on different utterances, a measure of vocabulary growth, via positive parenting skills due to the documented lag associated with bilingualism in early childhood (Hoff et al., 2012).

Findings also did not support an indirect effect of negative parenting skills on the relation between group and total utterances at the 3- and 6-month follow-ups, even when removing questions from the negative parenting skills composite, which suggests the frequency of questions, commands, and negative statements used by parents did not lead to changes in infant language. This finding is inconsistent with previous research showing that frequent use of directive and corrective statements are associated with delays in children's language abilities (Barnes et al., 1983; Delaney & Kaiser, 2001). However, the current study is the first to examine the effect of negative parenting skills on language production in infants. Therefore, it is possible that the negative effects of parent use of directive and corrective statements (i.e., negative parenting skills) on language production do not emerge until later in development. It is also possible that although questions are traditionally a part of the negative parenting skills, they may have contributed to the null findings, as research examining the role of questions in language development suggests open-ended questions in particular are positively associated with language development (Bond & Wasik, 2009). Future research should examine the effects of parenting do and negative parenting skills on language production longitudinally in order to examine the possibility of a delayed effect, as well as further categorize types of questions to examine their role in language development.

The current study had several strengths, including the use of randomized controlled trial methodology, the use of observational coding schemes for both parent skill use and infant language production, and measurement of outcomes at multiple time points. Despite these strengths, the current findings should be interpreted in light of some limitations. First, the current study consisted of a relatively small sample, which may reduce the power to detect effects on language, particularly at the 3-month follow-up. Second, the sample was primarily Hispanic, and included a small number of families from other racial and ethnic backgrounds. To date, parenting intervention research has primarily focused on middle-class, White families despite differences across cultures and socioeconomic groups (Cardona, Nicholson, & Fox, 2000). However, some research suggests Hispanic caregivers display a more authoritarian and directive parenting style (Fromm & Maccoby, 1970), suggesting cultural differences in parenting (Cardona, Nicholson, & Fox, 2000). It is possible that the effect of the IBP on language via parenting skills may not generalize to families from other racial and ethnic backgrounds, who speak languages other than English and Spanish, and with varying levels of acculturation. Nonetheless, the current study was an important first step in examining the role of parenting skills on infant language production among predominantly Hispanic families, which is particularly relevant given the projected population growth for Hispanics in the United States (Colby & Ortman, 2015). Third, inclusion criteria consisted of elevated behavior problems on the problem scale of the BITSEA. Therefore, the current findings may not generalize to typically developing infants. Fourth, data were collected only from mothers. Future research should examine whether effects on infant language production differ based on fathers' parenting skills. Fifth, the study used a limited number of language measures (i.e., total and different utterances) that only assess expressive language. In addition to assessing both expressive and receptive language, future studies should go beyond assessing only language production and examine the relation between language production and language ability (e.g., using the Expressive Vocabulary Test and Peabody Picture Vocabulary Test). These findings will allow researchers to examine which aspects of early language production are associated with later language ability, as well as moderators and mechanisms of change. Last, a standard care condition was used as the control group, which did not allow us to control for expectancy effects. Therefore, future research should include an active comparison group.

The current study has clinical implications for prevention and intervention work. Parenting skills have consistently been associated with improvements in child behavior and have now been found to account for child and infant language outcomes following a behavioral intervention in the current study and in previous work (Garcia et al., 2014). The current study highlights the significant effect a brief, low-cost behavioral parenting intervention can have on expressive language skills during a

crucial time period in which infants are developing speech. Findings suggest that promoting positive parenting skills in infancy may serve as building blocks for language that can have important implications for school readiness and social functioning with potential impact for policy-level changes. Findings from the current study also suggest that significant gains can be made in language production with low-income, ethnic-minority families by teaching parents to use behavioral skills during play with their infant. Taken together with previous research, the current study suggests that a targeted, brief parenting intervention can lead to long-term positive outcomes in infant language in addition to behavior.

### Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

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Received: April 4, 2018
Accepted: September 8, 2018
Available online: 11 September 2018