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Infant Communication and Subsequent Language Development in Children from Low Income Families: The Role of Early Cognitive Stimulation

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There is a wealth of theoretical support and empirical evidence suggesting that aspects of infant communication, particularly those emerging in the second half of the first year, play an important role in shaping language learning trajectories. For instance, it has been argued by theorists such as Bruner¹ and Tomasello² that the attainment of the capacity to share attention with others at approximately 8–10 months is the greatest milestone en route to language learning. The crux of this argument is that the ability to share attention with others sets the stage for the child's first experiences with shared meaning, crucial for development of language abilities, which requires common understanding of words for representing objects and concepts. This conjecture about the significance of this early communicative capacity has been robustly supported, with ample empirical evidence demonstrating that individual differences in joint attention behaviors during late infancy are associated with toddler and preschool language abilities³.

There is also evidence suggesting that other aspects of communication, such as eye gaze, expression of emotion and attention getting, emerging even earlier in infancy, may also be critical for shaping trajectories of language development. Infant gaze-following is theoretically important because of its direct significance for word learning⁴, and it has been empirically shown as early as 6 months to be associated with later receptive and expressive language skills^{5,6}. Research has also demonstrated that early aspects of infant communication such as eye gaze, emotion expression, and making bids for the attention of others strongly predict other communicative capacities emerging later in infancy, such as joint attention, which in turn set the stage for language development⁴. Taken together, the literature suggests that individual differences in infant communication are not only evident

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Conflicts of Interest

There are no conflicts of interest declared by any of the authors.

and detectable in early infancy, prior to the emergence of the capacity to share attention, but are also meaningful for further language development.

Given the significance of early forms of infant communication for later language learning, it is important to understand the ways in which they might be impacted by early differences in the social environment. A review of the literature on early childhood development leaves little doubt that cognitive stimulation in the context of parents' interactions with their young children is critical⁷. Research on the language development of toddlers and preschoolers has established that stimulating children cognitively, through such reciprocal interactions such as reading, teaching, playing with toys, and other interactions involving verbal responsivity on the part of the parent, is associated with enhancements in children's language development. Specifically, it has been consistently demonstrated that parents who use richer language input, who scaffold children's vocalizations more in the context of play, and who read aloud more frequently to their children, have toddlers and preschool-aged children with more advanced language skills⁸.

While the evidence documenting the effect of cognitively stimulating interactions on late infant communication and toddler/preschool language development is abundant, there has been limited study of whether and how variations in these interactions in early infancy are associated with individual differences in very early communication abilities such as eye gaze, emotion expression and making bids for the attention of others. The limited study of impacts in these domains is likely due to a host of factors, including that pre-verbal communication is less readily measurable than later language ability. Also, due to theoretical stipulations put forth by Piaget and others that young infants are in the sensorimotor phase of cognitive development - that is, not yet capable of representational thought - the role of "cognitive stimulation" in these early months may be less likely to be considered. However, such interactions in the earliest months of life are likely to shape the way that infants engage and communicate with others, and therefore likely to facilitate interactions in late infancy and toddlerhood, critical for language learning. This question of the impact of parenting on early infant communication is therefore of general importance for our understanding of how early experiences spur development, but also has practical importance for how pediatricians and practitioners advise parents early in infancy.

Answering this question would have relevance for the broader population but would have particularly great implications for children in low-income families, for whom: (1) research on the significance of early communication in relation to later language development is lacking; (2) language development often lags behind that of middle-class peers; and (3) early cognitive stimulation in the home is likely to be even more crucial. There is a longstanding body of research indicating that cognitive stimulation and verbal input in the homes of low-income families are less frequent than in middle-income homes⁸. Furthermore, this relative lack of such verbally-rich parent-child interactions in low-income homes is a clear contributor to disparities in language development, and school readiness more generally, experienced by children reared in such environments⁹. Interventions seeking to mitigate such poverty-related disparities, delivered both in the home (e.g., Parent Child Home Program¹⁰, Play and Learning Strategies¹¹) and in health care settings (e.g., Reach Out and Read¹², Healthy Steps¹³, Video Interaction Project¹⁴⁻¹⁶), have thus aimed to enhance parent-child interactions. If it were indeed the case that cognitive stimulation beginning in early infancy impacted later language through enhancements to infant preverbal communication, this would provide strong support for working to enhance cognitive stimulation beginning as early in infancy as possible.

Accordingly, the present study aims: (1) to determine whether cognitive stimulation in early infancy is associated with preverbal aspects of infant communication at 6 months and with

toddler language development at 24 months for a low-income sample; (2) to determine whether preverbal aspects of infant communication predict later toddler language development for this low-income sample; (3) to determine the extent to which early impacts of cognitive stimulation on infant communication are important in setting the course for further language learning - that is, to determine whether early communication mediates the relationship between early cognitive stimulation and 24-month language development; and (4) to perform exploratory analyses of whether specific aspects of cognitive stimulation in the home in early infancy are associated with early and late language indicators.

We hypothesized that early cognitive stimulation (measured at 6 months) would be associated with enhanced early infant communication (also measured at 6 months) and with subsequent toddler language outcomes (measured at 24 months). We also hypothesized that early infant communication would directly predict 24 month language outcomes. Finally, we hypothesized that the relationship between early cognitive stimulation and toddler language would be explained in part, by early impacts on infant communicative behavior.

METHOD

Study Design

This was a longitudinal analysis of a subset of parent-child dyads enrolled in the Bellevue Project for Early Language, Literacy, and Education Success (BELLE), a randomized controlled trial (RCT) assessing the effect of two pediatric primary care interventions (i.e., the Video Interaction Project and Building Blocks) on parenting and child development. IRB approval was obtained from New York University School of Medicine, Bellevue Hospital Center (BHC) and the New York City Health and Hospitals Corporation. Parents provided informed consent prior to participation.

Participants

Participants were 320 mother-infant dyads enrolled from the postpartum ward of an inner-city public hospital serving low-income, primarily immigrant families. Inclusion criteria were that the infant had no significant medical complications (requiring extended stay or transfer to Level II/III nursery, or with potential adverse developmental consequences), full term gestation ≥ 37 weeks, and birth weight ≥ 2500gm. Additionally, the mother was the primary caregiver, was ≥ 18 yrs, spoke English or Spanish as her primary language, and intended her child to receive pediatric primary care at the same institution for at least three years.

Study Variables and Assessments

Cognitive Stimulation—*Cognitive Stimulation*, measured at 6 months, was comprised of four indicator variables tapping into different aspects of parent-child interactions. These indicator variables were all assessed by parental interview using subscales of the infant version of StimQ, a measure validated for use in low SES populations in English and Spanish with good internal consistency, test-retest reliability, and predictive validity of cognitive development^{17,18}. The StimQ-I has been used in a number of studies of early child development performed with urban economically disadvantaged populations^{14–16}. The four indicators/subscales measuring cognitive stimulation were (1) Availability of Learning Materials (such as infant, manipulative, and symbolic toys) provided by the caregiver in the home (StimQ-I *ALM*, range 0 to 6); (2) Reading activities (StimQ-I *READ*, range 0 to 19) including the number and diversity of books read to the child, frequency of reading activities, and associated interactions; (3) Parental Involvement in Developmental Advance (StimQ-I *PIDA*, range 0 to 7) including teaching and play activities, such as naming objects, teaching body parts, or teaching the child to play with toys (e.g., stacking blocks) and

playing make believe games with the child; and (4) Parental Verbal Responsivity (StimQ-I PVR, range 0–11) including caregiver-child verbal interactions such as talking while feeding and making sounds together. Prior reports have documented impacts of study interventions on parent-child interactions as measured by StimQ-I^{14–16}.

Early Infant Communication—*Early Infant Communication* was a construct comprised of three indicator variables: (1) Emotion and eyegaze, (2) Communicative Bids, and (3) Intensity of Emotion Expression. Emotion and eyegaze were measured using the “Emotion and eyegaze” subscale of the Communication and Symbolic Behavior Scale DP (CSBS DP) checklist, a parent-report instrument in which parents are asked to describe various aspects of their children’s behavior. This subscale consists of four items (e.g., “Does your child look at you while (s)he is happy?”), answered on a three point Likert scale (0–2) with 0 representing, “Never true of my child,” and 2 representing, “Always true of my child,” yielding a score ranging from 0–8. Communicative bids were assessed using two items from the CSBS DP checklist, (e.g., “When you are not paying attention to your child, does (s)he try to get your attention?”), measured using the same Likert scale previously described, and yielding a total ranging from 0–4. The CSBS DP checklist has been shown to be valid for capturing information about children in diverse populations aged 6–24 months, and has good internal consistency ($\alpha=.96$) and interrater reliability ($\alpha=.88-.89$)¹⁹. The third indicator of early infant communication, Intensity of Emotion Expression, was measured using one item from the Short Temperament Scale for Infants (STSI; “My child displays much feeling during feeding or changing”), answered on a three point Likert scale ranging from 0 (“Never true of my child”) to 2 (“Often true of my child”). The STSI is a parent report measure of various aspects of infants’ temperament which has been demonstrated to have good psychometric properties with reliability ranging from .57 to .76²⁰.

Toddler Language—*Toddler language* was assessed at 24 months using Preschool Language Scale-4th edition (PLS-4), administered in either Spanish or English depending on the primary language spoken in the home. The PLS-4 is an observational measure comprised of two indicators: (1) Standard Expressive Communication Ability, and (2) Standard Auditory Comprehension. This test has been found to reliably assess language ability in children from birth through age 6 years 11 months (Cronbach’s coefficient $\alpha=.93$)²¹.

Socio-demographic Data—Socio-demographic data were obtained via parental interview at enrollment to characterize the sample. For mothers, variables obtained were age, level of education completed, Latino ethnicity, family Hollingshead Four Factor Socioeconomic Status (SES), primary language, marital status, and country of origin (US immigrant status). Also, at the 6 month assessment, we assessed maternal presence of depressive symptoms using the Patient Health Questionnaire-9. For the child, we obtained information about gender and birth order.

Study Sample

From November, 2005, through October, 2008, a total of 469 mother-infant dyads were enrolled as part of the larger project, of which 320 infants (68.2%) were evaluated at age 6 months on cognitive stimulation and infant communication. Of these, 210 (65.6%) also had an evaluation of language at age 24 months. Families assessed and not assessed at 24 months were similar for cognitive stimulation in the home at 6 months, and were similar on most socio-demographic factors. However, assessed families were more likely to speak Spanish as the primary language ($p<.001$), to have immigrated to the US ($p<.001$), and to be married or living in a two-parent home ($p<.05$). For those children missing an assessment of language at 24 months, scores were estimated using statistical techniques as

described below. Therefore, data from all 320 families assessed were analyzed in this study. Table 1 shows descriptive data for these families.

Statistical Analysis

Prior to any statistical analyses, the data were inspected for violations of normality. Structural equations modeling (SEM) techniques were used to evaluate the three hypotheses of the current study. SEM is a powerful statistical technique which is used to determine whether sample data fits a specified theoretical model among variables, either observed or latent (construct indirectly observed from a set of variables). After specification of a theoretical model, which is a type of Confirmatory Factor Analysis, SEM can further be used to evaluate hypotheses about relationship among observed and latent variables within the model. SEM analyses in this study were performed using the Full Information Maximum Likelihood (FIML) estimation method in Stata12. FIML estimation maximizes the likelihood of the model given the observed data, while also using all information of the observed data to estimate the mean and variance of any variables within the model with missing data²². Model fit was evaluated using the Bentler Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), Root-Mean-Square Error of Approximation (RMSEA), in addition to the χ^2 goodness of fit test which compares the model to the saturated model. The recommended cutoff values for good fit using these indices are $>.95$ for CFI, $>.90$ for TLI, $<.06$ for RMSEA, and $p >.05$ for the χ^2 goodness of fit test²³.

In the structural models, four of the socio-demographic variables described above were considered as potential confounders (maternal education, maternal depressive symptoms, child gender, and SES) as they have been documented in prior research to be related to either cognitive stimulation in the home or to child language development^{8,9}. Therefore, these were included as exogenous variables with paths estimated from each potential confounder to each primary study variable.

First, the measurement model was estimated to assess the validity of the latent factor structure of the variables included in the structural model [see Table 2 for factor loadings with associated standard errors and confidence intervals]. The fit of the structural model was then tested, and relationships among variables were assessed by calculating betas (standardized regression coefficients) and associated significance level for each path.

To test our hypotheses about interrelationships among cognitive stimulation, early communication, and later language, a series of nested models including all confounders were evaluated in 4 steps utilizing Baron and Kenny's method²⁴. In Step 1, we evaluated a nested model (eliminating infant communication) to estimate the direct impact of early cognitive stimulation on toddler language; In Step 2, we evaluated a nested model (eliminating early cognitive stimulation) to estimate the direct association of early cognitive stimulation with infant communication; In Step 3, we evaluated the full structural model explained above to estimate the impact of infant communication on toddler language (adjusting for early cognitive stimulation); In Step 4, we also evaluated the full structural model to assess the direct impact of early cognitive stimulation on toddler language (adjusting for infant communication). Using this method, the association between early cognitive stimulation and toddler language would be considered to be mediated by infant communication if associations were found in Steps 1–3, but with the association between cognitive stimulation and toddler language eliminated or reduced following adjustment for infant communication in Step 4. Additionally, the magnitude and significance of the indirect effect of early cognitive stimulation on toddler language was estimated in Stata 12 using the `estat teffects` command which utilizes the delta method to estimate standard errors²⁵.

Secondary analyses were conducted using structural equation modeling to explore which particular aspects of early cognitive stimulation (i.e., reading, teaching, being verbally responsive in the context of daily routines, or playing with toys) were most strongly associated with impacts on infant communication and toddler language. For these analyses, four separate models were assessed, each with one StimQ subscale total observed score predicting infant communication and toddler language, adjusting for all potential confounders.

RESULTS

Model Fit—Results demonstrated that the full structural model provided an excellent fit to the data, with $\chi^2(48) = .46$, CFI=1.000, TLI=0.999, and RMSEA= .004 (90% CI: 0.00–0.04). Figure 1 illustrates the structural model assessed as well as the Betas associated with each path, with solid lines representing significant associations.

Findings Related to Hypotheses—Results from analyses of nested models as indicated by the four steps of the Baron and Kenny method are presented in Table 3. In line with predictions, in Step 1, it was found that early cognitive stimulation was positively associated with toddler language, with $\beta = .20$, $p < .05$. In Step 2, it was found that early cognitive stimulation was associated with infant communication, with $\beta = .63$, $p < .001$. In Step 3, infant communication was found to be a significant predictor of toddler language ability, independent of early cognitive stimulation, $\beta = .49$, $p < .01$. Also as hypothesized, in Step 4, it was found that the direct path leading from early cognitive stimulation to toddler language became non-significant after adjusting for infant communication.

Therefore, results indicate mediation based on the Baron and Kenny criteria²⁴ and are in line with our prediction that the relationship between early cognitive stimulation and toddler language development was explained at least in part by impacts of cognitive stimulation on early infant communication. The magnitude of the indirect effect between cognitive stimulation and 24 month language ability was $\beta = .28$, and significant with unstandardized coefficient $B = 1.56$, $SE = .49$, $z = 3.21$, $p = .001$.

Secondary Analyses

To address our final aim, analyses were conducted to explore the differential impact of various types of early cognitive stimulation on early infant communication and on toddler language, by assessing direct and indirect associations with these factors for each subscale of the StimQ-I separately. Results (Table 4) indicated that availability of learning materials (ALM), reading to infants (READ), engaging in teaching behaviors with infants (e.g., using verbal labels for objects in the environment) (PIDA), and using verbal responsivity in the context of daily routines (e.g., engaging in back and forth reciprocal vocalizations) (PVR), all were significantly associated with 6 month infant communication. Results from analyses of the indirect effects of each aspect of cognitive stimulation on toddler language mirrored these findings, showing significant indirect impacts of availability of learning materials in the home (ALM), reading (READ), teaching (PIDA), and verbal responsivity (PVR).

DISCUSSION

In this study, we sought to assess whether early cognitive stimulation in the home is associated with measurable changes in early infant communicative capacities. We also sought to determine whether such impacts on early infant communication are critical for language learning trajectories. To address these aims, we investigated the relationship between early cognitive stimulation in the home and both 6 month infant communication

and 24 month language outcomes in a low-income sample. We also explored the extent to which early associations between cognitive stimulation and early infant communication explained later language development. Understanding these relationships is important, not only because they shed light on the types of early experiences that are important for children's language development, but also because they provide insight as to how early these experiences lead to changes in longer-term trajectories. The importance of this study is further underscored by its focus on low-income families who, for a multitude of reasons, have children at greater risk than middle-income peers for experiencing setbacks in school readiness, including language development.

Results supported our first hypothesis that early cognitive stimulation in parent-child interactions is associated with individual differences in 6 month infant communication, including reported eye gaze following, emotion expression, and communicative bids. These results are aligned with findings in literature on infant development which suggest that adaptive communication patterns, such as the capacity to share attention with others in late infancy, are fostered by early dyadic interactions with caregivers that are reciprocal, responsive, and affectively attuned²⁶. However, this study also adds significantly to this literature as it is among the first to look specifically at the impacts of cognitive stimulation on these adaptive communication patterns in early infancy. Results also indicated that early cognitive stimulation is associated with direct effects on 24 month language ability, indicating that these early experiences are not only important for short term differences in communication, but have long term implications for how children acquire language.

Our findings also suggest that the relationship between early cognitive stimulation in the home and later language development is explained, at least in part, by early impacts on infant communication. This finding is significant because it underscores how early in life these environmental influences may begin to take effect on long-term trajectories. The significance of these early parent-child interactions should be considered in light of the extensive literature championing the import of triadic interactions (i.e., those in which the child coordinates his/her attention in relation to another person and simultaneously to an object/symbol/third party in the environment) in late infancy for language development²⁷. It is often argued that engagement in such triadic interactions is critical, because it is in the context of such interactions that infants gain experience with shared attention and, ultimately, shared meaning -- a necessary precursor to adopting a shared symbol system such as language. Results of the current study demonstrate gains in infant communication and toddler language associated with participation in interactions with others prior to six months. This suggests that such early infant experiences, even prior to the age at which mature joint attention capacities have emerged, are valuable in facilitating triadic interactions in later infancy which set the course for language development. Our findings are consistent with theories put forth by Bruner¹ and Legerstee²⁸, which emphasize that infants' earliest social interactions play a pivotal role in building the foundation necessary to engage in more advanced forms of communication and are thus fundamental for language development.

Another mechanism by which these cognitively stimulating interactions in early infancy might prove to impact language learning trajectories, not measured in the current study, is by enhancing early phonological skills. Literature on language acquisition makes evident that from birth, infants are given the task to detect and distinguish sounds that are unique to language, and as they get older, they become more sophisticated in detecting/distinguishing those sounds that are unique to their own language²⁹. These abilities, as early as infancy, have been reliably linked to young children's language development and impending literacy acquisition³⁰. It would be reasonable to expect that engaging infants in language-rich interactions, such as those found to be important in this study, would provide them

experiences that could foster the development of these skills. Future research on the mechanisms by which early interactions are important for language development should consider and assess the development of phonology in addition to aspects of preverbal communication.

This study also sought to explore whether some types of cognitive stimulation in the home during early infancy are more related to enhancements in infant communication and toddler language than others. Results indicated that each type of cognitive stimulation in the home examined- reading, teaching, verbal responsivity, and availability of learning materials- was related to these outcomes, and no single type of parent-child interaction emerged as being most linked to communication and language outcomes.

In addition to adding to our knowledge about the effects of the early social environment on trajectories of language development, results from this study have significant practical import for practices and programs in primary health care. Current Bright Futures guidelines recommend that pediatricians advise parents regarding verbal interactions and reading aloud as part of routine primary care visits. Programs such as Read Out and Read¹², the Video Interaction Project¹⁴⁻¹⁶ and Healthy Steps¹³ formalize provision of such advice through curricula implemented through a variety of intervention strategies. Findings from the current study provide additional support for the continuation and expansion of such programs in pediatric primary care settings. They also provide strong evidence that such parenting interventions are optimally begun prior to 6 months of age in order to impact early infant capacities that serve as the foundation for further language development.

There were three main limitations to this study. First, measures of cognitive stimulation in the home and of infant communication were assessed at the same time, when children were 6 months of age. The unidirectional path in the assessed model from early cognitive stimulation in the home to infant communication was guided by the principle that the StimQ reflects cumulative parenting (both prior and current), while the infant communication measures largely represent current infant behaviors. Nevertheless, this limitation makes it impossible to decipher causality and gives rise to the possibility that some aspects of infant communication had influenced the level of cognitive stimulation in the home, or perhaps that those parents who interacted more with their children were also more prone to noticing their children's communicative bids. Results of the current analyses therefore do not preclude the validity of alternative models proposing either that early infant communication impacts early cognitive stimulation in the home, or that there is a bidirectional relationship between early cognitive stimulation and infant communication. In fact, a model in which the direction of the path from cognitive stimulation to infant communication is reversed provides the same exact fit to the observed data in this study. In future studies, longitudinal data will be analyzed from this same cohort to determine how infant communication may also influence later parenting including cognitive stimulation in the toddler period.

Second, measures of cognitive stimulation and of infant communication were parent-report measures. This could be problematic because it may introduce shared method variance, and also because measures obtained via this method are subject to social desirability bias on the part of the parent. However, the measures used have been shown to be reliable and valid¹⁷⁻¹⁹, and found to have convergent validity with observational measures of the same aspects of parent and child behavior. In future studies, we aim to replicate and extend the present findings by analyzing changes in observed communicative capacities in later infancy (as they relate to both early cognitive stimulation and early infant communication) in the same sample of children. A third limitation is that results may not be generalizable to families of other ethnicities or with higher levels of income.

In conclusion, this study provides evidence that cognitive stimulation in early infancy is associated with important differences in early infant communicative capacities, such as eyegaze following, emotion expression, and the capacity to make bids for others' attention. Although additional study is needed, findings demonstrating early associations of cognitive stimulation in the home with infant communication have importance for investigators and clinicians. Interventions aimed to impact language-learning trajectories for children in low-income families, who are at greatest risk for setbacks in school readiness, should target parent-child interactions beginning in early infancy.

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Figure 1.

Structural equation model predicting toddler language at 24 months, $\chi^2(48) = 48.21$, $p = .46$; RMSEA = 0.004; CFI = 1.000; TLI = 0.999. Solid lines represent significant paths while dashed lines indicate non-significant paths. Lines with two arrows indicate variables allowed to co-vary. Standardized regression coefficients (β s), are displayed adjacent to their corresponding path.

Table 1

Sample Demographics

	Mean (SD) or n (%) n=320
<u>Maternal Characteristic</u>	
Mean Age (SD)	27.4 (5.3)
7 th grade education	236 (74%)
Latino ethnicity	296 (93%)
Low SES	288 (90%)
Spanish-Speaking	254 (79%)
Married/Living with Partner	264 (83%)
US Immigrant	275 (96%)
Depressive symptoms present (PHQ-9 ≥ 5)	88 (28%)
<u>Child Characteristic</u>	
Female	166 (52%)
Firstborn	125 (39%)

Table 2

Measurement Model: Latent Variables, Factor Loadings, and Associated Significance

	β (SE)	95% CIs	<i>p</i>
<u>StimQ- 6 Months</u>			
Availability of Learning Materials (ALM)	0.54 (.05)	0.44–0.64	<.0001
Reading Activity (READ)	0.49 (.05)	0.38–0.59	<.0001
Parent Involvement in Developmental Advance (PIDA)	0.65 (.05)	0.55–0.74	<.0001
Parent Verbal Responsivity (PVR)	0.70 (.05)	0.61–0.79	<.0001
<u>Early Infant Communication- 6 Months</u>			
CSBS Emotion and Eye Gaze	0.58 (.06)	0.46–0.69	<.0001
CSBS Communication	0.65 (.06)	0.53–0.77	<.0001
STSI Intensity of Emotion Expression	0.27 (.07)	0.14–0.40	<.0001
<u>24 Month Language Development</u>			
PLS4 Expressive Language Standard Score	0.84 (.10)	0.64–1.04	<.0001
PLS4 Auditory Comprehension Standard Score	0.70 (.09)	0.52–0.87	<.0001

Table 3Tests of study hypotheses based on full and nested structural models^a

	β (SE)	95% CI ^c	<i>p</i>
Step 1:			
<i>Nested model eliminating Infant Communication</i>			
Cognitive Stimulation → Toddler Language	0.20 (.10)	0.002–0.40	.048
Step 2:			
<i>Nested model eliminating Cognitive Stimulation</i>			
Cognitive Stimulation → Infant Communication	0.63 (.07)	0.48–0.77	<.0001
Step 3:			
<i>Full structural model adjusting for Cognitive Stimulation</i>			
Infant Communication → Toddler Language ^c	0.49 (.16)	0.17–0.81	<.0001
Step 4:			
<i>Full structural model adjusting for Early Communication</i>			
Cognitive Stimulation to 24 Month Language	–0.12 (.17)	–0.45–0.22	.49

^a All models were adjusted for impacts of maternal education, maternal depressive symptoms, SES, and child gender^b Standardized regression coefficients and standard errors^c 95% Confidence Intervals for standardized regression coefficients

Table 4

The Direct Effect of Cognitive Stimulation on 6 Month Communication and Indirect Effect on 24 Month Language^a

<u>StimQ Subscale</u>	Direct Effects on Infant Communication			Indirect Effect on Toddler Language		
	<u>Coef.^b</u>	<u>SE</u>	<u>95% CI^c</u>	<u>Coef.^b</u>	<u>SE</u>	<u>95% CI^c</u>
ALM	0.04 (.02)		0.01–0.08	0.25 ***	1.16 (.45)	0.28–1.59 *
READ	0.01 (.00)		0.00–0.02	0.27 ***	0.32 (.12)	0.07–0.56 *
PIDA	0.05 (.02)		0.02–0.08	0.42 ***	1.44 (.48)	0.50–2.38 ***
PVR	0.04 (.01)		0.02–0.06	0.45 ***	0.94 (.33)	0.28–1.59 ***
Overall STIMQ	0.06 (.02)		0.02–0.09	0.63 ***	1.56 (.49)	0.61–2.51 ***

* $p < .05$;

** $p < .01$;

*** $p < .001$;

$t_p < .10$

^a Analyses adjusted for maternal education, maternal depressive symptoms, SES and child gender.

^b Unstandardized Regression Coefficients

^c 95% Confidence Intervals for the unstandardized regression coefficients