Enhancing Parent Talk, Reading, and Play in Primary Care: Sustained Impacts of the Video Interaction Project

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Objective To determine the early impacts of pediatric primary care parenting interventions on parent cognitive stimulation in low socioeconomic status families and whether these impacts are sustained up to 1.5 years after program completion.

Study design This randomized controlled trial included assignment to 1 of 2 interventions (Video Interaction Project [VIP] or Building Blocks) or to a control group. Mother–newborn dyads were enrolled postpartum in an urban public hospital. In VIP, dyads met with an interventionist on days of well-child visits; the interventionist facilitated interactions in play and shared reading through provision of learning materials and review of videotaped parent–child interactions. In Building Blocks, parents were mailed parenting pamphlets and learning materials. We compare the trajectories of cognitive stimulation for parents in VIP and control from 6 to 54 months.

Results There were 546 families that contributed data. VIP was associated with enhanced reading, parent verbal responsivity, and overall stimulation at all assessment points, with analyses demonstrating a 0.38 standard deviation increase in cognitive stimulation overall. Trajectory models indicated long-term persistence of VIP impacts on reading, teaching, and verbal responsivity.

Conclusions VIP is associated with sustained enhancements in cognitive stimulation in the home 1.5 years after completion of the program and support expansion of pediatric interventions to enhance developmental trajectories of children of low socioeconomic status. *(J Pediatr 2018;199:49-56).*

Trial registration Clinicaltrials.gov: NCT00212576.

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Differences in the early home environment related to the amount of cognitive stimulation provided by parents, such as reading, teaching, and overall verbal responsivity, explain much of the variance in child developmental outcomes.[1-4] Furthermore, evidence suggests that both the quantity and quality of these interactions in the home vary markedly by socioeconomic status (SES).[5-7] Therefore, parent–child interactions are important targets for preventive interventions aiming to reduce poverty-related disparities in developmental outcomes.

The pediatric primary care platform offers unique opportunities to widely implement strategies to bolster parent–child interactions and prevent the emergence of poverty-related disparities; this is due to the near universality of access, the frequency of contact, and the potential for low cost afforded by leveraging existing resources.[8] The Video Interaction Project (VIP) is a pediatric healthcare intervention, built on the Reach Out and Read (ROR) model,[9,10] which is designed to capitalize on these opportunities beginning at birth. VIP provides learning materials, such as toys and books, and uses review and reinforcement of positive parenting behaviors in the context of videotaped parent–child interactions, led by a designated parenting coach who meets one on one with families at the time of well-child visits. In a pilot randomized, controlled trial, VIP was found to enhance parenting, including reported reading, teaching, and verbal responsivity[11,12] and observed mother utterances.[13] However, because impacts were not assessed beyond the intervention conclusion, it is unknown whether VIP impacts on parenting may be

BB	Building Blocks
ROR	Reach Out and Read
SES	Socioeconomic status
$StimQ_2$-I	StimQ Infant Revised
$StimQ_2P$	StimQ Preschool Revised
$StimQ_2T$	StimQ Toddler Revised
VIP	Video Interaction Project

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sustained long term, an important criterion for program effectiveness as highlighted by the US Department of Health and Human Service.[14] A second, larger randomized, controlled trial called the Bellevue Project for Early Language, Literacy, and Education Success, continued follow-up of VIP families beyond intervention conclusion and is providing the opportunity to address this need. This randomized, controlled trial also includes a sample with greater sociodemographic diversity than the prior randomized, controlled trial, particularly regarding level of education and social risk, and helps to determine whether VIP impacts on parenting extend to a broader population of low SES families. In this randomized, controlled trial, VIP is being evaluated alongside a lower intensity intervention called Building Blocks (BB) and a control group receiving ROR as standard of care. Early findings from this randomized, controlled trial reported the emergence of parenting impacts at child age 6 months related to both VIP and BB, with effects of VIP being more robust and pronounced.[15] The primary goal of the current investigation is to assess whether these early VIP impacts were sustained over the intervention period as well as at 1.5 years after intervention completion. We hypothesized that VIP would be associated with enhanced parenting compared with controls, with impacts sustained beyond program completion. We also investigated whether BB would continue to be associated with enhanced parenting during late infancy/toddlerhood.

Methods

We performed a single-blind, 3-way randomized, controlled trial, with parent–child dyads assigned to 1 of 2 intervention strategies (VIP and BB) or to a control group receiving ROR only (as standard of care). Institutional review board approval was obtained from New York University School of Medicine, Bellevue Hospital Center, and the New York City Health and Hospitals Corporation. Parents provided informed consent before participation. The trial was registered at clinicaltrials.gov (NCT00212576).

Enrollment was performed in the postpartum ward of an inner-city public hospital (Bellevue Hospital Center) serving low SES, primarily immigrant families, between November 2005 and October 2008. Consecutive mother–newborn dyads planning to receive pediatric primary care at our institution and meeting eligibility criteria were enrolled, designed to provide homogeneity of medical status across groups, enhance feasibility, and reduce likelihood of receipt of prior/concurrent comparable services. Eligibility criteria were: 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), birth weight >2500 g, and singleton gestation. Feasibility criteria were: mother as primary caregiver, mother able to maintain contact (working phone, intention to maintain geographic proximity), and mother's primary language English or Spanish. Criteria for no prior or concurrent services were: mother >18 years (because adolescent mothers routinely receive parenting services at our institution) and no participation in a prior study of VIP or BB.

After enrollment, dyads were randomized to VIP, BB, or control using a random number generated using Microsoft Excel (Microsoft, Inc, Redmond, Washington). Randomization group assignments were concealed from research assistants performing enrollment. Families in all groups received the same well-child care, delivered by the same primary care pediatricians. Beginning at 6 months of age, all families received ROR as standard of care. VIP, BB, and control, the 3 groups analyzed in this study, are described.

VIP

VIP, which has been previously described,[16-19] takes place from birth to 3 years, with up to fifteen 25- to 30-minute sessions taking place primarily on the day of primary care visits. Sessions are facilitated by an interventionist, who meets one on one with families, providing an individualized, relationship-based intervention. At each session, parent–child dyads are video-recorded for approximately 5 minutes while interacting with a developmentally appropriate toy and/or book provided by the program. These recorded interactions are then reviewed together by the interventionist and the parent, while the interventionist indicates instances of positive parenting behaviors during the interaction (eg, responding to vocalizations, engaging in conversation), in effect reinforcing these behaviors and promoting self-reflection on the part of the parent. To promote generalization of positive parenting behaviors in the home, the video is given to the parent to take home, along with the learning material used in the interaction. Parents are also given pamphlets that provide suggestions for interactions in the contexts of play, shared reading, and everyday routines, and also encouraged to develop plans for interactions to promote their child's development. VIP is estimated to cost $150-$200 per child per year at scale.[13]

BB

As described,[16,19] BB uses mailed parenting pamphlets and learning materials to promote parenting self-efficacy and positive parent–child interactions. Each month, parents are mailed a toy or book, along with a newsletter that provides information on encouraging learning and ideas for interactions around a specific developmental goal. Parents are also asked to fill out the Ages and Stages developmental questionnaires every 4-6 months. BB has an estimated cost of $75-$100 per child per year.[19]

Control

As described, control families received all standard pediatric care, including all routine anticipatory guidance, and developmental surveillance. In addition, ROR was delivered to participants in all 3 groups.

Measures

As described elsewhere, we assessed baseline sociodemographic and other data characterizing the sample based on parental interview at enrollment.[15] For parents, this included mother's age, country of origin, education level, primary language spoken, and marital status, and family Hollingshead Four

Factor SES based on parental education and occupation.[20] As in previous studies,[17,19] mothers were considered to be at increased social risk if they had one or more of the following: homelessness, being a victim of violence, having involvement with child protective services, financial difficulties, food insecurity, smoking or alcohol use during pregnancy, or having a history of prior mental illness including depression. For the child, we obtained information about sex and birth order. In addition, at the 6-month assessment, we assessed maternal literacy in the mother's preferred language using the Woodcock-Johnson III[21]/Bateria III Woodcock-Muñoz Tests of Achievement,[22] and the Letter-Word Identification Test.

Dependent Variables

We assessed parent cognitive stimulation in the context of play, shared reading, and daily routines using the $StimQ_2$-Infant ($StimQ_2$-I) at child age 6 months, the $StimQ_2$-Toddler ($StimQ_2$-T) at child ages 14 and 24 months, and the $StimQ_2$-Preschool ($StimQ_2$-P) at ages 36 and 54 months. The StimQ uses a structured interview with the child's caregiver to assess interactions in the home[23] and has been validated, and recently revalidated for use in low SES populations in English and Spanish.[24,25] The $StimQ_2$-I, $StimQ_2$-T, and $StimQ_2$-P consist of 4 subscales, which are summed together for a total score ($StimQ_2$-I range 0-42, $StimQ_2$-T range 0-46, and $StimQ_2$-P range 0-60). Availability of Learning Materials assesses learning materials such as toys provided by the caregiver in the home ($StimQ_2$-I range 0-6, $StimQ_2$-T range 0-7, and $StimQ_2$-P range 0-8). Reading Activities assesses number and diversity of books read to the child, frequency of reading activities, and associated interactions ($StimQ_2$-I range 0-15, $StimQ_2$-T range 0-19, and $StimQ_2$-P range 0-18). Parental Involvement in Developmental Advancement assesses caregiver teaching and play activities, such as naming objects, teaching the child to play with toys, and playing make believe games with the child ($StimQ_2$-I range 0-5, $StimQ_2$-T range 0-5, and $StimQ_2$-P range 0-15). Parental Verbal Responsivity assesses caregiver–child verbal interactions such as talking while feeding and making sounds together ($StimQ_2$-T range 0-16, $StimQ_2$-T range 0-15, and $StimQ_2$-P range 0-19). A limited number of StimQ items were missing due to their inclusion after the initiation of data collection. For those items, mean imputation at the item level was used for calculation of the overall scales used in these analyses. To allow for analyses of trajectories of cognitive stimulation over time based on different versions of the StimQ, z-scores were calculated for StimQ subscale and total scores.

At children's age of 54 months, parent verbal input was also assessed in the context of videotaped shared book reading interactions. For this assessment, parents were asked to share the wordless picture book, *Frog, Where Are You?*[26] with their child in any way that they would at home. They were video recorded and allowed up to 10 minutes to complete the shared book reading interaction. Book reading interactions were transcribed and coded using the Codes for Human Analysis of Transcripts[27] system and analyzed using the Computerized Language Analysis.[27] Collection and transcription of interactions were performed by research associates blinded to group assignment. Three measures of Parent Verbal Input were obtained including Utterances (total number of idea units verbally uttered by mother), Word Types (total number of different words used by the mother), and Word Tokens (total number of words used by the mother).

Statistical Analyses

There were 225 families enrolled per group to provide >80% power to find a 0.67 SD effect for VIP and BB compared with control, assuming 33% attrition. Statistical analyses were performed using Stata SE 14 (StataCorp, College Station, Texas)[28] and IBM SPSS 20 (SPSS, Inc, Chicago, Illinois).[29] All statistical analyses comparing VIP and BB with control for parenting over time were performed based on intention to treat. Owing to limited resources to conduct follow-up assessments, BB was assessed only through 24 months, and thus comparisons including this group were not possible beyond that time point. At age 3 years, VIP and control families were offered participation in a second phase of study that included random assignment to either a preschool component of the VIP intervention (or to control). Although future analyses will address impacts of this preschool component, the focus of the present investigation was limited to impacts of VIP delivered during the birth to age 3 period; therefore, assignment to the preschool intervention was adjusted for in all present analyses involving data beyond 36 months. As noted, differences in parent cognitive stimulation among VIP, BB, and control groups at age 6 months have been published in a prior study.[15] For the current investigation, impacts of VIP and BB on parent cognitive stimulation at ages 14, 24, 36, and 54 months were assessed using multiple regressions, in which VIP and BB were dummy coded and compared with controls. Regression analyses were adjusted for child age and sex (because the outcome variables are not normed for these factors), as well as maternal literacy/education given demonstrated moderation of the outcome variable in prior study of these interventions.[12,16] Effect sizes were calculated using Cohen d. We also performed secondary, within group analyses at 36 and 54 months to determine the effect of VIP dose on parenting outcomes for VIP families. Consistent with prior analyses,[15] we dichotomized the number of VIP visits and used regressions to compare parenting outcomes of those completing at least 5 visits with those completing 1-4 visits. We also performed comparisons of trajectories of parent cognitive stimulation for the VIP and control groups over time from 6 to 54 months using multilevel modeling with age, group, and group × age included as predictors of mean Stim-Q z-scores for total StimQ and each StimQ subdimension. Based on prior analyses showing education to be a moderator of VIP impact and literacy to be a mediator of associations between education and parent–child interaction,[11,12,15] we also used multilevel modeling to determine whether parenting trajectories for VIP and control groups were affected by level of maternal literacy/education (9th grade or higher literacy; education used as proxy for any cases missing literacy) by assessing the significance of a maternal literacy/education by group interaction. Furthermore, based on evidence of increased impacts of VIP on child behavior outcomes

for children in families with greater social risk in this sample,[19] we explored whether trajectories of parenting were moderated by level of social risk by assessing the significance of a social risk by group interaction. Finally, to analyze parent verbal input in the context of parent–child book reading at 54 months, we performed multiple regression analyses, also based on intention to treat and adjusted for child sex, age, and maternal literacy/education, with effect sizes calculated using Cohen d.

Results

Enrollment took place from November 2005 through October 2008. Of 905 eligible dyads, 675 (74.6%) were enrolled and randomized to VIP (n = 225), BB (n = 225), and control (n = 225) (**Figure**; available at www.jpeds.com). All families were allocated to group as randomized and assessed based on group assignment; however, 16 of 225 allocated to VIP attended primary care elsewhere and did not participate in any VIP visits before 36 months. BB families were not followed beyond 24 months.

Of 675 families, 546 (80.7%) were assessed for cognitive stimulation 1 or more times over the course of 5 time points, including 194 of 225 VIP families (86.2%), 160 of 225 (70.7%) BB families, and 192 of 225 controls (85.3%). A total of 1365 observations of cognitive stimulation were recorded. Mean (SD) child age in months at each of the 5 assessments was 6.9 (1.3) at 6 months, 15.5 (1.6) at 14 months, 25.7 (2.3) at 24 months, 39.1 (3.7) at 36 months, and 57.9 (4.5) at 54 months. **Table I** (available at www.jpeds.com) shows the characteristics by group for all participants enrolled at baseline and for those participants with data collected during at least the assessment point. Groups did not differ significantly for any baseline sociodemographic characteristic or for maternal word reading assessed at the 6-month assessment. Dyads assessed during at least 1 assessment point did not significantly differ from those who were not assessed for maternal age, marital status, education, Hollingshead SES, level of social risk, child birth order, or child sex. However, assessed mothers were more likely to speak Spanish as primary language ($P < .001$), to self-identify as Latina ($P < .05$), and to be immigrants to the US ($P < .001$). Of 194 VIP families assessed at 1 or more assessment points, 184 (94.8%) attended at least 1 VIP visit; 130 of these families (67.0%) attended 7 or more of 15 possible visits. There were no adverse events related to participation.

Primary Analyses

Table II shows the impacts of VIP and BB on parent cognitive stimulation at 14 and 24 months. At 14 months, VIP families had increased overall StimQ relative to control with effect size based on Cohen d of 0.54, as well as increased interactions in reading, teaching and verbal responsivity, with an effect size ranging from 0.39 to 0.49, and a marginal increase in the availability of learning materials in the home. At 14 months, BB families engaged in significantly more teaching behaviors than control families (effect size of 0.22). BB families also engaged in more parental verbal responsivity and overall cognitive stimulation, but these differences did not reach significance. At 24 months, VIP was also associated with enhanced reading, verbal responsivity, and overall parent cognitive stimulation when compared with controls, with effect size ranging from 0.27 to 0.36. BB families did not differ from Controls at this timepoint.

Table III shows the impacts of VIP on cognitive stimulation during the preschool period at 36 and 54 months. At 36 months, VIP was associated with enhanced reading, verbal responsivity, and marginally with enhanced overall cognitive stimulation when compared with controls, with effect size ranging from 0.19 to 0.27. Finally, at 54 months, 1.5 years after VIP intervention completion, VIP was associated with significantly enhanced reading, verbal responsivity, and greater overall cognitive stimulation, with effect size ranging from 0.35 to 0.38. VIP at 54 months was also associated with enhanced teaching with effect size of 0.23, but this finding did not reach significance. Within group analyses of families in VIP indicated that greater VIP dose (≥5 doses) was associated with greater overall cognitive stimulation in the home both at 36 months ($\beta = .17$; $P < .05$) and at 54 months ($\beta = .17$; $P < .05$).

Table II. Parenting scores at child age 14 and 24 months*

	14 Months					24 Months				
StimQ subscale	VIP (n = 110)	BB (n = 105)	C (n = 109)	Effect size† BB vs C	Effect size† VIP vs C	VIP (n = 161)	BB (n = 62)	C (n = 151)	Effect size† BB vs C	Effect size† VIP vs C
READ	8.03 (2.68)	7.32 (2.71)	7.16 (2.56)	.09	.39‡	8.44 (2.68)	8.12 (2.45)	7.82 (2.71)	0.15	.27§
PIDA	3.32 (1.54)	3.00 (1.31)	2.67 (1.45)	.27§	.49¶	3.51 (1.36)	3.39 (1.35)	3.39 (1.32)	.06	0.11
PVR	8.61 (3.26)	7.84 (2.78)	7.30 (3.07)	.24**	.48¶	8.77 (3.30)	7.47 (2.71)	7.81 (2.89)	.02	.36‡
ALM	4.27 (1.78)	3.74 (1.68)	3.80 (1.78)	.08	.22**	5.23 (1.69)	5.37 (1.30)	5.19 (1.57)	0.18	.06
StimQ Total	24.20 (7.09)	21.91 (6.35	20.95 (6.43)	.22**	.54¶	25.94 (7.28)	24.33 (5.93)	24.21 (6.45)	0.11	.30‡

ALM, availability of learning materials; *PIDA,* Parental Involvement in Developmental Advancement; *PVR,* Parental Verbal Responsivity; *READ,* reading activities.
Values are Mean (SD).
*Analyses adjusted for child age, sex, and maternal literacy/education.
†Effect size based on Cohen d.
‡$P < .01$.
§$P < .05$.
¶$P < .001$.
**$P < .10$.

Table III. Parenting scores at child age 36 and 54 months

StimQ subscale	36 Months			54 Months		
	VIP (n = 153)	C (n = 149)	Effect size* VIP vs C	VIP (n = 123)	C (n = 130)	Effect size* VIP vs C
READ	8.73 (3.11)	8.09 (3.33)	.23†	10.43 (4.2)	10.00 (4.30)	.35‡
PIDA	6.22 (2.64)	6.39 (2.50)	.03	9.75 (2.72)	9.06 (2.99)	.23§
PVR	5.68 (2.30)	5.15 (2.21)	.27†	9.20 (3.63)	8.10 (3.77)	.36‡
ALM	6.13 (2.28)	5.91 (2.30)	0.13	5.99 (1.50)	5.47 (1.69)	0.10
StimQ total	27.76 (8.21)	25.55 (8.09)	.19§	35.33 (8.82)	32.63 (10.22)	.38‡

Values are mean (SD).
BB not included in table owing to a lack of data beyond 24 months. Analyses adjusted for child age, sex, maternal literacy/education, and assignment to VIP 3-5.
*Effect Size based on Cohen d.
†$P < .05$.
‡$P < .01$.
§$P < .10$.

Table IV shows results from multilevel models of VIP impacts on trajectories of reading, teaching, parent verbal responsivity, availability of learning materials in the home, and overall cognitive stimulation as measured by the StimQ. Results of multilevel modeling yielded a main effect of group, indicating that VIP mothers engaged in more cognitive stimulation than control mothers beginning at child age 6 months and continuing through 54 months; this was true for reading, ($z = 3.78$; $P < .001$), teaching ($z = 2.77$; $P < .01$), parent verbal responsivity ($z = 4.80$; $P < .001$), availability of learning materials in the home ($z = 2.17$; $P < .05$), and overall cognitive stimulation ($z = 4.47$; $P < .001$). The coefficient associated with the effect of overall cognitive stimulation indicated that the cognitive stimulation engaged in by VIP mothers from 6 to 54 months was on average 0.38 SD greater than that engaged in by control mothers. There was a significant group by age interaction found for availability of learning materials in the home ($z = -2.56$; $P < .05$) and marginally significant for overall cognitive stimulation in the home ($z = -1.96$; $P = .05$), suggesting that the group differences on these outcomes over time remained significant, yet decreased. However, for reading, teaching, and verbal responsivity, there was no significant interaction found between group and age, suggesting that the rate of change over time was similar for both the VIP and control groups, after the initial increase experienced by VIP mothers by 6 months of age.

Further analyses were conducted to assess whether maternal literacy/education or level of social risk moderated positive impacts of VIP on cognitive stimulation. Subgroup analyses suggested comparable effect sizes for both literacy (low literacy effect size of 0.33 [$P < .05$]; high literacy effect size of 0.39 [$P < .001$]; interaction $P = .80$) or social risk (low risk effect size of 0.36 [$P < .001$]; high risk effect size of 0.36 [$P < .05$]; interaction $P = .92$), suggesting that associations between VIP and trajectories of parent cognitive stimulation did not vary depending on the levels of these characteristics.

Finally, we performed analyses based on observed measures of parent verbal input in the context of shared wordless picture book reading between mothers and their children at 54 months of age. Findings from these analyses of observed parent behaviors converged with findings obtained from assessment of behaviors using StimQ, demonstrating that participation in VIP was associated with increased parent language input (Table V). In particular, VIP mothers used significantly more utterances altogether, word types (ie, number of different words), and word tokens (ie, total number of words) while sharing a wordless picture book with their children than mothers in the control group.

Discussion

This study demonstrates that pediatric primary care parenting interventions delivered beginning in early infancy can be effective at promoting early and long-lasting changes in positive parenting behaviors with implications for enhancing development and preventing disparities often experienced by children from low SES households. Both interventions studied, VIP and BB, had impacts on aspects of parent–child interaction critical to early development.

In line with earlier findings from a prior[11,12] and the current randomized, controlled trial,[15] VIP and BB, which begin in early infancy, were associated with enhanced parent–child interactions at 14 months. These findings reinforce previous conclusions from prior studies that pediatricians should consider intervening with families beginning in early infancy. In addition, VIP had impacts on parenting that were greater and more robust than those of BB. Participation in VIP was associated with changes in multiple domains of parent cognitive stimulation including reading, verbal responsivity, availability of learning materials, and teaching behaviors during the infancy, toddler, and preschool periods. In contrast, BB was primarily related to enhanced teaching behaviors and only marginally related to enhanced verbal responsivity at child age 14 months. Impacts of BB at 14 months were similar in magnitude to those reported at 6 months; however, unlike at 6 months, BB was not found to be associated with changes in availability in learning materials and reading behaviors at this age. Furthermore, no differences in parenting were associated with BB participation at child age 24 months. The reduced sample size of BB at 24 months may limit interpretability of findings at that time point. However, results could suggest that, although parenting advice given through parenting pamphlets may be sufficient to increase select parenting behaviors, other intervention

Table IV. Multilevel model results: Predictors of StimQ z-scores at 6-54 months

Predictors	Unstandardized coefficients	95% CI	*P* value
StimQ Read			
Main effects model*			
VIP	0.303	0.146 to 0.461	<.001
Age	0.000	−0.002 to 0.003	.78
Interaction model†			
VIP × age	−0.0002	−0.005 to 0.004	.90
Moderation models‡			
VIP × maternal literacy/education	0.011	−0.341 to 0.363	.95
VIP × social risk	0.072	−0.268 to 0.411	.68
StimQ PIDA			
Main effects model*			
VIP	0.196	.057 to 0.334	.01
Age	0.000	−0.003 to 0.003	.84
Interaction model†			
VIP × age	−0.004	−0.010 to 0.001	.11
Moderation models‡			
VIP × maternal literacy/education	0.192	−0.117 to 0.501	.22
VIP × social risk	0.069	−0.138 to 0.275	.51
StimQ Parent Verbal Responsivity			
Main effects model*			
VIP	0.384	0.227 to 0.541	<.001
Age	−0.001	−0.004 to 0.001	.35
Interaction model†			
VIP × age	−0.003	−0.008 to 0.001	.14
Moderation models‡			
VIP × Maternal literacy/education	0.05	−0.301 to 0.401	.78
VIP × social risk	−0.04	−0.274 to 0.195	.74
StimQ Availability of Learning Materials			
Main effects model*			
VIP	0.174	0.017 to 0.331	.03
Age	−0.00001	−0.003 to 0.003	.99
Interaction model†			
VIP × age	−0.006	−0.010 to −0.001	.01
Moderation models‡			
VIP × maternal literacy/education	−0.111	−0.463 to 0.241	.54
VIP × social risk	0.045	−0.191 to 0.280	.71
StimQ Total			
Main effects model*			
VIP	0.375	0.211 to 0.540	<.001
Age	−0.0002	−0.002 to 0.003	.84
Interaction model†			
VIP × age	−0.004	−0.008 to 0.000	.05
Moderation models‡			
VIP × maternal literacy/education	0.048	−0.320 to 0.417	.80
VIP × social risk	0.016	−0.230 to 0.262	.90

*Adjusts for child sex, child age, maternal literacy/education, and 3-5 at 54 months. Coefficients for VIP represent the difference in z scores for VIP compared with control across the 6- to 54-month period.
†Includes all predictors from main effects model in addition to listed interaction terms. Coefficients represent difference in slope between 6 and 54 months for VIP compared with control.
‡Two separate models including all predictors from the main effects model in addition to listed interaction terms. Coefficients represent the difference in VIP impact for different levels of maternal literacy/education and social risk.

Table V. VIP impacts on observed parenting at 54 months

Verbal input variable	VIP (n = 119)	C (n = 111)	*P* value*	Effect size
Mother, no. of utterances	148.61 (58.13)	132.58 (57.45)	.04	0.29
Mother, no. of word types	161.05 (53.96)	147.41 (49.57)	.03	0.30
Mother, no. of word tokens	534.97 (217.86)	476.4 (209.81)	.03	0.30

Values are mean (SD).
**P* value based on multiple adjusted regression adjusting for child age, child sex, and maternal literacy/education.

components used by VIP but not BB, such as modeling, video-prompted self-reflection, and provision of social support through a relationship with an interventionist, may be important for targeting other parenting behaviors, such as reading and other aspects of parenting responsivity more broadly. Future research delineating which intervention components are most predictive of its efficacy would be useful for dissemination of this model in primary care.

The effects of VIP on parenting were robust and experienced long term. In cross-sectional analyses, VIP was associated with significant enhancements in overall parent cognitive stimulation, reading behaviors, and parent verbal responsivity at ages 24, 36, and 54 months. Sustained impacts of VIP were further supported by analyses of parenting trajectories using multilevel modeling. Findings demonstrated that the impacts of VIP on parenting, including reading, teaching, verbal responsivity, and availability of learning materials in the home experienced by 6 months persisted through child age 54 months, 1.5 years after intervention completion. Significant age by group interactions in multilevel models reveal diminishing impact over time for provision of learning materials in the home, but no age by group interaction was observed for other parenting measures, indicating persistence of early VIP impacts on reading, teaching, and verbal responsivity. Variability in persistence of outcomes suggest that VIP, despite distributing learning materials to families, may not meaningfully be affecting the availability of learning materials in the home per se after infancy, but rather is changing the way in which parents interact with their children with the materials that they do have; further study is needed to disentangle the effects of the intervention on these different aspects of parenting. Unlike prior analyses of VIP's impact on socioemotional development,[19] VIP's impact on parenting was not found to vary with of social risk; this suggests that there may be some differences in the mechanisms by which these domains are affected by VIP. Additionally, current findings yielded comparable impacts on parenting regardless of maternal literacy/education, differing from prior analyses demonstrating some reduction in impacts on parent cognitive stimulation for families with very low literacy.[15] Although additional study, including qualitative research, would be needed to understand why this was the case, findings suggest the possibility that cumulative exposure to VIP may have resulted in greater impacts for these families.

Demonstration of long-term VIP impacts on parenting was additionally supported in this study with evidence from

observed parent verbal input, including increased number of utterances, word types, and word tokens in the context of parent–child book reading at 54 months of age. Taken together, evidence demonstrates the potential of parenting interventions in pediatric primary care to lead to meaningful changes in parenting that are sustained over a year beyond program completion, meeting this aforementioned key aspect of program effectiveness as detailed by the US Department of Health and Human Service.[14] Ongoing study of the cohort will assess whether these ongoing impacts of VIP on parenting are also related to developmental outcomes as well as early school achievement.

Effect sizes on parent cognitive stimulation found for mothers who participated in VIP are comparable with those seen in other platforms for intervention during the infant–toddler period, including home visitation and center-based programs,[30-32] as well as to those seen in other programs using review of videotaped interactions to promote self-reflection such as Play and Learning Strategies.[33] Future consideration should be given to how videotaped interactions can also be used in primary care therapeutically to foster positive parent–child interactions for families identified to have particularly high risk in this area, as done in programs such as the Circle of Security.[34] Although some effects became more modest over time, effects on parent reading and teaching and verbal responsivity were robust and long lasting, with evidence of continued measurable differences in parenting behaviors 1.5 years after the conclusion of the VIP program. Such differences in the early home environment are likely to have cascading impacts on domains of child development important for transition to school and early academic achievement.[1,5] Given the relatively lower cost associated with pediatric primary care parenting interventions,[8] and the opportunity for population-wide application, findings may have important implications for public health policy.

There were 3 main limitations to this study. First, owing to limitations in resources, we were unable to follow BB fully beyond 14 months, or at all beyond 24 months. The smaller sample size of the BB group at 24 months may have left analyses underpowered to detect impacts of BB at this timepoint. Second, results at 6-36 months were based entirely on parent report, which, despite being obtained from measures that are reliable and valid, can be subject to biases. However, results converged with observed measures of verbal input at 54 months in shared book reading interactions. Third, participating mothers were primarily first generation, Hispanic/Latina immigrants, and results therefore may not generalize to families with other sociodemographic characteristics.

In conclusion, this study provides evidence that pediatric primary care parenting interventions for low SES families from birth to 3 years can result in sustained enhancements in parent–child interactions critical for early development and school readiness. Findings contribute support for the introduction of these programs in infancy, and suggest that ongoing implementation may have continued impacts before school entry. Given the potential for low cost and for population-level reach offered by the primary care platform, findings suggest that intervention strategies using this platform may play an important role in enhancing the early home environment and thereby preventing poverty-associated disparities in readiness for school. ■

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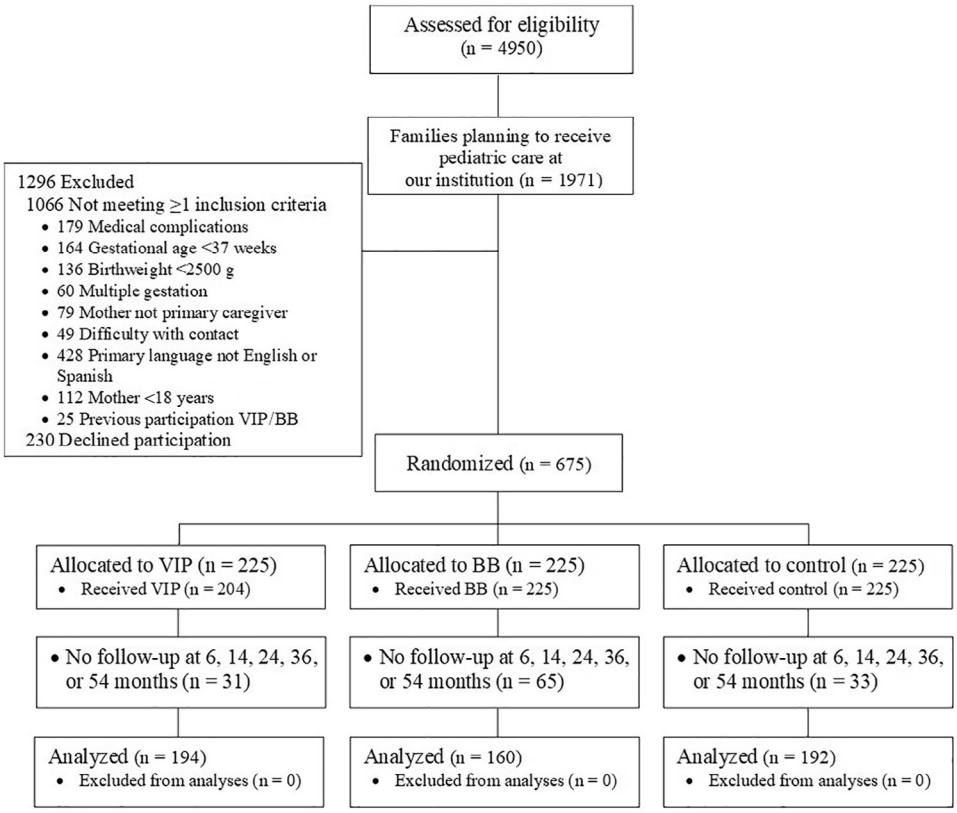

Figure. Participant enrollment and assessment.

Table I. Demographic characteristics of analytic sample

Characteristic	VIP (n = 194), %	BB (n = 159), %	C (n = 192), %	*P* value*
Mother <age 21	10	13	10	.75
Hispanic	93	95	91	.28
Non-high school graduate	61	51	60	.13
Born outside US	90	85	85	.25
Married/partner	83	87	84	.53
Spanish speaking	81	77	79	.71
Low SES	92	87	91	.27
Female child	54	50	48	.51
First born child	43	40	38	.57
Low maternal literacy (<9th grade)	32	31	23	.12
High social risk	35	28	36	.94

*P value based on χ^2 tests.