ARTICLE

Primary Care Strategies for Promoting Parent-Child Interactions and School Readiness in At-Risk Families

The Bellevue Project for Early Language, Literacy, and Education Success

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Objective: To determine the effects of pediatric primary care interventions on parent-child interactions in families with low socioeconomic status.

Design: In this randomized controlled trial, participants were randomized to 1 of 2 interventions (Video Interaction Project [VIP] or Building Blocks [BB]) or the control group.

Setting: Urban public hospital pediatric primary care clinic.

Participants: Mother-newborn dyads enrolled post partum from November 1, 2005, through October 31, 2008.

Interventions: In the VIP group, mothers and newborns participated in 1-on-1 sessions with a child development specialist who facilitated interactions in play and shared reading by reviewing videos made of the parent and child on primary care visit days; learning materials and parenting pamphlets were also provided. In the BB group, parenting materials, including age-specific newsletters suggesting interactive activities, learning materials, and parent-completed developmental questionnaires, were mailed to the mothers.

Main Outcome Measures: Parent-child interactions were assessed at 6 months with the StimQ-Infant and a 24-hour shared reading recall diary.

Results: A total of 410 families were assessed. The VIP group had a higher increased StimQ score (mean difference, 3.6 points; 95% confidence interval, 1.5 to 5.6 points; Cohen d, 0.51; 0.22 to 0.81) and more reading activities compared to the control group. The BB group also had an increased overall StimQ score compared with the control group (Cohen d, 0.31; 95% confidence interval, 0.03 to 0.60). The greatest effects for the VIP group were found for mothers with a ninth-grade or higher reading level (Cohen d, 0.68; 95% confidence interval, 0.33 to 1.03).

Conclusions: The VIP and BB groups each led to increased parent-child interactions. Pediatric primary care represents a significant opportunity for enhancing developmental trajectories in at-risk children.

Trial Registration: clinicaltrials.gov Identifier: NCT00212576

Arch Pediatr Adolesc Med. 2011;165(1):33-41

During the past 3 decades, a broad national consensus has emerged identifying poverty-related disparities in child development and school readiness as a critical public health problem.[1,2] Children growing up in poverty

See also page 42

fall behind their middle-class peers in development from the time they say their first words, usually shortly after their first birthday.[3] In a 2009 population-based analysis,[4] 40% of low-income eighth graders performed below the basic level for their age group in reading. Verbal interactions between parents and children in the context of play and shared reading are critical for school readiness but less frequent in families with low socioeconomic status (SES).[5,6]

Pediatric primary health care provides a substantial opportunity for population-wide, low-cost, early childhood preventive interventions to promote parent-child interactions and school readiness. Reasons include the frequency and near universality of visits, the close relationship between parents and health care professionals, the ability to use existing health care infrastructure, and the lack of need for additional travel. The most studied model for using pediatric primary health care to promote school readiness is Reach Out and Read (ROR), in which health care professionals provide children's books,

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guidance, and modeling of reading activities during well-child care visits beginning at age 6 months. Consistent effects on shared reading and development have been found for ROR despite its low intensity and cost.[7-10]

There is currently insufficient evidence to determine the optimal timing and intensity of primary care interventions to promote parent-child interaction and child development in children from families with low SES. We designed the Bellevue Project for Early Language, Literacy, and Education Success (BELLE Project) to assess, through a randomized controlled trial (RCT), whether providing a primary care intervention before the beginning of ROR at 6 months and in addition to ROR after it has begun would result in an increased positive effect. This RCT compares 2 interventions that build on ROR: the Video Interaction Project (VIP) and Building Blocks (BB). The VIP and BB interventions add to ROR by beginning earlier (during the first 2 weeks of life), by providing learning materials such as toys in addition to books, and by including additional strategies for enhancing interactions. We hypothesized that VIP and BB would each be associated with enhanced parent-child interaction compared with the control group and that VIP would have greater effects than BB.

METHODS

STUDY DESIGN

Ours was a single-blind, 3-way RCT, with 2 intervention-strategies groups (VIP and BB) compared with a control group. 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).

STUDY SAMPLE

Enrollment was performed in the postpartum ward of an inner-city public hospital (Bellevue Hospital Center) serving familes with low SES, primarily from immigrant backgrounds, from November 1, 2005, through October 31, 2008. We enrolled consecutive mother-newborn dyads who planned to receive pediatric primary care at our institution and met additional eligibility criteria. These criteria were chosen to provide medical homogeneity, enhance feasibility, and reduce the likelihood of receiving comparable services. Medical criteria were a lack of significant complications requiring extended stay, transfer to a level II/III nursery, or potential adverse developmental consequences; full-term birth at 37 weeks or more; birth weight of 2500 g or more; and singleton gestation. Feasibility criteria were mother as the primary caregiver, ability to maintain contact (working telephone and intention to maintain geographic proximity), and primary language of English or Spanish. Criteria for no comparable services were maternal age 18 years or older (adolescent mothers routinely receive parenting services at our institution) and no participation in the prior study of VIP or BB.

RANDOMIZATION GROUPS

After enrollment, dyads were randomized to the VIP, BB, or control group using a random number generated by the project director via Microsoft Excel 2003 (Microsoft Corp, Redmond, Washington). Randomization was stratified in blocks of 9 to guarantee equal distribution across groups. Randomization group assignments were concealed from the research assistants who performed the enrollment. After enrollment, randomization group assignments were provided to study participants.

The VIP, BB, and control groups received the same well-child care provided by the same primary care pediatricians. All 3 groups were scheduled to receive ROR during routine care beginning at 6 months. Reminder telephone calls were made regarding upcoming pediatric visits to equalize primary care across groups.

VIP Group

The VIP intervention, which has been previously described,[11,12] takes place from birth to 3 years, with fifteen 30- to 45-minute sessions taking place mostly on the day of primary care visits. Sessions are facilitated by a child development specialist (CDS) who meets 1-on-1 with families, providing an individualized, relationship-based intervention.[13,14] The CDS delivers a curriculum focused on supporting verbal interactions in the context of pretend play, shared reading, and daily routines. The VIP intervention uses the following strategies:

1. Videotaping of mother-child interaction: A 5- to 10-minute videotape or DVD is created and reviewed of each dyad engaging in activities suggested and modeled by the CDS using provided developmentally appropriate learning material. The mother and CDS watch the tape or DVD together, with the CDS making observations about the mother's interactions with her child. The CDS reinforces positive interactions (eg, the mother responding to the child's vocalizations or engaging the child in back-and-forth conversation as the child develops language) and provides suggestions regarding opportunities for interaction. The mother takes home a copy of the tape or DVD to support the implementation of activities in the home and encourage sharing with other family members.
2. Provision of learning materials: Developmentally appropriate, stimulating learning materials are given to families at each visit to take home. These were selected to promote cognitive stimulation, verbal engagement, and emergent literacy. Learning materials provided before 6 months are a lullaby audiocassette or CD, plush shapes with contrasting patterns, a mirror, keys on a plastic ring, and a cloth book.
3. Pamphlets: Messages are reinforced using written, visit-specific pamphlets that the CDS reviews with each mother. Pamphlets include suggestions for interacting with the child through play, shared reading, and daily routines. Pamphlets were developed in English and Spanish and written at a fourth- to fifth-grade reading level using "plain language" principles.[15] The CDS encourages the parent to show the pamphlet to the primary health care professional provider (ie, physician or nurse practitioner), who further reinforces messages.

BB Group

The BB intervention also takes place from birth to 3 years. As with VIP, BB delivers a curriculum focused on supporting verbal interactions in the context of pretend play, shared reading, and daily routines. In contrast to VIP, this curriculum is delivered through written pamphlets and learning materials mailed on a monthly basis to the family. The BB intervention uses the following strategies:

1. *Building Blocks* newsletters (*Primeros Pasos* in Spanish): On a monthly basis, age-specific newsletters are designed to encourage parents to interact with their child around a specific developmental activity, building on "parent education by

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mail."[16-18] The newsletters provide specific information on child development, play and learning activities, and general parenting information (eg, feeding and discipline). Newsletters have a clean, simple, user-friendly format and are written at a third-to-fourth-grade reading level.

2. Learning materials: A developmentally stimulating toy, book, or other type of learning material is mailed on a monthly basis with each newsletter. Learning materials provided before 6 months are a music audiocassette, pattern cards, a rattle, a teething toy, a mirror, and a feeding dish. Learning materials are highlighted in the newsletter with suggestions for use in engaging the child.

3. Parent-completed questionnaires: Two to 3 times a year, parents are mailed written developmental questionnaires (Ages and Stages Questionnaires[19] and open-ended questions about BB content) to complete and return, with the goal of encouraging them to observe their child's development and accomplish ongoing developmental screening. When questionnaires suggest possible delay in age-appropriate development, the program contacts the parent and primary heath care provider to coordinate further assessment or a referral to early intervention.

Control Group

Control families received all standard pediatric care. This included all routine anticipatory guidance and developmental surveillance.

OUTCOME MEASURES

Bilingual research assistants masked to group assignment performed assessments. We assessed parent-child interactions in the context of play, shared reading, and daily routines when the child was 6 months old. Two instruments were used:

1. StimQ: This assessment uses a structured interview with the child's caregiver to assess interactions in the home.[20] It is validated for use in low-SES populations whose primary language is English or Spanish[21] and has been used in recent studies[22,23] of early child development. It has good internal consistency (Cronbach $\alpha = .88$), test-retest reliability (intraclass correlation coefficient = 0.93), and criterion-related validity (correlation with the Home Observation for Measurement of the Environment Inventory: $r = 0.5$-0.6). It also has good concurrent validity with cognitive and language measures ($r = 0.3$-0.5). The StimQ-Infant consists of 4 subscales, which are summed for a total score (range, 0-43). Availability of Learning Materials assesses learning materials, such as toys, provided by the caregiver in the home (range, 0-6). Reading Activities assesses number and diversity of books read to the child, frequency of reading activities, and associated interactions (range, 0-19). 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 (range, 0-7). Parental Verbal Responsivity assesses caregiver-child verbal interactions, such as talking while feeding and making sounds together (range, 0-11). In addition, new StimQ items were piloted in preparation for possible inclusion in an updated instrument.

2. Reading diary: We used a 24-hour recall diary based on an interview with the mother as an additional measure of reading activities in the home. Use of this diary represents an extension of previous work by some of us[24,25] measuring media exposure, with validity supported by many studies.[24-27] We asked the mother to provide information about any reading or storytelling involving the infant that had taken place during the last typical day, including the material used (eg, book or magazine) and time spent for each reading activity that had taken place. We calculated total daily duration by adding each exposure during the 24-hour period.

SOCIODEMOGRAPHIC CHARACTERISTICS

We assessed sociodemographic characteristics based on parental interview at enrollment. Characteristics included mother's age, country of origin, educational level, primary language spoken, marital status, and family Hollingshead SES.[28] Mothers were considered to be at increased social risk if they met 1 or more of the following criteria: being homeless, having experienced violent victimization, being involved with Child Protective Services, having received limited or late prenatal care (defined as beginning beyond the third month of pregnancy), or having a history of mental illness. For the child, we determined sex and birth order. At the 6-month assessment, we assessed maternal literacy in the mother's preferred language using the Woodcock-Johnson III/Bateria III Woodcock-Muñoz Tests of Achievement, Letter-Word Identification Test[29]; this test correlates moderately with, but tends to overestimate, reading comprehension.[30]

STATISTICAL ANALYSIS

A total of 225 families were enrolled per group to provide 90% power to find 0.67 SD effects for the VIP group compared with the control group and 80% power to provide 0.33 SD effects for the BB group compared with the control group, assuming 33.3% attrition by the age of 3 years. Statistical analyses were performed using SPSS statistical software, version 17.0 (SPSS Inc, Chicago, Illinois). Primary statistical analyses comparing groups for parent-child interactions were performed based on intention to treat. We performed comparisons of means using analysis of variance, with planned post hoc analyses by the Tukey honestly significantly different test; effect sizes were obtained using mean differences with associated 95% confidence intervals (CIs) and also calculated using Cohen d for purposes of comparability with related studies. We performed comparisons of frequencies using χ^2 tests, with continuity correction for 2×2 tables, and planned post hoc analyses using the Keppel modified Bonferroni correction for multiple χ^2 tests.[31] On the basis of prior analyses[11,12] showing education to be a moderator of VIP effect and literacy to be a mediator of associations between education and parent-child interaction,[22] we performed subgroup analyses in which we compared mothers with low literacy levels (less than ninth grade) to those with literacy levels of ninth grade or higher; for 38 cases with missing literacy data, educational level was used as a proxy. We performed exploratory analyses comparing groups for individual StimQ items to further define effects. Finally, we performed secondary, within-group analyses of dose effect for VIP families. Because the VIP visit rate was skewed among families assessed at 6 months, with more than two-thirds completing all 4 visits, we dichotomized the number of VIP visits and compared those completing all 4 visits with those completing 1 through 3 visits. Unadjusted analyses were performed using independent-sample *t* tests; adjusted analyses were performed using multiple regression, including all sociodemographic characteristics. Within-group analyses were not performed for the BB families because no comparable marker of dose effect was available.

RESULTS

STUDY SAMPLE

Enrollment took place from November 1, 2005, through October 31, 2008. Of 905 eligible dyads, 675 (74.6%) were enrolled and randomized to the VIP (n = 225), BB (n = 225), or control (n = 225) group (**Figure**). All families were al-

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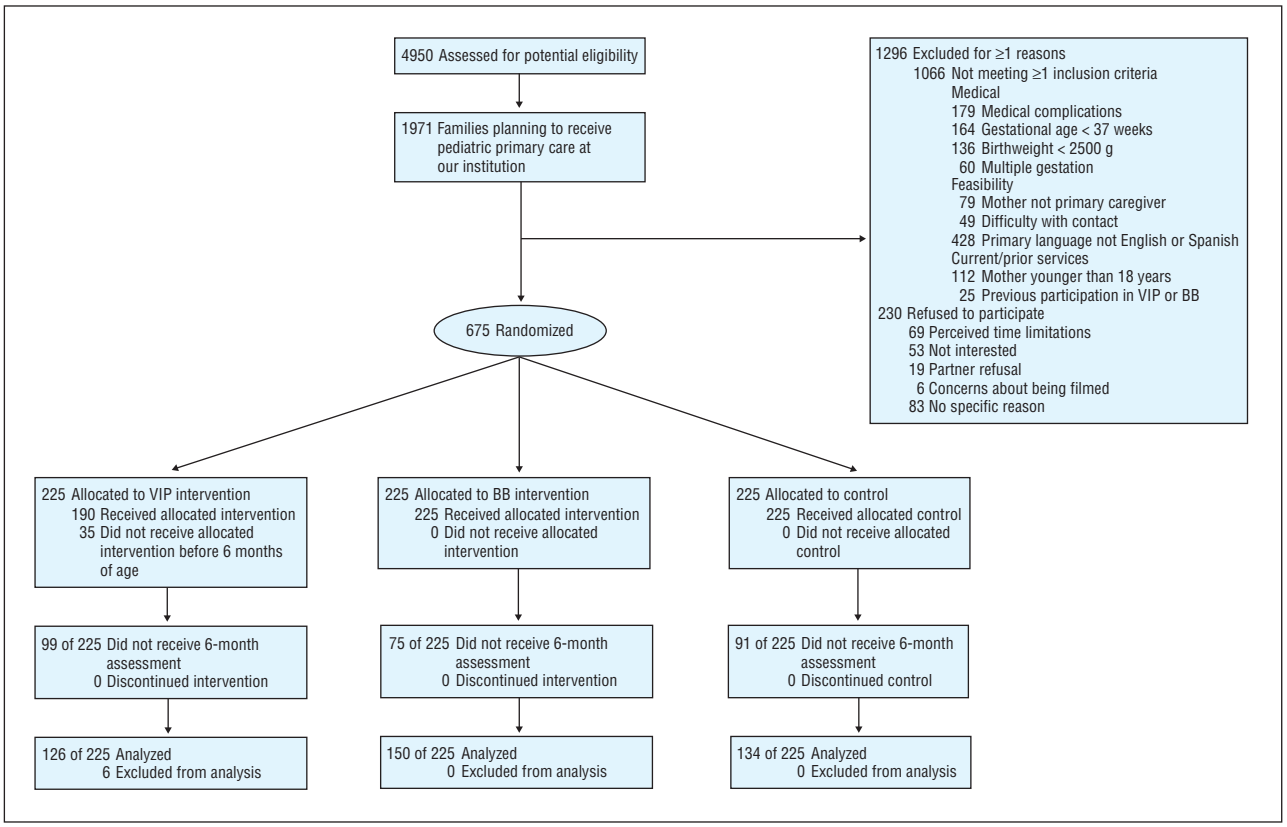

Figure. Participant enrollment and assessment. BB indicates Building Blocks; VIP, Video Interaction Project.

Table 1. Characteristics at Enrollment and 6 Months[a]

	Enrollment (Birth)			6-Month Assessment		
Characteristic	**VIP (n=225)**	**BB (n=225)**	**Control (n=225)**	**VIP (n=126)**	**BB (n=150)**	**Control (n=134)**
Mother, %						
Hispanic/Latina	92.4	93.8	88.9	91.3	95.3	92.5
Immigrant	87.6	80.9	82.7	89.7	86.0	88.1
Spanish as primary language	78.2	73.8	75.6	80.2	79.3	85.8
Married or living with partner	83.1	83.1	83.6	82.5	86.7	82.8
Maternal educational level, mean (SD)[b]	10.0 (3.7)	10.5 (3.7)	10.5 (3.5)	10.2 (3.7)	10.3 (3.7)	9.6 (3.5)
Maternal literacy, word reading, mean (SD)[c]	NA	NA	NA	12.4 (4.8)	12.5 (5.0)	12.6 (4.6)
Maternal low SES, %[d]	90.5	88.1	90.9	89.7	87.9	91.7
Maternal social risk factors, %[e]	23.9	22.3	24.9	26.4	22.0	22.0
Child, %						
Female sex	52.9	45.3	48.9	54.0	51.3	50.0
Firstborn	42.2	41.3	39.1	42.1	40.7	41.8

Abbreviations: BB, Building Blocks; NA, not applicable; SES, socioeconomic status; VIP, Video Interaction Project.
[a] All differences were insignificant at enrollment and at 6-month assessments.
[b] Last grade completed.
[c] Grade level for word reading, measured at 6 months.
[d] Hollingshead SES level of 4 or 5.
[e] One or more of the following conditions: homeless, physically abused, involved with Child Protective Services, limited or late prenatal care (defined as beginning beyond the third month of pregnancy), or a history of mental illness.

located to a group as randomized and assessed based on group assignment; however, 35 of 225 allocated to the VIP group attended primary care elsewhere and did not participate in any VIP visits before 6 months.

A total of 410 families were assessed at a mean (SD) child age of 6.9 (1.3) months, including 126 of 225 VIP families (56.0%), 150 of 225 BB families (66.7%), and 134 of 225 controls (59.6%). **Table 1** gives the characteristics by group at baseline and at 6 months. Groups did not differ for any sociodemographic characteristics or for word reading at enrollment or assessment. Mothers who were assessed did not significantly differ from those who were not assessed for Latino ethnicity, marital status, Hollingshead SES, social risk factors, or child

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Table 2. Effect of VIP and BB on Parent-Child Interaction at 6 Months: Mean (SD) StimQ and Reading Diary Scores

Score	Group, No. (%)					VIP vs Control		BB vs Control	
	VIP (n=126)	BB (n=150)	Control (n=134)	*F*	*P* Value[a]	Mean Difference (95% CI)	ES	Mean Difference (95% CI)	ES
Assessment									
StimQ total	19.9 (7.0)[b]	18.6 (6.8)	16.4 (7.0)[b]	8.70	<.001	3.6 (1.5 to 5.6)	0.51 (0.22 to 0.81)	2.2 (0.2 to 4.1)	0.31 (0.03 to 0.60)
ALM	2.8 (1.1)[b]	2.6 (1.2)	2.3 (1.2)[b]	7.00	.001	0.5 (0.2 to 0.9)	0.46 (0.16 to 0.75)	0.3 (0.01 to 0.7)	0.30 (0.02 to 0.58)
READ	8.0 (4.2)[b]	8.2 (3.7)	6.8 (4.4)[b]	4.83	.008	1.3 (0.1 to 2.5)	0.31 (0.02 to 0.60)	1.4 (0.3 to 2.6)	0.34 (0.06 to 0.62)
PIDA	3.3 (1.6)[b]	2.8 (1.7)[b]	2.5 (1.5)	8.18	<.001	0.8 (0.3 to 1.3)	0.49 (0.20 to 0.79)	0.2 (–0.2 to 0.7)	0.15 (–0.14 to 0.43)
PVR	5.7 (2.6)[b]	5.1 (2.5)	4.8 (2.3)[b]	4.93	.01	1.0 (0.2 to 1.7)	0.38 (0.08 to 0.67)	0.3 (–0.5 to 1.0)	0.10 (–0.19 to 0.38)
Reading Diary									
Time spent reading, min/d	18.3 (25.6)[b]	15.3 (20.7)	10.8 (16.3)[b]	4.07	.02	7.4 (1.2 to 13.6)	0.35 (0.06 to 0.65)	4.4 (–1.5 to 10.4)	0.21 (–0.07 to 0.49)
Reading, instances/d	1.1 (1.3)[b]	1.0 (1.0)	0.6 (0.7)[b]	7.16	.001	0.5 (0.2 to 0.8)	0.45 (0.16 to 0.74)	0.4 (0.1 to 0.6)	0.33 (0.05 to 0.61)

Abbreviations: ALM, Availability of Learning Materials; BB, Building Blocks; CI, confidence interval; ES, effect size; PIDA, Parental Involvement in Developmental Advancement; PVR, Parental Verbal Responsivity; READ, Reading Activities; VIP, Video Interaction Project.

[a] Omnibus *P* value based on *F* test for analysis of variance.

[b] Letter denotes groups differing at $P<.05$ on post hoc testing by Tukey honestly significantly different test.

birth order or sex. However, assessed mothers had lower educational levels (10.0 vs 10.8 years, $P<.001$) and were more likely to speak Spanish as their primary language (81.7% vs 66.8%, $P<.001$) and be immigrants to the United States (87.8% vs 77.4%, $P<.001$).

Of 126 VIP families assessed at 6 months, 85 (67.5%) attended all 4 visits, 23 (18.3%) attended 3 of 4 visits, 9 (7.1%) attended 2 of 4 visits, 5 (4.0%) attended 1 of 4 visits, and 4 (3.2%) attended no visits. Of 150 BB families assessed at 6 months, BB packages were mailed to 150 (100%) following the BB schedule, and 125 (83.3%) completed and returned the 4-month Ages and Stages Questionnaires. No adverse events were related to participation, to our knowledge.

PRIMARY ANALYSES

Table 2 lists the effects of VIP and BB on parent-child interaction. The VIP families had a 3.6-point (95% CI, 1.5 to 5.6 points) increase on average in overall StimQ score, increased interactions in all 4 StimQ domains (provision of toys, reading activities, teaching, and parental verbal responsivity), and increased reading activities (time spent and instances per day) as measured by the reading diary. Overall effect size (ES) based on the Cohen d was 0.51 for StimQ total score and ranged from 0.31 to 0.49 for each of the other measures. The BB families also had enhanced parent-child interaction, including overall score (ES, 0.31), 2 subscales (provision of toys and reading; ES, 0.30 to 0.34), and 1 of the Reading Activities variables measured by the diary (ES, 0.33).

Table 3 lists the effects of VIP and BB on parent-child interaction in subgroups based on maternal literacy. For mothers with a literacy level of ninth grade or higher, VIP was associated with increased overall StimQ score (ES, 0.68) and increased interactions across all subscales (ES, 0.36 to 0.72) and the reading diary (ES, 0.46 to 0.58); BB was associated with increased overall StimQ score (ES, 0.38) and reading activities (ES, 0.40). For mothers with a less than ninth-grade literacy level, the only statistically significant effect was found for BB and related to provision of toys.

Exploratory analyses were conducted to further define the effect of the interventions by relating group status to individual StimQ items. **Table 4** gives the results of these analyses for items selected as illustrative of differences found with $P<.10$. Among the 3 Availability of Learning Materials categories, greater provision of infant toys was associated with both interventions. Children in the VIP and BB groups were reported to have started playing with toys at an earlier age compared with children in the control group. Measures of reading (frequency and interactions), teaching (including naming objects), and responsivity (telling stories and talking about surroundings) indicated increased activities and interactions for the VIP and BB groups.

SECONDARY ANALYSES

Table 5 gives the secondary, within-group analyses of dose effect for families randomized to VIP. Assessed families who attended 4 of 4 visits had significantly increased parental involvement in developmental advancement and parental verbal responsivity compared with those with fewer visits in the unadjusted (ES, 0.51 and 0.39, respectively) and multiple regression analyses adjusting for all sociodemographic variables (0.51 and 0.40, respectively). The overall StimQ score was also somewhat higher (0.31 in adjusted analyses), but this difference was not statistically significant. No relationships were found between attendance at VIP visits and reading diary measures.

COMMENT

Pediatric primary care, which has the potential to provide low-cost parenting interventions that can be applied population-wide beginning early in infancy, represents a significant opportunity for enhancing developmental trajectories among children from families with low SES, who are

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Table 3. Effects of VIP and BB on Parent-Child Interaction at 6 Months: Mean (SD) StimQ and Reading Diary Scores

Factor	VIP	BB	Control	F	P Value[a]	VIP vs Control Mean Difference (95% CI)	VIP vs Control ES	BB vs Control Mean Difference (95% CI)	BB vs Control ES
Literacy Level Less Than Ninth Grade									
StimQ total score	16.4 (6.8)	16.3 (6.7)	14.5 (7.1)	.93	.40	1.9 (–1.9 to 5.6)	0.27 (–0.27 to 0.79)	1.8 (–1.8 to 5.4)	0.27 (–0.26 to 0.79)
ALM score	2.4 (1.1)	2.5 (1.2)[b]	1.9 (1.1)[b]	3.53	.03	0.6 (–0.01 to 1.2)	0.49 (–0.05 to 1.03)	0.6 (0.02 to 1.2)	0.54 (0.02 to 1.05)
READ score	7.1 (4.5)	7.2 (4.1)	6.1 (4.4)	.85	.43	1.0 (–1.3 to 3.3)	0.23 (–0.30 to 0.76)	1.1 (–1.1 to 3.3)	0.26 (–0.24 to 0.77)
PIDA score	2.5 (1.6)	2.7 (1.6)	2.4 (1.4)	.43	.65	0.1 (–0.8 to 0.9)	0.03 (–0.51 to 0.57)	0.3 (–0.5 to 1.1)	0.19 (–0.33 to 0.70)
PVR score	4.4 (2.5)	4.1 (2.2)	4.2 (2.4)	.13	.88	0.2 (–1.1 to 1.5)	0.08 (–0.46 to 0.62)	–0.1 (–1.3 to 1.2)	–0.03 (–0.54 to 0.49)
Reading Diary									
Time spent reading, min/d	13.8 (20.9)	13.6 (16.0)	11.9 (21.4)	.11	.90	1.8 (–8.6 to 12.2)	0.09 (–0.44 to 0.63)	1.7 (–8.1 to 11.4)	0.09 (–0.42 to 0.59)
Reading, instances/d	0.8 (0.9)	1.0 (1.0)	0.7 (0.8)	1.96	.15	0.1 (–0.4 to 0.6)	0.12 (–0.41 to 0.65)	0.4 (–0.1 to 0.8)	0.40 (–0.10 to 0.91)
Literacy Level Ninth Grade or Higher									
StimQ total score	21.5 (6.4)[b]	19.6 (6.6)[b]	17.1 (6.9)[b]	10.1	<.001	4.5 (2.2 to 6.9)	0.68 (0.33 to 1.03)	2.5 (0.2 to 4.8)	0.38 (0.04 to 0.72)
ALM	3.0 (1.1)[b]	2.7 (1.2)	2.4 (1.2)[b]	5.1	.007	0.6 (0.1 to 1.0)	0.47 (0.12 to 0.82)	0.3 (–0.1 to 0.6)	0.21 (–0.12 to 0.56)
READ score	8.5 (4.0)[b]	8.6 (3.4)[b]	7.0 (4.4)[b]	4.7	.01	1.5 (0.05 to 2.9)	0.36 (0.01 to 0.72)	1.6 (0.3 to 3.0)	0.40 (0.07 to 0.74)
PIDA score	3.7 (1.5)[b]	2.8 (1.7)[b]	2.6 (1.6)[b]	12.8	<.001	1.2 (0.6 to 1.7)	0.72 (0.37 to 1.07)	0.2 (–0.3 to 0.8)	0.14 (–0.20 to 0.48)
PVR score	6.4 (2.4)[b]	5.6 (2.5)[b]	5.1 (2.2)[b]	6.4	.002	1.4 (0.5 to 2.2)	0.55 (0.20 to 0.90)	0.5 (–0.4 to 1.3)	0.19 (–0.15 to 0.52)
Reading Diary									
Time spent reading, min/d	20.3 (27.5)[b]	16.1 (22.7)	10.4 (13.7)[b]	4.7	.009	10.0 (2.3 to 17.7)	0.46 (0.10 to 0.81)	5.8 (–1.7 to 13.2)	0.26 (–0.08 to 0.60)
Reading, instances per day	1.3 (1.5)[b]	1.0 (1.1)	0.6 (0.7)[b]	7.7	.001	0.7 (0.3 to 1.0)	0.58 (0.23 to 0.94)	0.3 (–0.04 to 7.2)	0.31 (–0.04 to 0.65)

Abbreviations: ALM, Availability of Learning Materials; BB, Building Blocks; CI, confidence interval; ES, effect size; PIDA, Parental Involvement in Developmental Advancement; PVR, Parental Verbal Responsivity; READ, Reading Activities; VIP, Video Interaction Project.

[a] Omnibus *P* value based on *F* test for analysis of variance.

[b] Letter denotes groups differing at $P<.05$ on post hoc testing by Tukey honestly significantly different test.

already at risk. Both of the interventions studied in this trial, VIP and BB, had effects on aspects of parent-child interaction critical to early development.

Regarding our first hypothesis, VIP and BB, which begin in early infancy, were associated with enhanced parent-child interactions at 6 months. Our findings represent a generalization of those from a prior RCT of VIP,[11,12] reflecting varying interventions across a sociodemographically broader range of families. These findings are important because they suggest that pediatricians should consider intervening with families beginning in early infancy. We note that this analysis took place at 6 months, the age at onset of ROR, which precluded direct assessment of the effects of VIP and BB beyond that of standard ROR. Analyses of the cohort at later ages will enable us to determine whether increasing intensity of intervention will result in enhancement of long-term trajectories related to parent-child interaction and child development.

Regarding our second hypothesis, VIP, with greater intensity, had effects on parenting that were greater and more consistent than those of BB. For VIP, effects were found across all domains of verbal interaction, including provision of toys, shared reading, teaching, and parental verbal responsivity; for BB, effects were found primarily related to provision of toys and reading. Examples of specific effects likely to be clinically important included initiation and frequency of reading, interactions, naming of objects, telling stories, and talking together about surroundings. Compared with controls, the VIP families spent nearly twice as many minutes per day reading aloud. Compared with the BB families, the VIP families had statistically stronger effects for teaching (parental involvement in developmental advancement) and provision of infant toys for the sample as a whole and stronger effects for parental verbal responsivity for mothers with literacy levels of ninth grade or higher. The effects of VIP were further supported by within-group analyses showing associations between visit attendance and both teaching and verbal responsivity. It is not clear why similar within-group findings were not present for reading aloud, given our robust between-group differences in this domain. Ongoing study of the cohort will assess whether effects are also found on early development and school readiness, as have been previously shown in a prior RCT of VIP.[11,12]

As with ROR, the targeted nature of VIP and BB may represent an important factor in their being associated with enhanced parenting outcomes without need for home visits. Results of this study stand somewhat in contrast with those[32,33] regarding Healthy Steps for young children, a pediatric primary care intervention program that addresses parenting broadly but has found fewer effects on shared reading and play. Our study of VIP and BB, together with prior studies of ROR and Healthy Steps, suggests that a targeted approach may be preferred for primary care interventions to promote parent-child interaction and early child development.

Given the likely lower cost of targeted pediatric primary care interventions compared with home-based

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Table 4. Effect of VIP and BB on Parent-Child Interaction at 6 Months: Selected Individual StimQ Items

	VIP (n=126)	BB (n=150)	Control (n=134)	*F* or χ^2	*P* Value[a]
ALM					
Infant toys, mean (SD) scaled score	1.4 (0.5)[b]	1.2 (0.6)[b]	1.0 (0.5)[b]	19.2	<.001
Age started playing with toys, mean (SD), mo[c]	2.5 (1.6)[b]	2.6 (1.4)[b]	3.0 (1.3)[b]	4.3	.02
READ					
Reads books to child (yes/no), %	86.4	89.2[b]	78.4[b]	6.8	.03
Age started reading, mean (SD), mo (n=345)[c]	2.8 (1.8)	3.2 (1.9)	3.3 (1.9)	2.9	.06
Frequency of reading, mean (SD), d/wk	3.9 (2.6)[b]	3.6 (2.4)	3.1 (2.5)[b]	3.4	.03
Reads every day (yes/no), %	69.6	75.0[b]	59.0[b]	8.5	.01
Reads bedtime story, mean (SD), d/wk (n=345)[c]	1.9 (2.6)[b]	1.2 (2.0)[b]	1.4 (2.2)	3.1	.04
Reads books at other times of day, mean (SD), d/wk (n=345)[c]	3.7 (2.4)	3.4 (2.3)	3.1 (2.3)	1.8	.16
Names pictures in books (yes/no), %	78.4[b]	81.1[b]	64.9[b]	10.9	.004
Asks questions about pictures (yes/no), % (n=344)[c]	56.5[b]	46.2[b]	28.8[b]	16.8	<.001
PIDA, %					
Names objects in house	64.0[b]	47.3[b]	42.9[b]	12.8	.002
Names objects in grocery store	38.4[b]	27.4	21.8[b]	8.9	.01
PVR					
Plays in front of a mirror, %	57.6	49.0	42.9	5.6	.06
Practices making sounds together, %	60.8[b]	55.2	45.1[b]	8.6	.04
Talks while feeding, %	26.4	15.9	17.3	5.4	.07
Tells stories, mean (SD), d/wk[b]	1.5 (2.3)[b]	0.8 (1.6)[b]	0.8 (1.6)[b]	5.9	.003
Talks together about surroundings, mean (SD), d/wk (n=353)[c]	3.5 (3.1)[b]	2.7 (2.7)	1.8 (2.7)[b]	9.8	<.001

Abbreviations: ALM, Availability of Learning Materials; BB, Building Blocks; PIDA, Parental Involvement in Developmental Advancement; PVR, Parental Verbal Responsivity; READ, Reading Activities; VIP, Video Interaction Project.
[a] Ominibus *P* value based on analysis of variance or χ^2 test.
[b] Subscripts denote groups differing with $P<.05$ on planned pairwise comparisons using Tukey honestly significant difference test for analysis of variance or Keppel's modified Bonferroni correction for χ^2.
[c] Items piloted for possible inclusion in revised StimQ assessment.

Table 5. Mean (SD) VIP Attendance and StimQ Scores[a]

	Attended 4 of 4 VIP Visits (n=85)	Attended 1 to 3 VIP Visits (n=37)	Unadjusted[b]		Adjusted[c]	
			Mean Difference (95% CI)	ES	Mean Difference (95% CI)	ES
StimQ total score	20.5 (6.2)	18.4 (8.3)	2.0 (–0.7 to 4.7)	0.29 (–.10 to 0.69)	2.1 (–0.6 to 4.9)	0.31 (–0.09 to 0.71)
ALM score	2.8 (1.2)	2.7 (1.1)	0.1 (–0.3 to 0.6)	0.12 (–0.27 to 0.51)	0.1 (–0.3 to 0.6)	0.12 (–0.28 to 0.53)
READ score	7.9 (4.0)	8.0 (4.7)	–0.02 (–1.7 to 1.6)	–0.01 (–0.40 to 0.38)	0.05 (–1.6 to 1.7)	0.01 (–0.39 to 0.41)
PIDA score	3.6 (1.6)	2.8 (1.7)	0.8 (0.2 to 1.5)	0.51 (0.12 to 0.90)	0.8 (0.2 to 1.5)	0.51 (0.11 to 0.91)
PVR score	6.1 (2.8)	5.0 (2.8)	1.1 (0.003 to 2.2)	0.39 (0.001 to 0.79)	1.1 (0.01 to 2.2)	0.40 (0.004 to 0.80)

Abbreviations: ALM, Availability of Learning Materials; BB, building blocks; CI, confidence interval; ES, effect size; PIDA, Parental Involvement in Developmental Advancement; PVR, Parental Verbal Responsivity; READ, Reading Activities; VIP, video interaction project.
[a] Data include families with 1 or more visits only.
[b] Unadjusted estimates based on independent-samples *t* test.
[c] Adjusted estimates based on multiple regression adjusting for all sociodemographic characteristics.

programs,[34] cost-effectiveness analyses will be needed to better understand implications for public health policy. Such analyses will provide data regarding whether pediatric interventions should be used for the population as a whole or for specific at-risk populations.

There were 3 main limitations to this study. First, there was larger-than-expected loss to follow-up at 6 months because of limitations in resources, which led us to prioritize later assessment points. The threat to validity resulting from loss to follow-up may have been limited because assessed participants were equivalent across groups for all measures. Second, results at 6 months were based on parent report, which can be subject to biases. However, StimQ has been shown to be reliable and valid, and convergent results regarding shared reading were found using 2 different types of interviews (a structured interview [StimQ] and an open-ended reading diary). Later assessments will also include observational measures based on videos made of parents and children. Third, participating mothers were primarily first-generation Hispanic/Latino immigrants. Results may not be generalizable to families with other sociodemographic characteristics.

This study showed limited effects for families scoring in the lowest third of word reading in this low-SES, at-risk sample, consistent with previous findings in studies of VIP.[10,11] Although interventions such as VIP and BB may have important effects on most families

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with low SES, who are already at risk, other approaches (higher intensity or conceptually different) may be necessary in families with the lowest levels of education and literacy.

In conclusion, 2 interventions provided in pediatric primary care for families with low SES, namely, VIP and BB, resulted in enhanced parent-child interactions critical for early development and school readiness. These interventions began early in infancy and used innovative strategies to support enhanced interactions, including videotaping with self-reflection in VIP and parent recording of written observations and plans for both interventions. Refinement and dissemination of pediatric primary care interventions can play an important role in addressing the public health issue of school readiness and educational achievement in at-risk families.

Accepted for Publication: June 7, 2010.
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Financial Disclosure: None reported.
Funding/Support: This work was supported by initial grant 5R01HD047740-01-04 and competing renewal 2R01HD047740-05 (Promoting Early School Readiness in Primary Health Care) and R01 HD40388 01-04 (An RCT of a Low-Intensity Intervention to Reduce Delay) from the National Institutes of Health/National Institute of Child Health and Human Development, the Tiger Foundation, the Marks Family Foundation, the Rhodebeck Charitable Trust, the New York Community Trust, the New York State Empire Clinical Research Investigator Program, the Academic Pediatric Association Young Investigator Award Program, the Society for Developmental and Behavioral Pediatrics Research Grant, Children of Bellevue Inc, and KiDS of NYU Foundation Inc.
Previous Presentation: This study was presented in part at the Pediatric Academic Societies Annual Meeting, American Academy of Pediatrics Presidential Plenary; May 4, 2008; Honolulu, Hawaii.
Additional Contributions: We thank many colleagues for their guidance and support, including J. Lawrence Aber, PhD, Clancy Blair, PhD, David Dickinson, EdD, Arthur Fierman, MD, Virginia Flynn, MS, Gilbert Foley, EdD, Emily Forrest, MD, Harris Huberman, MD, Perri Klass, MD, Mary Jo Messito, MD, Erin O'Connor, EdD, Cybele Raver, PhD, Catherine Tamis-Lemonda, PhD, Wendy Tineo, PhD, Suzy Tomopoulos, MD, Purnima Valdez, MD, Linda van Schaick, MSEd, and Hiro Yoshikawa, PhD. Finally, we thank many additional individuals who contributed to this project, including Melissa Acevedo, MD, Jenny Arevalo, BA, Nina Burtchen, MD, Daniela Romero, BS, Jessica Urgelles, MA, Linda Votruba, BA, Margaret Wolff, BA, and Brenda Woodford, MA.

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