Literacy Promotion in Primary Care Pediatrics: Can We Make a Difference?

Pamela C. High, MD*‡§; Linda LaGasse, PhD‡§; Samuel Becker, BA*; Ingrid Ahlgren, BA*; and Adrian Gardner, BS‡

Abstract. *Background.* Reading skills are critical to children's success in school and the increasingly technologic workforce. Children from low-income families are at risk for home environments that fail to promote emergent literacy and for reading failure. A home environment that encourages learning and parents who are involved in their children's education are important factors in school achievement.

Objective. To evaluate the effects of a literacy promoting intervention delivered by pediatric providers as part of well-child care on parent attitudes and behaviors and on child language.

Design/Methods. A multicultural group of 205 low-income families with 5- to 11-month-olds were prospectively enrolled, interviewed, and randomized to intervention ($n = 106$) or control ($n = 99$) groups. Families in the intervention group received developmentally appropriate children's books and educational materials and advice about sharing books with children, while those in the control group received no books or materials relevant to literacy. After an average of 3.4 well-child visits in both groups, 153 (75%) were reinterviewed and the children's receptive and expressive vocabulary was tested using a modified version of the MacArthur Communication and Development Inventory (Short Form). Parents were asked if their child understood (receptive vocabulary) or said (expressive vocabulary) each of 100 words, half of which were in the books given. Families were found to have a Child-Centered Literacy Orientation if they mentioned reading aloud as one of their child's favorite activities or as one of their own favorite joint activities or if they usually read together at bedtime. At follow-up toddlers were 18.4 months old on average.

Results. Intervention and control groups had similar literacy related characteristics at baseline. There was a 40% increase in Child-Centered Literacy Orientation among intervention families compared with 16% among controls. Intervention families read more with their toddlers (4.3 vs 3.8 days/week). Both receptive and expressive vocabulary scores were higher in older intervention toddlers (18–25 months old; $n = 88$), but not in younger intervention toddlers (13–17 months old; $n = 62$). This significant effect of the intervention on vocabulary scores in older toddlers was found for both the 50 words in the books and those not in the books. After parent education, foreign birth and language proficiency, and child age were statistically controlled, the intervention remained significantly associated with higher language outcomes in older toddlers. However, when reading aloud was added to the multivariate analysis, the influence of the intervention was no longer evident, suggesting the intervention's effect on child language was mediated through increased shared reading with these toddlers.

Conclusion. This simple and inexpensive intervention, delivered as part of well-child care, changed parent attitudes toward the importance of reading with their infants and toddlers. These intervention parents and their children read more together and this was associated with enhanced language development in older toddlers in this diverse group of low-income families. *Pediatrics* 2000;105:927–934; *literacy, reading promotion, child, books, anticipatory guidance, multicultural, underserved populations, language development, receptive vocabulary, expressive vocabulary.*

ABBREVIATION. CCLO, Child-Centered Literary Orientation.

Success as an adult depends in part on the learning and development that occur in infancy and early childhood. Infants raised in safe and stimulating environments are better learners later in life than those raised in less secure and attentive settings.[1] Because many children from socially and economically disadvantaged backgrounds lack environments that promote language and literacy growth, they are at risk for failing to develop essential literacy skills. *The National Assessment of Educational Process 1998 Reading Report Card for the Nation* found that children in the United States who live near or below the poverty line have lower average reading scores than their peers.[2] Of adults living in poverty, almost half read and write at the lowest literacy level.[3] This lack of basic literacy skills is linked to decreased productivity, increased rates of teenage pregnancy, and increased welfare dependence.[3,4] Low literacy levels contribute to the propagation of the cycle of poverty.[5]

Several studies have evaluated the efficacy of literacy promoting anticipatory guidance delivered

From the *Department of Pediatrics, Rhode Island Hospital; ‡Brown University School of Medicine; and §Women and Infants Hospital, Providence, Rhode Island.

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Reprint requests to (P.C.H.) Infant Development Center, Women and Infants Hospital, 101 Dudley St, Providence, RI 02905.

by pediatric primary care providers as part of well-child care. In 1991, Needlman and his colleagues[6] indicated that family literacy orientation could be increased by a simple intervention in which pediatricians distributed children's books to children of low-income parents at their health maintenance visits. We initially conducted a similar intervention study with multicultural, low-income families (100 intervention, 51 historical control).[7] At all scheduled well-child visits in a hospital clinic setting, primary-care providers distributed children's books and educational materials to the parents of 6- to 38-month-old children in the intervention group. This study established the concept of Child-Centered Literacy Orientation (CCLO), a measure of a family's ability and willingness to engage in literacy-promoting activities with young children. CCLO was considered present if parents mentioned reading in answer to open-ended questions about their child's favorite activities, or their favorite things to do together, or if they usually shared books at bedtime. We found that 33% of parents had CCLO in the historical control group compared with 69% of families who had received the intervention. Controlling for parental education, ethnicity, reading habits, and sex and age of children, we found that CCLO was almost 5 times more likely to be present in the intervention families.[7] These data extended Needlman's findings because the sample size was larger, and we controlled the number of books children received, the duration between the intervention and the interview, and child health status.

In a related study in pediatric continuity settings, we demonstrated that low-income families with toddlers and preschoolers often lack a CCLO.[8] Only 40% of children <5 years old had 10 or more books at home, and only 39% of families gave a positive response to one of the questions measuring CCLO. Living in 2-parent families and in those with higher adult to child ratios appeared to have protective effects. However, living in environments where English was rarely spoken and with parents who rarely read were additional risk factors for lack of both children's books and a CCLO in the home.

In a prospective, randomized trial, pediatricians delivered a bilingual literacy promoting intervention to low-income Hispanic families with infants.[9] Ninety six percent of enrolled families were reinterviewed on average 10 months later when children were 14 to 24 months old. Parents receiving the intervention were 10 times more likely to read books with their children at least 3 days a week compared with control families, and they were also more likely to report that reading aloud was one of their 3 favorite things to do with their child. Only trends toward higher language scores in intervention children >18 months old were found.

To expand on these studies and to assess the potential role of community-based pediatric primary care providers in enriching the literacy experiences of low-income multicultural children, we designed a prospective, randomized trial to evaluate the effectiveness of this simple and culturally appropriate literacy-promoting intervention. This study was modeled after the previous study; however, we planned to enroll a larger number of participating families from diverse cultural backgrounds and to deliver the intervention in English alone. We hypothesized that providing age-appropriate children's books, handouts, and literacy-related anticipatory guidance to low-income parents would provide them with both the knowledge and the tools they would need to change their attitudes about the importance of reading with young children and, as a result, their behavior. Specifically, we hypothesized that this intervention would increase the frequency of parent-child reading in this population. We also hypothesized that our intervention would facilitate toddler's acquisition of receptive and expressive vocabulary.

METHODS

Subjects

Between August 1996 and September 1997, we enrolled 205 families with infants, who presented to 1 of 4 urban community-based health centers for pediatric care. The health centers serve a low-income multiethnic population. Pediatric care is provided by 7 pediatricians and a pediatric nurse practitioner. Families were eligible if: 1) the interviewed parent could speak English well enough to participate in the initial interview; 2) the interviewed parent was the primary caregiver; and 3) the infant was between 5 and 11 months old at the time of the enrollment interview. Children were enrolled at this age, when pediatric visits occur frequently, to enable us to intervene at multiple points over a short period of time. This is also a time in infant development when parents may be particularly receptive to their pediatrician's advice and when children start to enjoy looking at picture books. Families were excluded from the study if: 1) the infant's birth weight was <5 pounds; 2) the infant had a significant developmental delay, congenital anomaly, or sensory deficit; or 3) the infant had been hospitalized >14 days.

Study Design/Intervention

A single research assistant identified potentially eligible families by review of appointment schedules and patients' charts during busy clinic sessions. Eligible parents were approached in the waiting room and asked to participate in a study of children's play activities, interests, language development, and sleep habits. Our interest in literacy was not disclosed. Parents were informed that they would be contacted for follow-up interviews in about a year to ascertain how their child's interests and activities may have changed. Eight parents declined participation in the study, and 15 parents could not communicate in English well enough to complete the interview. After obtaining informed consent, a research assistant conducted an 80-item structured face-to-face interview similar to one reported previously.[16–18] The interview included demographics, children's play interests and sleeping habits, and parental language proficiencies. Parents received a bag of diapers as an incentive for participating in the interview.

At enrollment, families were randomized to intervention (n = 106) or control group (n = 99), using an alternate day schedule with those enrolled on even days of the month assigned to the intervention group. At this initial visit and at all subsequent well-child visits, pediatricians gave children in the intervention group an age-appropriate children's board book; an age-specific handout explaining how children can benefit from, enjoy, and interact with books; and literacy promoting anticipatory guidance. The books chosen were developmentally appropriate, contained brightly colored pictures and simple language, depicted culturally diverse images, and promoted parent-child interaction. Infants presenting for the 6-, 9-, 12-, 15-, and 18-month visits received *Babies*,[10] *Goodnight Moon*,[11] *Moo, Baa, La, La, La!*,[12] *Bedtime for Bunnies*,[13] and *Three Little Chicks*,[14] respectively. Educational material presented briefly some benefits of

reading to children, starting at a very young age [illegible] interaction between the parent and the child. This 1-page handout also suggested that a good time to share books was as part of a regular bedtime routine. Handouts were written in English at a third-grade reading level and were given to the parent when their child received the book.[7] The research assistant responsible for enrollment and tracking placed books and handouts in patient charts before scheduled visits for ease of distribution of the intervention. The intervention was determined to have occurred when the child had a documented clinic visit and the book disappeared from the chart.

The pediatric providers participated in a training session describing the study design and objectives and the importance of their participation. We did not structure a standardized scenario for them to deliver, but rather encouraged them to briefly provide guidance on the benefits of reading aloud to children, reinforcing the information in the handouts. Families in the control group received routine pediatric care, without any books or handouts. The providers were asked to continue with their usual anticipatory guidance practices. Control families were not differentiated from nonenrolled families for providers, thereby decreasing the likelihood of unusual practices.

Follow-up

A month after the child had completed 3 well-child visits or, in those with fewer visits, when the child turned 22 months old, initial 205 families enrolled, 43 were lost to follow-up. Nine families were located for follow-up interviews when children were 26 to 33 months old and these were considered to be too old for inclusion in this analysis. The remaining 153 families (77 intervention and 76 control families) were reinterviewed when children were between 14 and 25 months old and are the subjects considered in this analysis.

As shown in Table 1, at follow-up mean age of children was 18.7 months for intervention and 18.3 months in the control group. Intervention families had attended 3.4 well-child visits and had received 3.2 books, compared with control families with 3.4 visits but no books. Parents were reinterviewed by 1 of 6 research assistants not involved in enrollment or tracking, and therefore unaware of the families' group assignment. Interviews were conducted by telephone and in the home when families could not be reached by telephone. A second bag of diapers was given as incentive for participation.

The follow-up interview consisted of a shortened version of the one conducted at baseline. Main outcome variables included the number of days/week that the parent read books with the child and the number of nights/week a parent and child shared books at bedtime. Parents were asked to list their child's 3 favorite things to do and their 3 favorite things to do with their child. If reading books was mentioned in response to either of these questions or if families shared books at bedtime at least 6

TABLE 1. Demographic Characteristics and Exposure to Intervention at Follow-up (n = 153)

	Control (n = 76)	Intervention (n = 77)	P
Children			
Age	18.3 (.4) mo	18.7 (.4) mo	.43
13- to 17-month-olds†	15.4 (.2) mo	15.6 (.2) mo	.66
18- to 25-month-olds†	20.4 (.3) mo	21.0 (.3) mo	.25
Female	45% (34)	45% (35)	.93
Parents (%, n)			
Female	89% (68)	92% (71)	.56
Education			
Not high school graduate	33% (25)*	49% (38)*	
High school graduate or GED	43% (33)*	26% (20)*	
≥1 year college/vocational	24% (18)*	25% (19)*	.05*
Ethnic group			
Non-Hispanic white	16% (12)	21% (16)	
Hispanic	41% (31)	53% (41)	
Other	43% (33)	26% (20)	.08
Born in the continental United States of America	29% (22)**	49% (38)**	.01**
Languages spoken at home			
English only	25% (19)	26% (20)	
Multilingual	64% (48)	62% (48)	
No English	11% (8)	12% (9)	.96
Speaks English well at follow-up	55% (42)	69% (53)	.08
Single or separated	54% (41)	55% (42)	.94
Adult to child ratio†	1.06 (0.1)	1.12 (0.1)	.65
Occupation			
Employed (full or part time)	44% (33)	42% (32)	.76
Student	21% (16)	23% (18)	.73
Public assistance (low income)			
Medicaid	86% (65)	74% (57)	.08
AFDC	47% (36)	47% (36)	.94
WIC	95% (72)	92% (71)	.53
Visits and anticipatory guidance			
Number of well-child visits†	3.39 (.8)	3.38 (.8)	.87
Number of books given†	0 (0)***	3.25 (.1)***	<.001***
Number books parent remembers getting†	.35 (.1)***	2.65 (.2)***	<.001***
Parent memory of anticipatory guidance			
Discussed accident prevention	57% (42)	66% (51)	.23
Discussed child's nutrition	85% (64)	79% (61)	.33
Reading books with your child	37% (28)	76% (59)	<.001***
Bedtime routines	25% (19)*	42% (32)*	.03*
Child received a book	12% (9)***	91% (70)***	<.001***

* $P < .05$. ** $P < .01$. *** $P < .001$.
χ^2 (%, n) unless specified by † = 2-sample t test with equal variance (mean, SE).

nights/week they were identified as having a CCLO.[7,8] A minimum of 6 nights was chosen as indicative of a firmly established family routine. Parents were also asked how often they read themselves, whether they had a library card, whether they had visited the library with their child, as well as how many total books were in the home. These were considered to be literacy outcome variables less likely to be affected by, or distal to, the intervention. A modified version of the MacArthur Communicative Development Inventories (Short Form), a parent report test that provides a receptive and expressive language score, was also administered at follow-up. We selected 50 words from the MacArthur that were not present in any of the books and 50 words from the books given to all intervention children. This provided receptive (0–100) and expressive (0–100) vocabulary scores. Independent scores were generated for the 50 words present in the books and the 50 words not present in the books.[9]

Contamination of control families with anticipatory guidance was assessed by asking parents, at the conclusion of the interview, if their pediatrician had discussed reading books with their child at their most recent clinic visit. Twenty-eight parents (37%) in the control group and 59 intervention parents (77%) reported receiving such guidance. In addition, 9 control families (12%) and 70 intervention families (91%) remembered being given at least 1 book to take home by their pediatrician.

Statistical Analysis

Data were analyzed using the Stata Statistical Software: Release 5.0. (Stata Corporation, College Station, TX). Frequency counts of categorical variables provided descriptive information about the sample as a whole. χ^2 tests on dichotomous variables and 2-tailed t tests on continuous data were used to compare demographic, literacy, and language variables of the groups. Change scores were computed for literacy outcome variables measured at both enrollment and at follow-up so that each family was its own control. For example, if parents read to their child 3 days/week at enrollment and 5 days/week at follow-up, the change in this would be 2 additional days/week of reading. Hierarchical multiple linear regressions of vocabulary scores were performed correcting for parent education, country of birth, language proficiency, and child age at the first step. For 2 step regressions, intervention status was added at step 2. For 3 step regressions frequency of reading aloud was added at step 2 followed by intervention status at the third step. Power analysis showed that 150 total subjects provide sufficient power (>.80) to detect medium effects, testing differences between 2 groups (intervention and control). In addition, 88 subjects provide sufficient power (.80) to detect medium effects in a hierarchical regression with 3 sets (first set 4 predictors, second and third sets, 1 predictor each) with R^2 of the total model of 30% and R^2 increments of 10%.

Demographic Characteristics

The control and intervention groups that were comparable in their major sociodemographic characteristics with few exceptions. The mean age of the children at baseline was 7.0 (± .2) months in both intervention and control groups and 52% were male. Half of these parents (49%) were Hispanic, 17% were non-Hispanic white, and 34% belonged to other ethnic groups. Parents were first asked if they considered themselves to be Hispanic. If their answer was "no," they were asked if they considered themselves to be white, black, or Asian or something else including biracial. Of those who considered themselves black, more than 42% were born in West Africa, leaving only 7% of the initial parent sample US-born African-American. For this reason those who considered themselves black were included in the diverse *other* ethnic grouping, which also included Asian, Native American, and biracial parents. Sixty percent of parents were born outside the continental US in 1 of 27 different countries, and two-thirds of families spoke >1 language at home. Parents interviewed were primarily female (92%). Forty-one percent of parents were employed and 23% were students. More than half (62%) had at least a high school equivalency. At enrollment, there were no significant differences between intervention and control families in any of these demographic factors. At follow-up, as shown in Table 1, control parents were more likely to have graduated from high school than intervention parents and less likely to have been born in the continental United States.

Literacy Promoting Behaviors Proximal to the Intervention

At enrollment, when children were on average 7 months old, 2% of parents reported looking at books as 1 of their child's 3 favorite activities. Fifteen percent said that reading together was one of their favorite activities, and 16% usually shared books at bedtime. Only 27% of families were identified as having a CCLO. Parents reported reading with their children 2.5 days/week and sharing books as part of a bedtime routine 2.1 nights/week. Thirty-one percent of these children had >10 books of their own and more than a quarter had no books at all. At the time of the baseline interview, these literacy characteristics were virtually identical in intervention and control families.

At follow-up, when children were on average 18.5 months old, significant differences were found between intervention and control families in each of these literacy-related outcome variables, as shown in Table 2. Consistently, intervention families responded with more reading aloud, more enthusiasm for reading together, and more children's books at home. Intervention families were more likely to report an increase in book-sharing as 1 of their child's 3 favorite activities, as well as an increase in book-sharing as 1 of their 3 favorite things to do with their child. A significant effect was noted on the frequency of parent-child book-sharing. Intervention families reported a 17% increase in usually sharing books at bedtime compared with control families who had a small decline in this behavior. CCLO increased by 40% in intervention families compared with 16% in control families. Intervention families had increased reading to their toddlers by almost 2 days/week, while control families reported very little change in this activity.

Literacy Promoting Behaviors Distal to the Intervention

At enrollment, parents read books themselves an average of 2.9 days/week, and almost half had a library card (49%). Twenty-two percent of parents interviewed had been to the library in the past 6 months, and 12% had taken their child to the library. Almost a quarter of these families (22%) had <10 books total. At the time of the baseline interview, there were no significant differences in these literacy characteristics between intervention and control families.

At follow-up, as shown in Table 2, parents in both groups reported a slight increase in reading for themselves, but the difference between groups was not significant. Of these literacy variables less likely to be affected by the intervention, the only significant difference was found in total books in the home. Intervention families had more books than control: 22% of parents in the control group reported having <10 books total in their home compared with 6% of intervention parents.

Child Language

At follow-up, parents were asked if their child understood (receptive vocabulary) or said (expressive vocabulary) each of 100 words in the modified MacArthur Inventories. As shown in Table 3, intervention children had higher receptive vocabulary scores than controls. We divided children into 2 categories for analysis: 13 to 17 months (younger) and 18 to 25 months (older). This division was based on the trends in Golova's bilingual study toward higher language scores in intervention children over 18 months of age[9] and seemed justified in light of the broad developmental spectrum of language found in children between 13 and 25 months old.

Higher receptive and expressive vocabulary scores were found in older, but not younger, intervention toddlers. The significant effect of the intervention on both receptive and expressive vocabulary scores in older toddlers was found for both the 50 words in the books and the 50 words not in the books (Table 3). To explore this finding further and to correct for variation in demographic variables between groups, hierarchical multiple linear regressions of both receptive and expressive vocabulary scores were performed, controlling for parent education, foreign birth and language proficiency, and child age at step 1, before entering intervention status at the second step. Again significantly higher receptive and expressive vocabulary scores were found in older (Tables 4 and 6) intervention toddlers. The intervention accounted for 6% of the variability in

TABLE 2. Literacy Characteristics Proximal and Distal to the Intervention at Follow-up and Change in These Literacy Outcomes as Compared With Baseline at Enrollment (n = 153)

	Control (n = 76)	Intervention (n = 17)	P
Literacy outcomes proximal to the intervention			
Books 1 of child's favorite	12% (9)*	27% (21)*	.02*
Books 1 of parent's favorite	33% (25)**	57% (44)**	.003**
Shares books >6 nights/wk	13% (10)**	32% (32)**	.006**
CCLO	43% (33)**	68% (52)**	.003**
Parent reads to child ≥3 d/wk	46% (35)***	78% (60)***	<.001***
Days/wk parent reads to child†	2.8 (.3)***	4.3 (.2)***	<.001***
Nights/wk shares book at bedtime†	2.1 (.3)**	3.4 (.3)**	.004**
Child has >10 child's books	45% (34)*	61% (47)*	.04*
Change in proximal literacy outcomes			
Change in books 1 of child's 3 favorites†	9% (4%)*	23% (6%)*	.04*
Change in books 1 of parent's 3 favorites†	18% (6%)**	43% (7%)**	<.01**
Change in shares books >6 nights/wk†	−4% (5%)**	17% (5%)**	.006**
Change in CCLO†	16% (6%)**	40% (6%)**	.007**
Change in d/wk parent reads to child†	.16 (.3)***	1.89 (.3)***	<.001***
Change in nights/wk share book at bedtime†	−.18 (.3)***	1.63 (.4)***	<.001***
Literacy outcomes distal to the intervention			
Days/wk parent reads a book†	3.05 (.3)	3.93 (.3)	.07
Parent has library card	45% (34)	55% (42)	.23
Parent has taken child to library	12% (9)	16% (12)	.50
Parent has used library	25% (19)	20% (15)	.93
Home has <10 total books	20% (15)*	6% (5)*	.02*
Change in distal literacy outcomes			
Change in d/wk parent reads books†	.22 (.4)	.56 (.4)	.56

* $P < .05$. ** $P < .01$. *** $P < .001$.
χ^2 (%, n) unless specified by † = two-sample t test with equal variance (mean, SE).

TABLE 3. Language Scores From MacArthur Communication and Development Inventories (Short Form) Modified Version at Follow-up (n = 150)

	Control (n = 75)	Intervention (n = 75)	P
Receptive Vocabulary 100 words	39.3 (2.7)**	51.0 (3.0)**	.004**
Receptive vocabulary (13–17 mo) (n = 62)	40.5 (3.7)	45.7 (4.4)	.37
Receptive vocabulary (18–25 mo) (n = 88)	38.3 (3.8)**	54.8 (4.1)**	.004**
Receptive Vocabulary 50 words in books	17.6 (1.3)**	23.4 (1.5)**	.008**
Receptive vocabulary (13–17 mo) (n = 62)	18.0 (1.7)	19.9 (2.2)	.48
Receptive vocabulary (18–25 mo) (n = 88)	17.4 (1.9)**	25.3 (2.1)**	.006**
Receptive Vocabulary 50 wds not in books	21.6 (1.4)**	28.0 (1.6)**	.003**
Receptive vocabulary (13–17 mo) (n = 62)	22.6 (2.2)	25.8 (2.3)	.31
Receptive vocabulary (18–25 mo) (n = 88)	21.0 (1.9)**	29.5 (2.1)**	.004**
Expressive Vocabulary 100 words	15.9 (2.3)	22.1 (3.1)	.11
Expressive vocabulary (13–17 mo) (n = 62)	13.5 (2.9)	7.9 (1.7)	.10
Expressive vocabulary (18–25 mo) (n = 88)	17.5 (3.3)*	32.1 (4.6)*	.01*
Expressive Vocabulary 50 words in books	7.2 (1.1)	10.3 (1.5)	.10
Expressive vocabulary (13–17 mo) (n = 62)	6.0 (1.4)	3.4 (.9)	.13
Expressive vocabulary (18–25 mo) (n = 88)	8.0 (1.6)**	15.3 (2.3)**	.01**
Expressive vocabulary 50 wds not in books	8.7 (1.2)	11.8 (1.6)	.13
Expressive vocabulary (13–17 mo) (n = 62)	7.6 (1.5)	4.5 (.9)	.10
Expressive vocabulary (18–25 mo) (n = 88)	9.5 (1.7)**	16.9 (2.4)**	.01**

* $P < .05$. ** $P < .01$. *** $P < .001$. Two-sample t tests with equal variance (mean, SE).

receptive vocabulary (Table 4) and 4% of the variability in expressive vocabulary in this older toddler cohort. In similar 3-step analyses with the frequency of reading aloud to children is added to these models at step 2 and intervention status entered at step 3, effects of the intervention were no longer present (Tables 5 and 7). In these models, reading aloud to children accounted for 17% of the variability in receptive (Table 5) and 11% of the variability in expressive (Table 7) vocabulary for this older group. This finding suggests that the effect of the intervention was mediated through increased reading aloud to these older toddlers.

DISCUSSION

In a multicultural group of low-income families, the provision of children's books and educational materials about sharing books with children by pediatric providers as part of well-child care significantly increased CCLO. We were able to show that the intervention increased the frequency of parent-child book-sharing as well as the child and parent's enjoyment of reading together. This is particularly important because parental involvement in children's education is an important factor in school achievement.[15] In addition, we believe this to be the first prospective, randomized trial to demonstrate that a literacy promoting intervention delivered by pediatric primary care providers can enhance the development of children's early oral language skills.

We found a strong association between this intervention and both receptive and expressive vocabulary in older toddlers. Regression analyses controlling demographic variables support the hypothesis that this effect was mediated through an

TABLE 4. Hierarchical Multiple Linear Regression of Receptive Vocabulary Scores in Older Toddlers (18–25 Months, $n = 88$) Correcting First for Parent Education, Foreign Birth, and Language Proficiency and Child Age at Step 1, Before Entering Intervention Status at Step 2

	Receptive Vocabulary Older Toddlers ($n = 88$)				
	Coefficient	SE	β	P	Adjusted R^2 by Step (Incremental)
Step 1: parental education, foreign birth and language proficiency and child age				.001	.15
Step 2: intervention	13.7	5.3	.25	.01	.06

TABLE 5. Hierarchical Multiple Linear Regression of Receptive Vocabulary Scores in Older Toddlers (18–25 Months, $n = 88$) Correcting First for Parent Education, Foreign Birth, and Language Proficiency and Child Age at Step 1, Before Entering Frequency of Reading Aloud at Step 2 and Then Intervention Status at Step 3

	Receptive Vocabulary Older Toddlers ($n = 88$)				
	Coefficient	SE	β	P	Adjusted R^2 by Step (Incremental)
Step 1: parental education, foreign birth and language proficiency and child age				.001	.15
Step 2: days per week parent reads to child	4.3	1.1	.38	<.001	.17
Step 3: intervention	6.4	5.2	.12	.22	.0

increased emphasis on and enjoyment of shared reading experiences in intervention homes. These data further support the view that sharing books with young children encourages the development of early oral language skills. However, it should be noted that we are able to account for only 26% to 32% of the variance in language outcomes in this sample. Many other factors also play important roles in vocabulary acquisition.

How might reading aloud with children promote language and literacy? Book-sharing may impact language development and increase vocabulary in toddlers through object-word association. Researchers hypothesize that reading provides rhythmic patterning and repetition that serve as memory aides for young children, helping them to retain new vocabulary.[16] Research indicates a relationship between joint book-sharing and children's development of language skills and acquisition of vocabulary,[17,22] which indirectly may result in acquisition of literacy. Reading aloud may also directly promote literacy acquisition through fostering emergent literacy skills such as orientation of the book, listening ability, page turning and print recognition.[23] Reading to young children, therefore, may help enhance reading achievement by strengthening the child's language skills, by giving them emergent literacy skills and by teaching them to enjoy books and reading enough that they are willing to work as hard as is necessary to master these skills themselves.[21,24] Because this intervention increases reading aloud and thereby enhances language development, it will likely lead to easier acquisition of literacy for this at-risk group of children.

The effectiveness of this intervention may have resulted from several factors. The books were selected to appeal to both parents and children with colorful pictures of animals or children and with simple and sometimes humorous language. They were sturdy board books that often contained finger puppets or peek holes to offer multiple opportunities for parent-child interaction. The educational materials were written at a third grade reading level and bulleted, making it clear and easy for parents to read. Pediatricians' guidance reinforced the information in the handouts. Pediatric providers in primary care settings are important sources of advice and support for families. Anticipatory guidance provided in this setting has been shown to influence parent behaviors in the areas of injury prevention[25] and sleep promotion.[26] In addition, the intervention took place at 3 or more visits and the presence of the books at home may have served as a further reminder, strengthening the message that reading aloud to young children is important. Yet another factor that may have contributed to the success of this intervention was that bedtime was recommended as a particularly good time to read with children. This provided structure and a regular time in the day for reading to occur.

The intervention did not appear to have a significant effect on the number of days/week parents themselves read books; however, the intervention may have modified parents' beliefs regarding the importance of reading books with their children. The intervention did not have an effect on whether or not the parents had a library card, visited the library to borrow books, or had taken their children to the library. Consistent with the findings of previous studies,[7,9] these outcome variables distal to the intervention were not affected by our intervention.

One limitation of this study was our failure to achieve equivalent distributions in demographic variables in intervention and control groups at follow-up. The overrepresentation of higher parental education in control parents should bias the results in the direction contrary to the hypothesis. One might expect that more educated parents might read to their children more and, thereby, their children could have higher vocabulary scores. On the other hand, the use of change scores, as shown in Table 2, might bias the results in the opposite direction due to a ceiling effect in the more educated group with less room for improvement available.

TABLE 6. Hierarchical Multiple Linear Regression of Expressive Vocabulary Scores Correcting First for Parent Education, Foreign Birth, and Language Proficiency and Child Age at Step 1, Before Entering Intervention Status at Step 2

	Expressive Vocabulary in Older Toddlers (n = 88)				
	Coefficient	SE	β	P	Adjusted R^2 by Step (Incremental)
Step 1: parental education, foreign birth and language proficiency and child age				.001	.15
Step 2: intervention	11.8	5.4	.22	.03	.04

TABLE 7. Hierarchical Multiple Linear Regression of Expressive Vocabulary Scores in Older Toddlers (18–25 Months, n = 88) Correcting First for Parent Education, Foreign Birth, and Language Proficiency and Child Age at Step 1, Before Entering Frequency of Reading Aloud at Step 2 and Then Intervention Status at Step 3

	Expressive Vocabulary in Older Toddlers (n = 88)				
	Coefficient	SE	β	P	Adjusted R^2 by Step (Incremental)
Step 1: parental education, foreign birth and language proficiency and child age				.001	.15
Step 2: days per week parent reads to child	3.5	1.2	.31	.003	.11
Step 3: intervention	5.8	5.5	.11	.30	.01

Baseline literacy characteristics were so low in both groups, however, that this may not have been an important factor. Given the extreme variability in parental ethnicity, it is not surprising that differences in language proficiency and country of origin were found between groups. As previously noted, parents had been born in 1 of 28 different countries. Although there were no between-group differences in numbers of languages spoken in the home, there was a trend toward more comfort speaking English in intervention parents at follow-up that could skew findings in the direction of the hypothesis. Multivariate analyses were used to control for these between-group differences in parents' country of origin, language proficiency and education as well as child age, an obvious confounder.

Another limitation of this study was the attrition of 25% of the enrolled sample. This loss did not appreciably reduce power in these analyses. The effect size remains medium (.44 vs .48) with 150 compared with 205 subjects in 2 group comparisons. This rate of attrition is not surprising for a 10- to 20-month follow-up within a low-income population in which household moves are frequent and telephone numbers are often changed or disconnected. In fact, an additional 4% of the sample was reinterviewed when children were 26 to 32 months old. No significant differences in any of the demographic or literacy variables studied were found in those families included in this analysis, compared with those lost to this first follow-up. Further, the attrition rate was equal in both intervention and control groups.

A third limitation of our study was that all outcome measures were based on data obtained by parental report. However, there is a long history of evidence supporting the use of parental report as an accurate means of assessing vocabulary and grammar in both typically and atypically developing children, especially in toddlers and preschoolers.[27–29] In addition, parents were not informed of our interests in literacy, did not know that the interviews were associated with the books that some had received, and the questions used to determine CCLO were open-ended. Finding effects of the intervention primarily in proximal literacy outcome variables, rather than in distal literacy outcome variables, supports the validity of these results. Parents were not trying to please us by providing uniformly positive literacy responses. Another limitation that relates to our language outcome measure was that we did not use a standardized and validated instrument to measure these skills. Although the instrument utilized was based on a standardized language test, it was specifically designed for this intervention. We were pleased to see effects of the intervention in both the words taken from the standardized test and in words taken from intervention books. Future studies that include home visitation with direct counts of books and the administration of standardized language testing of the children directly may provide more conclusive data to support our findings.

Another limitation of this work was that although the 6 research assistants who performed follow-up interviews were blind to a family's group assignment, they were not blind to the study hypothesis. Parents revealed their attitudes and practices around literacy early in the interview, before providing responses to the modified MacArthur vocabulary tests. This could potentially influence interviewers to skew vocabulary data in the direction of the hypothesis. The highly structured and simple format of this instrument, our reliance on data obtained by six different individuals, our failure to find significant effects in younger toddlers, and the known reliability of similar instruments used widely in clinical and research settings, all argue against the possibility that this limitation strongly influenced our results.

This study is important because it links pediatric anticipatory guidance, including giving books to

low-income infants and toddlers, with changes in parental attitudes and behaviors and also with improvement in child language outcomes. Because of the randomized prospective design of this study, it supports a causal link between early reading aloud and child language. This is important for 3 reasons: 1) The effects of the intervention on child language strongly support the conclusion that the intervention affected not only parent attitudes, but their behaviors as well, a much more important goal. 2) While many previous studies have established positive associations between reading aloud and child language, potential confounding from other sources, such as these same parents talking more with their children, has weakened claims to a causal connection. The randomized design of this intervention study largely eliminates the concern about unmeasured confounders, and thus it strongly supports the claim that reading aloud itself promotes language development. 3) The majority of previous research on reading aloud to children has addressed preschool-aged children, while this study extends this age range down into toddlerhood and infancy.

Interventions similar to the one in this study may encourage the development of literacy and language abilities in educationally at-risk low-income children and may help to equip children with the literacy skills they will need in the future, as they learn to read by and for themselves. Children must be followed for a longer period of time to assess whether interventions promoting sharing books starting at a very young age can influence children's later kindergarten preparedness, reading abilities, language skills, and overall school achievement. Moreover, this is the first study to show that literacy promoting anticipatory guidance at well-child visits can have a significant effect on language development in toddlers. Pediatricians are in a unique position to counsel high-risk parents about the joys, pleasures, and ultimate benefits of reading with their young children.

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