The Impact of a Clinic-Based Literacy Intervention on Language Development in Inner-City Preschool Children

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ABSTRACT. *Objective.* **To determine the effect of a clinic-based literacy intervention on the language development of preschool children.**

Methods. **A convenience sample of families presenting to 2 urban pediatric clinics for well-child care met the following criteria: the family was Latino or black and English- or Spanish-speaking; the child was 2 to 5.9 years old, with no neurodevelopmental disability, at a gestational age of 34 weeks or more, and not attending kindergarten. Participants at the first clinic (intervention group) were exposed to a literacy support program, based on Reach Out and Read (ROR), during the previous 3 years. At the second clinic (comparison group), a similar program started 3 months before the study. Parent-child reading activities were measured using the READ Subscale of the StimQ. Language development was measured using the One-Word Expressive and Receptive Picture Vocabulary Tests, and was performed in the child's primary language.**

Results. **A total of 122 study participants (49 interventions and 73 comparisons) met inclusion criteria and completed all measures. Intervention and comparison families were similar for most sociodemographic variables. Intervention families reported reading together with their children approximately 1 more day per week. Intensity of exposure to ROR (measured by total number of contacts with the program) was associated with increased parent-child reading activities, as measured by the StimQ-Read Subscale ($r = 0.20$). Intervention children had higher receptive language (mean: 94.5 vs 84.8) and expressive language (mean: 84.3 vs 81.6). After adjusting for potential confounders in a multiple regression analysis, intervention status was associated with an 8.6-point increase (95% confidence interval [CI]: 3.3, 14.0) in receptive language (semipartial correlation [SR]coefficient = 0.27), and a 4.3-point increase (95% CI: 0.04, 8.6) in expressive language (SR = 0.17). In a similar multiple regression, each contact with ROR was associated with an adjusted mean 0.4-point increase (95% CI: 0.1, 0.6) in receptive score, and an adjusted mean 0.21-point increase (95% CI: 0.02, 0.4) in expressive score.**

Conclusions. **ROR is an important intervention, promoting parental literacy support and enhancing language development in impoverished preschool children. Integration of literacy promoting interventions such as these into routine pediatric health care for underserved populations can be recommended.** *Pediatrics* **2001;107:130–134;** ***preschool children, literacy, child development, social environment, parent-child relations.***

ABBREVIATIONS. ROR, Reach Out and Read; SES, socioeconomic status; SR, semipartial correlation coefficient; SD, standard deviation; CI, confidence interval.

Impoverished inner-city children are at increased risk of language delay, compared with their middle class and upper middle class peers.[1] Although the cause is multifactorial, impoverished verbal interactions between parents and children are known to play an important role.[2] Parent-child reading activities represent a particularly rich source of verbal interactions. In fact, when different activities such as playtime, mealtime, dressing, and reading have been compared, the greatest quantity and quality of language interaction have been found during parent-child reading activities.[3] It is, therefore, not surprising that parent-child reading activities have been found to be correlated with later child outcomes such as oral language development, reading ability, and school performance.[4–9]

Over the last 2 decades, educators and psychologists have viewed the enhancement of parent-child reading activities as a means to improve language development and school performance, and have designed interventions to increase both the quantity and the quality of parent-child reading activities. Research has documented the beneficial effects of these programs. In one intervention program in rural Illinois, distribution of books and information about reading to families of children preparing to enter kindergarten was associated with decreased placement into low reading groups in first grade.[10] In another intervention program in Suffolk County, Long Island, Whitehurst et al randomized families to a 4-week intervention consisting of training parents in dialogic reading, an approach that is believed to enhance the parent-child verbal interactions that occur during reading. This intervention was found to be associated with improvement in both expressive and receptive language.[11]

More recently, pediatric visits have been viewed as a unique opportunity to increase parent-child reading activities because of the regularity of medical

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Received for publication Apr 5, 2000; accepted Jul 27, 2000.

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visits and the importance that parents place on advice given by their physician. Reach Out and Read (ROR), developed and implemented by Zuckerman, Needlman, and Klass at Boston City Hospital, Boston, Massachusetts, is an intervention program that integrates promotion of parent-child reading activity into the pediatric care of children 5 years old and younger.[12] This program consists of a waiting room program, anticipatory guidance about literacy development given by providers, and distribution of age appropriate children's books at each visit. ROR has subsequently been replicated in pediatric clinics across the United States. Research on ROR and other clinic-based programs has documented a significant effect on the frequency of parent-child reading activities.[13–15] However, there has been only 1 published study addressing the effect of these programs on child language outcomes.[16] In this report, we demonstrate an enhancement of language in inner-city preschool children participating in ROR.

METHODS

Study Sample

Study participants were enrolled at 1 of 2 inner-city general pediatric clinics during July and August 1998. Each clinic provides service to a similar population, which is poor and undereducated, with a preponderance of Latino immigrants. However, at 1 clinic (intervention clinic), an ROR intervention program had been in place for 3 years. At the other clinic (comparison clinic), a similar intervention had begun only 3 months before the study.

Convenience samples of families presenting for general pediatric routine well-child care to each institution were enrolled in the study. Inclusion criteria were: child 2 to 5.9 years old, not yet attending kindergarten, gestational age 34 weeks or more, normal birth history, no known neurodevelopmental disability (eg, visual or hearing impairment, static encephalopathy), no severe chronic disease (eg, cardiac disease, human immunodeficiency virus infection), and receipt of well-child care at the institution; family either Latino or black ethnicity with either English, Spanish or bilingual English-Spanish as the primary language(s) spoken in the home; and primary caretaker available for interview on day of presentation. Although the populations in each of the clinics are made up of a large number of ethnic groups, Latinos and blacks together make up >85% of registered families. The number of families in any other specific ethnic group (eg, white, Native American, East Asian, and South Asian) is extremely small. We were therefore concerned that we would not be able to control for cultural differences that might confound our results, and did not enroll children whose ethnicity was other than Latino or black. If 2 children in the same family who were both within the age range of the study presented at the same time, only the older child was enrolled.

At the time of enrollment, families were asked if they would participate in a study assessing parent-child activities in their homes. They were not told about our specific interest in literacy. At each institution, <5 families refused to participate. All who refused to participate did so because of concerns about time constraints, specifically that participation would cause either delay in seeing their provider, or difficulty in keeping other appointments. No incentives were given for participation.

Institutional review board approval was obtained separately at each institution. Parents provided informed consent before participation in the study.

Intervention

The intervention, based on the ROR program, consisted of 4 components:

1. While families waited to see their pediatrician, volunteers and/or staff members sat with children on large playmats and modeled reading activities.
2. While families waited to see their pediatrician, volunteers and/or staff members approached families and discussed the importance of reading.
3. Pediatricians counseled families about the importance and fun of reading.
4. Pediatricians distributed developmentally appropriate books to families at each American Academy of Pediatrics (AAP)-recommended well-child visit.

All pediatric clinic providers, including pediatric housestaff, attendings, and nurse practitioners, were trained and participated in the program. Training was performed during 1-hour seminars that provided background about parent-child interaction, language and literacy development, selection of developmentally appropriate books for children of different ages and developmental levels, and strategies for the incorporation of anticipatory guidance about literacy into the delivery of well-child care. These seminars were repeated for the incoming housestaff each year, along with annual follow-up sessions with all clinic providers.

Data Obtained

Demographic data were collected by parent interview, and included child's age, gender, ethnicity, gestational age, birth rank, birth history, medical history, developmental history, and attendance in preschool/day care; parental age, education, marital status, country of origin, and employment status; and family's ethnicity, receipt of government aid (including Aid to Families With Dependent Children or Medicaid) and history of homelessness. The family's Hollingshead four factor socioeconomic status[17] (SES) was determined based on parental education and occupation. In addition, parents were asked whether they found reading to be easy, a little difficult, or very difficult, and whether they believed that they needed help with reading. Parents were considered to have a reading problem if they reported that they did not find reading easy or if they reported that they needed help with reading.

Intensity of exposure to the literacy intervention was also collected by parent interview. Parents were asked to recall the number of times that the family had received counseling or books, or had participated in modeled reading activities at the clinic. These were added together to determine the total number of literacy-promoting contacts. For example, a family reporting 2 episodes of modeled reading, 1 episode of receiving counseling in the waiting room, 2 episodes of receiving counseling from the pediatrician, and receipt of 3 books would be considered to have had 8 literacy-promoting contacts.

Next, parents were interviewed to assess parent-child reading activities, using the READ Subscale of StimQ.[18] StimQ is an office-based scale measuring cognitive stimulation in the home environment. Information obtained from the StimQ READ Subscale includes frequency of reading activities, and number and variety of books that parents read to their children, as well as a total score.

Measures of the child's receptive and expressive language were obtained using the *Receptive One-Word Picture Vocabulary Test*[19] and the *Expressive One-Word Picture Vocabulary Test*.[20] The *One-Word Picture Vocabulary Test* is available using the same vocabulary in both English and Spanish. Each test was given in the child's preferred language; if the child was bilingual, both languages were used during the testing procedure.

Data were collected by 6 research assistants. To ensure the reliability of the data collected, the research assistants were trained together over a 2-week period. During that time, all data collection was directly supervised by 2 of the investigators, until reliability was achieved for each of the 6 research assistants for all measures. Periodic observation of the research assistants was performed throughout the study period to ensure continued reliability of data collection. Research assistants were not blinded to study hypotheses. However, research assistants measuring child's receptive and expressive language were blinded to results of all other measures.

Statistical Analyses

We assessed the effect of the intervention on all outcome measures, including number of children's books, frequency of reading, overall reading activities, and child's receptive and expressive language. The effect of the intervention was assessed in 2 ways. First, children were considered to be in the intervention or com-

parison group based on their location of primary care, and were compared with respect to outcome measures by t test. Second, because we were interested in determining whether there was a dose-effect related to quantity of exposure to ROR, we also assessed the effect of the intervention using parental report of literacy promoting contacts (defined above) as the measure of exposure. Pearson correlations were performed for these analyses. In each case, multiple regression analysis was then used to measure the association between the intervention and these outcomes after adjusting for potentially confounding variables.[21] Variables were considered to be potential confounders and included in the regression analyses if they were related to either intervention group membership or to language outcome with $P < .20$. A power analysis showed that in a multivariate model adjusting for 10 potential confounders, 100 participants would be needed to have 90% power to detect a semipartial correlation (SR) coefficient of 0.3 between intervention status and language outcome. Finally, we performed analyses in which potential confounders adding little to the model were eliminated using backward stepwise regression.[21] Starting with the regression model described above, which included intervention group membership and all potential confounders, variables contributing little to the simultaneous regression model (ie, with $P \geq .20$) were sequentially removed, leaving only those variables with potentially important contributions to the model (ie, with $P < .20$).

RESULTS

A total of 138 families were enrolled in the study, including 55 families in the intervention group and 83 families in the comparison group. Sixteen of these families (6 of 55 in the intervention group and 10 of 83 in the comparison group, Yates corrected $\chi^2 = 0.00$, $P = .99$) had incomplete language measures. Therefore, 122 of 138 (88.4%) of enrolled families with complete data were used in the analyses that follow.

The 49 intervention families and 73 comparison families were very similar with respect to most variables (Table 1). SES, for example, was exactly the same in both groups. No statistically significant differences were noted between the 2 groups. However, families in the intervention group were somewhat more likely to be Latino, were more likely to be recent immigrants, were less likely to have children in preschool or day care, were less likely to have the father of the child living at home, and had mothers who were less likely to have graduated high school. Each of these characteristics were controlled for in the multiple regression analysis.

Families in the intervention clinic had received a mean standard deviation (SD) of 4.0 (4.0) books, compared with 0.5 (0.8) books at the comparison site ($t = 7.2$; $P < .001$). Families in the intervention clinic reported that their doctors had discussed reading with them 3.0 (3.9) times, compared with 1.7 (2.7) times at the comparison clinic ($t = 2.3$; $P = .03$). Mean (SD) total literacy promoting contacts at the intervention site was 13.1 (10.5), compared with 2.3 (3.0) at the comparison site ($t = 8.3$; $P < .001$).

Outcomes are compared for the 2 groups in Table 2. Frequency of reading was reported to be approximately 1 day per week higher in the intervention group ($t = 2.1$, $P = .04$). Families in the intervention group reported that they had in their homes 5 more children's books that they read to their children and had higher overall reading activities, as measured by the StimQ-READ Subscale, than families in the comparison group; these differences did not reach statistical significance. However, when we assessed the effect of the intervention using parental report of literacy promoting contacts as the measure of exposure, total literacy-promoting contacts were statistically significantly related to overall reading activities, as measured by the StimQ-Read Subscale ($r = 0.20$; $P = .03$).

In unadjusted analysis, receptive vocabulary score was 9.7 (95% confidence interval [CI]: 4.5,15.0) points higher in the intervention clinic ($t = 3.7$; $P < .001$). Expressive vocabulary was 2.7 (95% CI: −1.7, 7.1) points higher in the intervention clinic, but this did not reach statistical significance ($t = 1.2$; $P = .23$). However, when we restricted the analysis to Latino families ($n = 86$), both receptive and expressive vocabulary were significantly better in the intervention group. For receptive vocabulary, the difference was 10.5 points (95% CI: 4.8, 16.3; $t = 3.7$; $P < .001$); for expressive vocabulary, the difference was 5.3 points (95% CI: 0.3, 10.3; $t = 2.1$; $P = .04$).

Multiple regression analysis was performed including all 10 variables that were related to either intervention clinic status or to vocabulary score with $P < .20$, and therefore considered to be potential confounders: child's age, gestational age, birth rank, attendance in preschool/day care, ethnicity; moth-

TABLE 1. Characteristics of Intervention and Comparison Families*

	Intervention ($n = 49$)	Comparison ($n = 73$)	P†
Child			
Age (y)	4.0 (1.0)	3.9 (1.0)	.59
Female gender	49.0%	39.7%	.41
Gestational age (wk)	39.7	39.2	.08
Preschool/day care	49.0%	59.7%	.36
Birth rank	1.9 (1.1)	1.8 (1.1)	.79
Parent			
Immigrant	30.6%	26.0%	.73
High school graduate	57.1%	62.5%	.60
Reading problem	38.8%	41.1%	.95
Family			
SES	4.2 (0.9)	4.2 (0.8)	.81
Ethnicity			.11
Latino	79.6%	64.4%	
Black	20.4%	35.6%	
English spoken in home	55.1%	71.2%	.10
Father in household	42.9%	46.6%	.83
Homeless	16.3%	16.4%	.99
Government assistance	93.8%	96.2%	.91

* Data are presented as mean (SD) or percent.
† P Value based on t test or χ^2 as appropriate.

TABLE 2. Outcome Measures*

	Intervention ($n = 49$)	Comparison ($n = 73$)	P†
Parent-child reading			
Days/wk reads	4.6 (2.3)	3.7 (2.5)	.04
Children's books	28.5 (21.3)	23.4 (20.7)	.18
StimQ-READ	12.7 (4.1)	11.8 (4.5)	.28
Language development			
Receptive vocabulary‡	94.5 (12.7)	84.8 (15.2)	<.001
Expressive vocabulary§	84.3 (12.9)	81.6 (11.5)	.23

* Data are presented as mean (SD) or percent.
† P value based on t test.
‡ Receptive One-Word Picture Vocabulary Test.
§ Expressive One-Word Picture Vocabulary Test-Revised.

er's education, country of origin, reading problem, family's language spoken in the home, and homelessness. As shown in Table 3, in multiple regression analyses adjusting for these 10 potential confounders, families attending the intervention clinic had statistically significantly higher receptive and expressive language scores. Intervention families had an adjusted mean receptive language score of 93.9, compared with 85.2 in comparison families (95% CI of the difference: 3.3, 14.0; SR = 0.27; $P = .002$). The adjusted mean expressive language score for the intervention group was 85.2, compared with 80.9 for comparison families (95% CI of the difference: 0.04, 8.6; SR = 0.17; $P = .048$). The effect of the intervention was equivalent to a 6-month improvement in receptive language and a three month improvement in expressive language.

In addition, we performed analyses in which potential confounders adding little to the model were eliminated using backward stepwise regression. For receptive language, intervention families scored 9.0 points higher than comparison families (95% CI: 4.0, 14.1; SR = 0.29; $P = .001$), adjusting for child's age and ethnicity and mother's education and reading problem. For expressive language, intervention families scored 4.5 points higher than comparison families (95% CI: 0.3, 8.7; SR = 0.18; $P = .036$), adjusting for child's age and gestational age, mother's education and reading problem, and family's language spoken in the home and homelessness.

Finally, we sought to determine if any measurable dose-effect existed between quantity of literacy-promoting contacts and degree of improvement in language development. Adjusting for the same confounders used above, multiple regression analyses were performed in which receptive and expressive language were the dependent variables, using total number of literacy-promoting contacts as the main predictor variable. Each literacy-promoting contact was associated with an adjusted mean 0.4 (95% CI: 0.1, 0.6)-point increase in receptive score ($P = .02$), and an adjusted mean 0.2 (95% CI: −0.02, 0.4)-point increase in expressive score ($P = .07$).

TABLE 3. Multiple Regression Results for Receptive and Expressive Language Scores

Variable	Receptive*		Expressive†	
	B	*P*	B	*P*
Child's age (y)	2.2	.12	−2.5	.03
Gestational age (wk)	0.7	.37	−1.2	.08
Attendance in day care	−0.7	.82	−2.9	.21
Birth rank	−0.02	.99	−0.4	.71
Mother immigrant	−0.6	.85	2.1	.41
Mother high school graduate	5.4	.05	4.9	.03
Mother has reading difficulty	−6.3	.02	−2.8	.20
Latino ethnicity	4.6	.15	−0.5	.83
English spoken in home	1.1	.74	3.8	.14
Homeless	−0.6	.87	−4.7	.11
Child attends intervention clinic	8.6	.002	4.3	.048

B indicates unstandardized regression coefficients.
* Overall regression: $F = 2.8$; $P = .003$.
† Overall regression: $F = 2.9$; $P = .002$.

DISCUSSION

Children born in poverty are at high risk for language delay, which in turn may lead to difficulties with reading and at school.[1,2] ROR is a pediatric primary care-based low-intensity intervention that seeks to ameliorate this risk through increasing reading activities in the home, thereby giving poor children some of the same opportunities now enjoyed by their middle class peers.

The hypothesis underlying ROR is that pediatricians can intervene to improve the home literacy environment of poor children, and thereby alter preschool language development, as well as later reading ability and school motivation and performance. Although the effect of ROR on the home literacy environment has been previously well-documented, there is less evidence concerning the effects on language outcomes.

At Boston City Hospital, Needlman et al showed that previous receipt of a book was associated with higher frequency of literacy orientation (defined as identifying reading as a favorite activity or reporting that parent-child reading activities had occurred during the previous 24 hours).[13] The effect was most pronounced in families receiving public assistance. In a randomized, controlled trial performed in Providence, Rhode Island, Golova, High, and their coworkers also showed that participation in a clinic-based literacy intervention was associated with increased frequency of parent-child reading activities and increased child-centered literacy orientation (defined as identifying reading as a favorite activity or as part of the bedtime routine).[14] Consistent with these other studies, our results show that families participating in ROR read together more frequently with their children.

Furthermore, our study provides evidence that ROR has a beneficial effect on child language development. Using a standardized, objective measure, we have shown that ROR exposure is associated with gains in both receptive and expressive language. These gains are large enough to be clinically relevant, with the potential to lead to a decrease in the incidence of preschool language delay. In addition, the effect was found to be dose-related, with each additional ROR contact associated with an incremental improvement in language development.

The only other published study to look at the effect of clinic-based literacy interventions on language outcomes was recently published by High et al.[16] In that study, intervention parents reported increased expressive and receptive vocabulary in their 18- to 25-month-old children, as compared with controls. The results of our study, taken together with these results, demonstrate that ROR can have a significant impact on preschool language development.

Given our study design, a possible limitation exists in that unmeasured differences between the 2 clinic populations could have accounted for some of the differences in language development that we attributed to ROR. In fact, it is unlikely that this was the case. The 2 clinics were very similar sociodemographically, with virtually identical Hollingshead

SES and percentages of families receiving government aid. If anything, the intervention clinic participants might have been at higher risk based on a somewhat lower high school graduation rate and a higher percentage of recent immigrants. Therefore, any differences between the 2 groups would have served to decrease the measured effect size. Consequently, when we accounted for differences between the 2 groups (either by multiple regression modeling or by restricting analysis to the Latino subgroup), the measured effect of the program increased.

Another limitation of this study was the reliance on parental report for reading activities in the home as well as degree of exposure to the intervention, leading to potential for recall bias. In the case of parental report of reading activities, the instrument that we used was the StimQ, which has been shown to be reliable and valid in similar situations.[18]

A third limitation was the lack of blinding of research assistants to either the study hypotheses or the site in which assessments were performed. However, research assistants measuring child's receptive and expressive language were blinded to results of all other measures.

Although the effects of ROR are extremely promising, it is still possible that more intensive approaches may be warranted. It should be noted that even in the intervention group, children still scored lower than the US sample on which the test was developed.[19,20] This was particularly true for expressive language, for which the intervention group adjusted mean score was 85.2, almost 15 points below the expected mean score of 100. In a study by Hart and Risley,[2] the factor that best predicted expressive language was the quantity and quality of language used by parents in their interactions with their child. It may be that the ROR intervention may improve primarily the quantity rather than the quality of verbal interactions between parent and child. More intensive interventions such as Whitehurst's dialogic reading may be required for more dramatic improvements in expressive language than were demonstrated here.[11]

Preschool language development is known to be an important predictor of school age reading achievement.[2] Although ROR has an important impact on preschool language development, further study will be needed to determine if ROR can improve outcomes beyond the preschool period, such as reading ability and school performance.

CONCLUSION

In summary, ROR is an important intervention, promoting parental literacy support and enhancing language development in impoverished preschool children. Integration of ROR into routine pediatric health care is indicated.

ACKNOWLEDGMENTS

We thank Children of Bellevue, Inc, the Dreyfus Corporation, Bellevue Hospital Center, Kids of NYU, and the Department of Pediatrics of New York University School of Medicine for their support of Children of Bellevue's Reach Out and Read program. We thank the Mount Sinai Auxiliary Board, the Children's Center Foundation, the Kekst Corporation, and the Department of Pediatrics of the Mount Sinai School of Medicine for their support of Mount Sinai's Reach Out and Read program. We would like to thank the pediatric housestaff and faculty, and the ROR staff and volunteers at both institutions for their enthusiasm and dedication. Also, we would like to thank Linda van Schaick, Trish Magee, and the Reach Out and Read Coalition of Greater New York for their leadership in the advancement of ROR in the New York City metropolitan area. Finally, we would like to thank the Reach Out and Read National Center for its ongoing support and guidance.

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