Effectiveness of a Primary Care Intervention to Support Reading Aloud: A Multicenter Evaluation

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Objective.—Failure to read at grade level predicts life-long economic and social disability. Early exposure to reading aloud may prevent reading problems. This study seeks to determine whether institution of Reach Out and Read (ROR) programs is associated with increased reading aloud in a national sample.

Design.—Before-after intervention study: separate convenience samples were studied before and after institution of ROR programs at multiple sites.

Participants and Setting.—A convenience sample of parents of children age 6–72 months seeking routine health care at 19 clinical sites in 10 states.

Interventions.—The ROR model incorporates anticipatory guidance about reading aloud and distribution of free picture books at health supervision visits from 6 months through 5 years as well as reading aloud in the waiting room.

Main Outcome Measures.—Parents were interviewed about their attitudes and practices related to reading aloud, using questions drawn from validated instruments.

Results.—The sample included 1647 subjects (730 intervention, 917 comparison). After controlling for multiple potential confounding factors, significant associations were found between exposure to ROR and reading aloud as a favorite parenting activity (Adjusted Odds Ratio [AOR] 1.6, $P < .001$); reading aloud at bedtime (Adjusted Odds Ratio [AOR*rsqb; 1.5, $P < .001$); reading aloud 3 or more days per week (AOR 1.8, $P < .001$); and ownership of ≥10 picture books (AOR 1.6, $P < .001$).

Conclusions.—In a national sample, implementation of ROR programs was associated with increased parental support for reading aloud. This study provides evidence of the effectiveness of a primary care intervention strategy to promote reading aloud to young children.

KEY WORDS: books; literacy; primary care; Reach Out and Read; reading

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The central importance of reading aloud in the development of literacy has long been a matter of consensus among educators.[1] Within the past 15 years, pediatricians and other primary care providers have increasingly taken an active role in the promotion of reading aloud, particularly in low-income communities, where reading aloud is relatively rare and reading problems are common.[2,3]

Most primary care interventions to promote reading aloud have been modeled on Reach Out and Read (ROR), originally developed at Boston City Hospital by Needlman et al.[4] ROR includes 3 components: 1) anticipatory guidance about reading aloud delivered as an integral part of routine preventive care, 2) the gift of a picture book at repeated health supervision visits between ages 6 months and 6 years of age, and 3) waiting room volunteers who read aloud with the children, modeling effective strategies for the parents. There are currently more than 2000 ROR sites in the United States, supported by a National Center that provides technical assistance as well as grants for books.[5]

Evidence of the efficacy of ROR and similar interventions has appeared in a dozen peer-reviewed articles.[6–17] A critical review of these studies has found that ROR is consistently associated with increased endorsement of reading aloud as a favorite activity of parents and children; increased frequency of reading aloud, particularly at bedtime; and, in three studies, clinically meaningful increases in preschool vocabulary, itself a strong predictor of later school success.[18]

However, caution is required when generalizing from this body of studies to the rapidly expanding number of ROR programs across the country. First, the demonstration of efficacy under study conditions may not translate to effectiveness in real life. Second, the diversity of outcome measures employed by different researchers hampers direct comparisons across studies.[18] Thus, it has not been clear whether results found in, say, New York City, apply equally to San Diego or to Omaha or whether certain ethnic groups are more or less responsive. Similarly, existing studies could not readily be combined to look at child age and gender as a predictor of response.

With these limitations in mind, the current study was

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Table 1. Wording of Key Dependent Variables in the Survey Instrument

Open-ended questions
1. What are your 3 favorite things to do with your child these days?
2. What do you do to help prepare your child for sleep at night?
3. Is there anything you do with your child now that will help him/her be successful when he/she goes to first grade?
Questions adapted from the StimQ
4. Do you ever read children's books to your child, or is she/he too young for that?
5. How many books do you have at home that you read to your child?*
6. How many days each week do you read children's books with your child?†

*For Literacy Support Summary Score, dichotomized as <5/≥5.
†For Literacy Support Summary Score, dichotomized as <3/≥3 times/wk.

designed to answer 2 questions: 1) Has program effectiveness been preserved in the process of program expansion? 2) Is the program equally effective across divides of geography, ethnicity, and child age? The study sought to address these questions by collecting data from ROR programs around the country, serving families whose ethnic makeup roughly reflects the populations most at risk for developing reading problems in school. We hypothesized that the institution of ROR under real-life conditions would be associated with positive changes in parent attitudes and behaviors related to reading aloud, regardless of child age and gender, parental ethnicity, and geographic location.

METHODS

Study Design

This was a prospective intervention study, using historical controls: At each site, a convenience sample of parents was interviewed before institution of the ROR program. This sample served as the comparison group. A separate convenience sample from the same site was interviewed after the ROR program had been established for at least 1 year. This sample served as the intervention group.

Enrollment

Enrollment was conducted at clinical sites across the United States at which ROR implementation was planned but had not yet begun. At each site, 2 convenience samples were enrolled, as described above. For each sample, the eligible study subjects were parents or guardians of children age 6 months to 6 years presenting for well-child care. If more than 1 child was eligible, the youngest was chosen. Children with severe neurodevelopmental disabilities (eg, Down syndrome, visual or hearing impairment, static encephalopathy) were excluded in order to reduce sample variability. Parents were informed that participation was entirely optional and unrelated to their child's medical care and that no personal identifying information would be asked or recorded. As the surveys did not contain any sensitive questions, the potential for causing harm was felt to be minimal. Authorization was received from the institutional review board or human studies committee of each relevant academic institution.

Intervention

All of the sites met the standards of the ROR National Center for clinician training and program infrastructure, as outlined in a comprehensive manual (available from www.reachoutandread.org). All served a predominantly low-income clientele; all provided new, free picture books at health supervision visits from 6 months up to the sixth birthday along with individualized guidance from the clinicians. The availability of waiting room readers varied.

Data Collected

Data were collected by interview using a structured questionnaire developed for this study. The survey instrument contained 6 literacy-related questions (Table 1). The first 3, adapted from previous studies,[6–9] were scored as positive if the respondent mentioned books or reading aloud. The next questions, asking specifically about the frequency of reading aloud and number of books present in the home and read to the child, were adapted from the StimQ. The StimQ was normed on low-income, urban Hispanic/Latino and African-American families and has been found to have good internal consistency (Cronbach $\alpha = .88$), test-retest reliability (intraclass coefficient of .93), criterion-related validity (correlation with the Home Observation for Measurement of the Environment: $r = .55$, $P < .001$) and predictive validity (correlation with the Bayley 2nd edition MDI: $r = .45$, $P < .01$).[19] Days per week of reading aloud was dichotomized at <3 versus ≥3 days per week;[2] number of children's books available in the home was dichotomized at <5 versus ≥5 and as <10 and ≥10. A literacy support summary score (Cronbach $\alpha = .71$) was created by assigning a value of +1 for a positive response to each of the 6 main outcome variables, as shown in Table 1.

The interviewers were either clinicians or assistants, who were trained in survey administration by the study director at each site, following explicit instructions. To minimize social desirability bias,[20] parents were told that the interview was about "things they do with their child" rather than explicitly mentioning books or reading. The first 3 questions were open ended, to avoid cueing parents, and the next question was worded so as to intentionally imply that parents might legitimately consider their child to be too young to be read to.

Data were also collected about child gender and age;

Table 2. Practice Characteristics of Participating Clinics/Offices

Type of Setting	N (%)
Hospital-based	9 (47%)
Community health clinic	7 (37%)
Private practice	3 (16%)
Location*	
Urban	12 (63%)
Suburban	4 (21%)
Rural	2 (11%)
General pediatrics visits per year	Mean 10 655; range 1080–35 000
No. of practices in which residents see patients	9 (47%)
Percentage of patients with public insurance† or uninsured (averaged across sites)	80%
Mean estimated social-class rating among all families using the clinic/office	4.0, corresponding to working poor

*One clinic, located in a rural/suburban area, could not be classified, therefore, the percentages do not sum to 100.
†Including Medicaid and SCHIP; other public insurances were not explicitly included.

birth weight was included as a marker for risk of developmental delay, categorized according to the usual cutoffs for low and very-low birth weight. Parents were asked to self-identify their ethnicity and the languages spoken in the home. Ethnicity and language were considered important as markers for potentially important differences in patterns of parent-child communication, as well as extent of acculturation to the United States.[21] A question about parental education was added partway through the study and was therefore only available for a subset of 8 sites (N = 567). Parental education was dichotomized as <12 years versus ≥12 years. Parents were also asked how many well-child visits the child had had in the previous year, as a marker of health care utilization.

Using a separate questionnaire, study leaders provided descriptions of the participating health centers in terms of type of setting (hospital based, community health clinic, or private practice), location (urban, suburban, or rural), size (number of visits), participation of residents, prevalence of public insurance among the patients, and estimates of patient social class (Table 2). Study leaders also described the extent to which the ROR model was implemented at their sites, in terms of provision of anticipatory guidance and how frequently (if ever) the book supply ran out. In addition, parents at a subset of sites were also asked to recall if they had been given a book by their child's doctor at a previous visit.

Analysis

The data were analyzed using SPSS-13. Two-tailed tests of significance were used throughout. In order to gauge overall program effectiveness (study question 1), all subjects interviewed before institution of ROR were combined as the comparison group, and all interviewed after ROR as the intervention group. Odds ratios and 95% confidence intervals were computed for categorical variables and independent-samples *t* tests for continuous variables.

In order to control for potential confounding factors, separate binary logistic regression analyses were performed for each outcome, adjusting for child sex and age (<12 months vs ≥12 months), as well as ethnicity, language spoken at home (Spanish or not), whether or not the child had attended the clinic for a health supervision visit in the past year, and study site. The last factor entered into each equation was intervention group versus comparison group. These analyses were repeated, with the addition of a variable to control for parental education in the subset in which parental education was known. Parental report of having received a book at a previous visit was not entered into the regressions because of our decision to look at program effectiveness on the basis of intention to treat (ie, existence of a ROR program) rather than of an idealized intervention. Adjusting for the consistency of program implementation would have undermined our ability to draw conclusions about real-world performance.

In order to look at program effectiveness within different subgroups (study question 2), stratified analyses were performed contrasting the comparison and intervention groups. For these analyses, we used the literacy support summary score (described above) as the dependent variable. The literacy support summary scores were dichotomized by a median split procedure. We then computed odds ratios and 95% confidence intervals for high (above the median) literacy support associated with the intervention within each subgroup. For the analyses of geographical region, the map of the United States was divided into 4 quadrants by drawing vertical and horizontal lines through the geographical center. The northeast quadrant comprised sites in Iowa, New York, and Ohio; the southeast quadrant comprised Florida, Louisiana, and North Carolina; the northwest quadrant comprised California, Colorado, and Montana; the southwest quadrant comprised Texas. We also carried out binary logistic regression analyses within each stratum, as described in Table 3.

RESULTS

Description of the Sites

Thirty program leaders expressed interest in participating in the study. Ultimately, data from both before and

Table 3. Odds Ratios for High (Above Median) Literacy Support Summary Scores as a Function of the Presence of a ROR Program, in Subsamples Stratified by Child Age and Gender, Geographic Region, Ethnicity, and Parent Education; Both Univariate and Multiple Logistic Regression Analyses Shown

Stratum	Subsample N (Comparison; Intervention)	Univariate Odds Ratio (95% Confidence Interval)	Adjusted Odds Ratio (95% Confidence Interval)*
Entire sample	917; 730	1.8 (1.4–2.1)	2.0 (1.3–3.2)
Age (mo)			
6–11.9	173; 146	1.6 (1.0–2.5)	1.8 (1.1–3.0)
12–35.9	415; 341	1.9 (1.4–2.5)	2.0 (1.4–2.7)
36–72	329; 243	1.9 (1.3–2.7)	2.1 (1.4–3.1)
Gender			
Female	448; 359	1.9 (1.5–2.6)	2.3 (1.6–3.1)
Male	446; 347	1.6 (1.2–2.2)	1.8 (1.3–2.4)
Geographic region			
Northeast (Iowa, New York, Ohio)			
Southeast (Florida, Louisiana, North Carolina)	225; 185	1.7 (1.2–2.8)	2.0 (1.3–3.2)
Northwest (California, Colorado, Montana)	230; 258	1.4 (0.95–2.0)†	1.5 (1.0–2.3)
Southwest (Texas)	376; 244	1.9 (1.3–2.6)	2.1 (1.4–3.0)
	56; 43	4.3 (1.8–10.2)	4.7 (1.9–12.1)
Ethnicity			
African American	145; 151	2.4 (1.5–3.8)	2.4 (1.5–4.0)
Latino	363; 264	2.2 (1.6–3.0)	2.1 (1.5–3.0)
White	338; 255	1.2 (0.9–1.8)†	1.5 (1.0–2.3)
Parental education			
<12 year of schooling	127; 105	2.4 (1.4–4.1)	2.8 (1.6–5.0)
≥12 years of schooling	160; 158	1.0 (0.6–1.6)†	1.2 (0.8–2.0)†

*Each multiple logistic regression controls for age, sex, region, and ethnicity, except where each variable is being stratified on. Thus, analyses stratified by age control for sex, region, and ethnicity; analyses for region control for sex, age, and ethnicity, and so on.

†Not statistically significant.

after program implementation were provided for 19 sites. These sites were located in 10 states, with representation across the United States, as noted above. All of the sites provided physician counseling and distribution of children's books, following the ROR model. At 10 sites, siblings of patients were also regularly given books, while 6 sites reported at least sometimes running out of books. Parents at 16 sites were asked whether they had received a book from their child's doctor at any previous visit; 70.1% in the intervention group responded affirmatively.

Intervention and Comparison Groups

The total sample comprised 1647 parents, 730 in the intervention and 917 in the comparison group. Intervention samples were collected on average 17.8 months after program initiation (range 10–35 months). The groups were similar in all respects, including child's age, gender, birth weight, respondent's relationship to child, ethnicity, language, and parental education (Table 4).

Main Findings

The presence of an ROR program was associated with greater parent-reported literacy-promoting attitudes and practices, including identification of books as a favorite activity (odds ratio [OR] 1.4, 95% confidence interval [CI] 1.2–1.8), reading aloud thought of as leading to school success (OR 1.5, 95% CI 1.2–1.8), use of books at bedtime (OR 1.5, 95% CI 1.2–1.9), all 3 of the above (OR 1.5, 95% CI 1.2–1.9), ever reading to the child (OR 1.9, 95% CI 1.4–2.7), and reading aloud 3 or more days per week (OR 1.4, 95% CI 1.1–1.8). The average number of days per week of reading aloud was higher in the intervention group (mean 4.7 ± standard deviation 2.3 vs 4.4 ± 2.5, $P < .01$). Reported ownership of 5 or more books for the child was nonsignificantly higher in the intervention group (OR 1.3, 95% CI 0.99–1.6), as was ownership of 10 or more books for the child (OR 1.2, 95% CI 0.99–1.5).

These results remained essentially unchanged in multiple logistic regression analyses adjusting for child gender and age, ethnicity, language spoken in the home, attendance at 1 or more well-child visits in the past year, and study site (Table 5). In these analyses, the association between the ROR intervention and book ownership did reach significance. With parental education included in the model (possible only for those sites for which education data were available in both intervention and control groups) the findings remained similar, although 2 dependent variables ("ever read to child" and "school success") no longer reached statistical significance (Table 5).

In order to assess whether ROR had consistent effects among various subgroups, stratified analyses were performed with the literacy support summary score as the dependent variable (Table 3). ROR was associated with the hypothesized increases in the literacy-support summary score, regardless of child's age, sex, or geographic region. A different pattern was observed for parental education and ethnicity. Exposure to ROR was associated

Table 4. Demographic Characteristics of the Parents and Children*

	Comparison (N = 917)	Intervention (N = 730)
Relationship to child		
Mother	808 (90.9%)	642 (90.4%)
Father	56 (6.3%)	41 (5.8%)
Grandparent, or other	25 (2.8%)	27 (3.8%)
Ethnicity		
African American	145 (15.8%)	151 (20.7%)
Latino	363 (39.6%)	264 (36.2%)
White	338 (36.9%)	255 (34.9%)
Other	71 (7.7%)	60 (8.2%)
Languages spoken at home		
English only	546 (59.5%)	475 (65.1%)
Spanish only	210 (22.9%)	145 (19.9%)
English and Spanish	98 (10.7%)	76 (10.4%)
Other	63 (6.9%)	34 (4.7%)
Education ≥ 12 years (HS)†	160 (50.3%)	158 (49.7%)
Child age (average months)	29.8 ± 18.7	28.6 ± 18.0
Child age by category (mo)		
6–11.9	173 (18.9%)	146 (20.0%)
12–35.9	415 (45.3%)	341 (46.7%)
36–72	329 (35.9%)	243 (33.3%)
Child sex		
Female	449 (50.2%)	359 (50.8%)
Male	445 (49.8%)	347 (49.2%)
Birth weight (g)		
≥2500	792 (89.8%)	613 (88.5%)
1500–2500	76 (8.6%)	71 (10.2%)
<1500	14 (1.6%)	9 (1.3%)

*There were no significant differences between the comparison and the intervention group for any parameter (all $P > .05$ by χ^2 analyses).

†Data on parental education available for both before and after samples, N = 567.

with higher summary scores only for families in which the caregiver had less than a 12th-grade education. Higher summary scores associated with ROR were observed among African-American and Latino families but not white ones. In each of these categories, education and ethnicity, the subgroups in which differences were not seen, the subjects started out with significantly higher literacy support scores before ROR compared with the rest of the sample (4.3 ± 1.5 vs 2.9 ± 1.8, $P < .001$ for whites vs others; and 3.9 ± 1.6 vs 2.7 ± 1.7, $P < .001$ for subjects with ≥12 years of schooling vs <12 years). In addition, although we did not see a summary-score difference among whites as a whole, exposure to ROR did appear to be associated with higher summary scores among whites with <12 years of schooling (3.8 ± 1.3 vs 3.2 ± 1.3), although the small N for this subgroup (26) precluded statistical analysis.

DISCUSSION

This large, multisite study confirms the findings from previous evaluations of ROR-based pediatric literacy interventions, performed in single locations.[6–17] The unique contribution of the present study is that it evaluated the effectiveness of the program as applied in real-world settings rather than the efficacy in an idealized research context. Combining data from across the country, parents exposed to ROR were approximately 1.5 times as likely to consider reading aloud a favorite activity, and similar increases were observed in reading aloud at bedtime, reading aloud at least 3 days per week, and picture books available and used in the home. As expected, these associations are modest in comparison with the findings of previous efficacy studies, several of which reported odds ratios of 4, with one as high as 10.[18]

Nonetheless, a 50% increase in the numbers of parents who report reading aloud regularly and valuing it highly is likely to be clinically meaningful, as well as statistically significant. Parental support for reading aloud is consistently associated with improved child language development and eventual school success.[1,3,22–25] For example, an analysis of national survey data by the National Center for Education Statistics found that preschool children who were read to 3 or more times per week were significantly more likely to be able to recognize all the letters of the alphabet, count to 20, write their names, and read or pretend to read, and were "nearly twice as likely as other

Table 5. Adjusted Odds Ratios (OR) for Indices of Reading Aloud as a Function of the Presence of a ROR Program, Controlling for Multiple Potential Confounding Factors (CI = confidence interval)†

	Full Dataset (N = 1647)		Parent Education Data Available (N = 567)	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Favorite activity includes books/reading	1.6*	1.3–2.0	1.9**	1.3–2.9
Bedtime routines includes books/reading	1.5*	1.2–2.0	2.0*	1.3–3.1
School success aided by books/reading	1.5*	1.2–1.9	1.0****	0.6–1.4
All 3 of the above	1.7*	1.3–2.3	1.9***	1.1–3.3
Ever read to child	2.6*	1.7–3.9	1.7***	.9–3.4
Reading aloud ≥3 days per week	1.8*	1.4–2.5	2.2*	1.4–3.4
≥5 books for child at home	1.6**	1.1–2.2	2.1**	1.2–3.6
≥10 books for child at home	1.6*	1.2–2.1	1.9**	1.2–3.0

†Variables included in regression: sex, age, language (English, Spanish), ethnicity (white, Latino, African American), well-child visits in past year (1 or more), and study site; in right-side column, parent education (high-school graduation) was also added.

*$P < .001$.

**$P < .01$.

***$P < .05$.

****Not statistically significant.

children to show three or more" of these emergent literacy skills.[2]

The large size of our study permitted us to look at a variety of subgroups. The program was effective regardless of the child's age, sex, region of the country, or home language and was effective for ethnic minorities and parents with lower education. The fact that we did not document changes in the literacy-support summary score among whites or high school graduates may have been due to a ceiling effect, as both of these groups had high literacy support scores at baseline. Measurement limitations notwithstanding, it appears that the intervention is most effective among those who need it most.

Limitations

Despite being a national study, the sample was not intended to reflect the demographics of the country nor were sites chosen at random. Therefore, one must generalize with caution.

The reliance on convenience samples raises the possibility of selection bias on the part of the interviewers. To the extent possible, this limitation has been addressed through multivariate analyses, controlling for potential confounding factors. Bias in the interpretation of the 3 open-ended questions could have contributed to the positive findings, but such bias is less likely to have affected the StimQ questions to the same degree because these did not rely on interviewer interpretation. Nonetheless, the fact that the interviewers could not be blinded to intervention status (the presence or absence of an ROR program) may have led to bias in the data collection. Social desirability may also have colored parents' responses, contributing to reporting bias, although we asked open-ended questions first and phrased other questions so as to imply acceptance for nonreading aloud.

The use of an historical comparison group raises the possibility that secular trends might account for the observed differences. However, data from the National Household Education Survey suggest that the pace of change in parental support for preschool literacy development has been slow in the country as a whole. Between 1993 and 1999, the percentage of parents of 3–5 year olds who reported reading aloud 3 or more days per week rose from 78% to 81%; among parents with less than a high school education, the percentage rose from 60% to 61%.[2] Secular changes over the period of our study are likely to have been smaller yet.

Implications

Innovative programs often appear highly efficacious as demonstration projects, only to lose their luster once widely disseminated. As ROR becomes integrated into standard practice across the country, it will become increasingly important to monitor for this dilution effect and to take steps to maintain program quality. Despite such real-world challenges, ROR does appear to be effective for children from a variety of backgrounds and to be most effective for those who need it most.

Future research will be needed to fine-tune clinic-based literacy-related interventions for different populations and individuals. The methodological limitations inherent in the present study could be overcome in a randomized, prospective trial utilizing direct measures of language development and school success. However, even without this gold-standard evidence, we may now know enough to proceed confidently with program dissemination and the integration of literacy-support interventions into standard pediatric practice. Every child in the country should have the opportunity to grow up loving books. Pediatricians and other providers of primary health care for children are in a strong position to help make this vision a reality.

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