

Review Article

Pediatric Interventions to Support Reading Aloud: How Good is the Evidence?

ROBERT NEEDLMAN, M.D.

Department of Pediatrics, Case Western Reserve University School of Medicine, Cleveland, Ohio

MICHAEL SILVERSTEIN, M.D., M.P.H.

Department of Pediatrics, University of Washington School of Medicine, Seattle, Washington

ABSTRACT. Pediatricians and family practitioners increasingly provide free picture books and anticipatory guidance about reading aloud as part of routine health supervision for infants and young children, and arrange for volunteers to read aloud to children in the waiting rooms. These interventions comprise the Reach Out and Read (ROR) model, which has been adopted by more than 2000 clinical sites nationally. To date, 12 published studies have evaluated ROR and its variations, including three prospective, controlled trials. All but one have shown associations between ROR and increased reading aloud; additionally, four studies have linked program exposure to clinically meaningful increases in child language. Nonetheless, conclusive evidence of efficacy is lacking. This article provides a systematic, critical review of the literature, focusing on theoretical assumptions, issues of study design and measurement, and directions for future research. *J Dev Behav Pediatr* 25:352-363, 2004. Index terms: *reading, literacy, Reach Out and Read, reading aloud.*

The last decade has seen a rapid increase in the number of pediatricians and family practitioners who incorporate interventions to promote reading aloud into their practice of child health supervision. These interventions generally follow the Reach Out and Read (ROR) model, in which clinicians distribute free picture books at "checkups" for children six months through five years of age, and provide anticipatory guidance about reading aloud. In addition to this clinical intervention, the ROR model includes volunteers who read aloud to children in the waiting rooms, with the goal of modeling developmentally appropriate techniques for looking at books with young children.¹

Since its inception in 1989, ROR has spread to more than 2000 clinics and offices serving low-income populations. There are now ROR sites in all 50 states, and in most pediatric residency training programs. This rapid expansion has been paralleled, and to some extent fueled, by clinical research documenting the effectiveness of the approach. To date, 12 studies have been published, and several more presented in abstract form. The majority—but not all—of

these studies support the general contention that "ROR works." However, they vary in the details of their interventions and outcome measures, as well as in overall study design. Some are methodologically stronger than others.

Given this heterogeneity, it is fair to ask whether the available evidence is adequate to conclude that the ROR model is effective, and if so, in what ways. These questions are of more than academic interest. Many physicians and other clinic staff, as well as many community volunteers, invest significant time, money, and effort in providing ROR-based interventions. And while distributing picture books is harmless, there may be harm in diverting resources away from other, potentially more effective, interventions. Therefore, questions about the effectiveness of ROR are appropriate and ought to be taken seriously. To our knowledge, no systematic review of this topic has yet been published.

The purpose of the present paper is to review the research that speaks directly to the effectiveness of the ROR approach. We have chosen the ROR approach as the subject of our review because it is far and away the most commonly implemented clinic-based literacy intervention. We have chosen to restrict the scope of our review to interventions based on the ROR model to limit heterogeneity; a comparison between ROR and other models is beyond the scope of this paper. We consider

Address for reprints: Dr. Robert Needlman, Department of Pediatrics, MetroHealth Medical Center, 2500 MetroHealth Drive, Cleveland, OH 44109; e-mail: Robert.needlman@case.edu.

the nature of the research questions asked, the outcome measures and findings, and issues of study design and methodology for each study. To account for publication bias, we include selected studies that have appeared

only as abstracts. Finally, we discuss areas for future research.

At present, the relevant body of evidence comprises 12 studies published in peer-reviewed journals.^{2-12,61} Table 1

Table 1. Study Designs, Samples, and Main Findings[†]

Study	n	Design	Sample ^a	Main Findings
Needman, 1991	79	Cross-sectional, retrospective	Boston, MA. 51% born outside US, 40% unmarried, 25% < HS education	4x ^b increase in having "literacy orientation" among parents given books
High, 1998	151	pre- and postintervention	Providence, RI. 30% born outside US; 37% Latino, 17% African-American; 37% < HS education	Approximately 4x ^b increase in having "child centered literacy orientation" in the intervention group
Golova, 1999	135	Prospective, quasi-randomized controlled study	Providence, RI. 92% born outside US; 90% Spanish speaking at home; 55% single; 57% < HS education	10x ^b increase in parents reading aloud ≥ 3 night/week; trend for increased receptive vocabulary among intervention children > 18 months old
High, 2000	205	Prospective, quasi-randomized controlled study	Providence, RI. 60% born outside US; 74% Latino; 54% single or separated; 41% < HS education	40% increase in receptive (parent-reported) vocabulary; 80% increase in expressive, among children > 18 months old
Jones, 2000	352	Prospective, quasi-randomized controlled study	Louisville, KY. 85% African-American; 90% single; 9% < HS education (91% HS graduates), but < 10% with more than HS education.	2x increase in proportion listing reading as favorite activity and increase doctor "helpfulness" and parent "receptiveness"
Sanders, 2000	122	Cross-sectional, retrospective	Palo Alto, CA. 90% of parents born in Latin America. 63% < HS education	3.6x ^b increase in likelihood of book sharing at least 3 times/week
Mendelsohn, 2001	122	Cross-sectional, between-clinics comparison	New York, NY. 28% born outside US, 55% single parents, 40% < HS education	Adjusted 8.6 points higher receptive vocabulary, 4.3 points higher expressive on standardized tests
Sharif, 2002	200	Cross-sectional, between-clinics comparison	New York, NY. 53% Latino, 46% African-American; 64% < HS education	Receptive vocabulary 7.2 points higher on standardized test
Silverstein, 2002	180	pre- and postintervention	Seattle, WA. 57% English <i>not</i> the primary language; mean education of non-English speakers = eighth grade	2.4x increase in proportion listing reading aloud as a favorite activity; 1.7x increase in proportion practicing regular bedtime reading; similar rises in English and non-English groups
Fortman, 2003	165	Cross-sectional, between-clinics comparison	Midwestern, middle-class, predominantly white and college-educated	No significant difference associated with intervention
Theriot, 2003	64	Cross-sectional, retrospective	Louisville, KY. 88% African-American; 89% receiving Medicaid	Receptive and expressive language scores correlated with number of books given by clinic multiplied by the number purchased by parents

HS, high school.

^aCombining intervention and control groups.

^bOdds Ratio.

[†]See Addendum for 12th study.

summarizes the basic study designs, sample sizes, study populations, and key findings. (See the Addendum for a description of the 12th study.)

THEORETICAL FRAMEWORK

The rationale underlying the ROR approach is that many children have difficulty learning to read in elementary school because they have been exposed insufficiently to reading aloud during the preschool years. By promoting reading aloud, the program aims to reduce the rate of early reading problems that may lead to persistent underachievement in reading, and ultimately to school failure. To date, however, no study has provided evidence that bears directly on the question of whether ROR, or any similar intervention, actually reduces reading problems in elementary school. The definitive way to address this question would be a longitudinal randomized controlled trial, comparing ROR with standard pediatric care. As with most of our interventions in the primary care setting, however, no such study exists; we are therefore left to infer ROR's effectiveness from less powerful study designs with more proximal outcome measures.

Stepping back from the ultimate research question, "Does ROR prevent elementary school reading problems," one can visualize a causal pathway for ROR's effectiveness related to a chain of study questions, each logically tied to its neighbors (Figure 1). Starting from the left, positive changes in parent attitudes towards reading aloud (box D) plausibly relate to increases in reading aloud and in the presence of picture books in the home (box C), which might stimulate verbal language development and what has been called "emergent literacy"¹³ (box B), which in turn might position the child for reading success in school (box A). The study questions located further out on this chain—parent attitudes and practices—are only indirectly linked to school success, the question of ultimate interest. However, as these questions are also more easily answered, they have been the subjects of the most study.

How strong are the links that bind this chain together? There is strong evidence that preschool verbal language ability ranks among the top predictors of later reading success (Figure 1, arrow 1).¹⁴⁻¹⁶ For example, Whitehurst, in a longitudinal study of low income, African-American children showed a robust correlation ($\beta .67$) between verbal language at age four and letter knowledge and phonemic segmentation; these factors in turn predicted word decoding

at age six.¹⁷ However, other research has questioned the linkage between verbal language and word-reading (i.e., decoding), while supporting a link between verbal language and reading *comprehension*.¹⁸ Emergent literacy refers to a set of concepts, skills, and expectations children acquire prior to the acquisition of standard writing and reading; for example, the understanding that the story in a children's book is conveyed by the letters on the page. Because emergent literacy and standard reading and writing fall along a developmental continuum, the links between them are strong.¹³

Moving toward the left, in Figure 1, there is evidence that reading aloud stimulates verbal language development and emergent literacy (Figure 1, arrow 2).^{13,19} Numerous observational studies detail the ways in which reading aloud creates a framework that optimally supports language development.²⁰ When reading aloud to their young children, parents typically engage in routines of pointing, questioning, and feedback, adjusting the complexity of the teaching to the child's increasing level of competence.^{20,21} Parents tend to use more complex and descriptive language and ask more questions while reading aloud than they do during other daily activities.²² Finally, there are experimental data showing that reading aloud promotes receptive and expressive vocabulary growth.²³

There is a strong consensus supporting a causal connection between preschool exposure to reading aloud and subsequent reading ability. In 1985, the National Institute of Education declared reading aloud to be "the single most important activity for building the knowledge required for eventual success in reading," a judgment echoed in 1998 by the International Reading Association and the National Association for the Education of Young Children.^{24,25} A meta-analysis of 29 studies found an overwhelming association between early reading aloud and later academic outcomes.²⁶

At the far left end of the chain in Figure 1 is the connection between parents' *attitudes* about reading aloud, and their actual reading aloud *behavior*. In general, parenting beliefs are meaningfully related to parenting behaviors.²⁷ Several studies have found moderate to strong correlations between beliefs and behaviors specifically with respect to reading aloud.^{28,29} For example, in one study, mothers with more facilitative beliefs on a 41-item scale were found to provide their children with more and broader reading aloud experiences.³⁰

In summary, there is evidence for the linkage between parental beliefs that favor reading aloud and behaviors that support the development of language and emerging literacy, and between all of the former and reading success in elementary school. However, it is clear that multiple variables affect the various outcomes along the chain. Genetics plays a role, in that up to 50% of the variance in language ability appears to be inherited.³¹ Phonological processing ability influences the ease with which children acquire basic reading and writing skills, but may be largely unrelated to reading-aloud exposure.³² Furthermore, an exclusive focus on *parental* reading aloud may not be justified as children may benefit from reading aloud by grandparents, child-care providers, or teachers as well as by parents. Therefore, while the importance of parental

Do ROR-model interventions result in ...

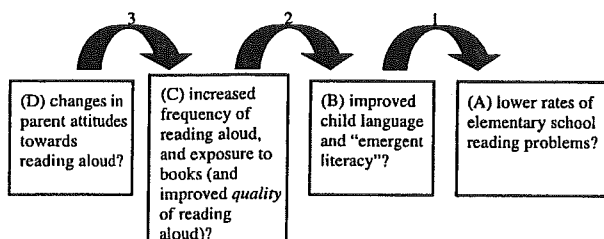


FIGURE 1. Chain of study questions.

attitudes and reading-aloud behaviors is evident, these are certainly not the sole factors influencing reading success.

Caution is also called for in connection with the intervention. Although the programs reviewed below were all modeled after ROR, they differed in details. Some extended the ROR intervention, for example, by having waiting room volunteers counsel parents about the importance of reading aloud⁸ or by beginning at a younger age.^{7,12} Other studies used a contracted intervention, for example, omitting the waiting room readers.^{4,5} As a group, the studies reviewed below represent the ROR approach, in a general sense, rather than the ROR model *per se*. Details of the various interventions are presented in Table 2.

STUDY SELECTION, OUTCOME MEASURES, AND FINDINGS

Studies were identified for review by performing a Medline search using the key words "literacy," "reading," and "books," limiting the search to infants and preschool children. From the resulting lists of articles, we selected those that either mentioned ROR specifically, or concerned programs modeled after ROR. We also reviewed all articles referenced in the identified sources, or identified as "related articles" by PubMed. We restricted our review to interventional studies, but accepted any program evaluation design.

Table 1 presents an overview of the main findings. Table 3 details the key outcome measures used, and the pattern of positive and negative results. These outcome measures can be grouped into two categories corresponding to self-reported parent attitudes and behaviors, and reported or observed indices of child language development.

Self-Reported Parent Attitudes and Behaviors

In the original pilot study by Needlman et al.,² the main outcome measure was termed "literacy orientation." This variable combined a measure of parent attitudes with a measure of parent-reported activity. Parents were asked to report their child's "three favorite activities," as well as everything they did with their child during the preceding 24 hours. Responses to either question that included looking at books or magazines were coded as positive for literacy orientation. These questions were asked in an open-ended format, before any mention had been made of books or reading in the interview, in the hopes of limiting social desirability bias.³³

No information was provided on the validity of this outcome variable in the original study. However, content validity for a similar measure was suggested in a later cross-sectional study. Celano et al created a three-question battery that included open-ended questions about parents' favorite activities and bedtime routines, and a direct question about whether the child looked at a picture book during the preceding day. The score on this battery showed moderate correlation with a battery comprising five direct questions about parent-child reading activities ($r = .41$), with a well validated measure of parental reading ability ($r = .33$), and with parental report of the child's interest in reading, ($r = .54$).³⁴

The first study by High et al used a different set of questions to characterize what they called "child-centered

literacy orientation" (CCLO).³ Parents were asked to name their child's three favorite activities (other than eating or sleeping), their *own* three favorite parenting activities, and how many nights each week they shared books with their child to prepare the child for sleep. CCLO was scored as positive if parents mentioned books or reading in response to either of the "favorite activities" questions, or reported reading aloud at bedtime at least six nights per week. CCLO was found to be associated with the intervention, as were positive responses to the individual component questions. A later study by High et al⁵ also found an association between the intervention and CCLO (these results are not shown in Table 1).

Content validity for CCLO was supported by a subsequent 1999 study, also by High et al.³⁵ In a multiethnic, low-income convenience sample, CCLO was independently associated with a higher adult-to-child ratio in the home (OR 1.92), English being the sole language in the home (possibly an indication of acculturation; OR 2.67), parents reading regularly for themselves (OR 2.86), and the presence of more than 10 children's books in the home (OR 3.30). The frequency of CCLO in this study (39%) was similar to the frequency of CCLO in High's 1998 study (33%), and similar to the frequency of the related measure, literacy orientation, in Needlman's 1991 pilot study (32%).

Open-ended questions about the favorite activities of either the child or parent, scored as positive if reading aloud is reported, have been incorporated into 9 of the 12 published outcomes studies (Table 3). Apart from one study (Sharif et al),⁹ which asked parents what they did to prepare their children for learning in school, few other parent attitudes have been explored with any consistency in this body of literature.

With respect to parent behaviors, several studies have asked parents to report their frequency of reading aloud, as well as the number of children's books in the home.^{4-6,8-10} In some cases, reading frequency and numbers of books have been reported as continuous variables; in other cases, they have been treated as dichotomous, with different cut points (see Table 3). Direct comparisons are therefore difficult. Statistically significant findings in the predicted direction are reported consistently for reading aloud frequency, but not for number of books, where three of seven studies did not have positive findings for this measure.

Direct questions about reading aloud frequency and books in the home have face validity, and have been used in numerous studies (e.g., Young et al,³⁶ in which 39% of a nationally-representative sample of parents reported reading aloud on a daily basis to their preschool children.) Two ROR studies, by Mendelsohn et al and Sharif et al,^{8,9} employed the StimQ READ subscale, a structured interview that includes questions about the variety of books and book-reading interactions, as well as frequency and number of books. The StimQ correlates well ($r = .55$) with the Home Observation for Measurement of the Environment (HOME) Scale,³⁷ a widely-used observational measure that is one of the best predictors of children's cognitive development. Statistically significant associations between exposure to

Table 2. Intervention Details and Nature of Control Group[†]

Study	Intervention Details					Control/Comparison Group
	Waiting Room Readers	Books Given by Doctors	Anticipatory Guidance Given by Doctors	Printed Information on Reading Aloud	Duration/ Extent of Intervention and Length of Follow-up	
Needlman, 1991	+	+	+	-	Study began 9 mo after program start	None; comparison made to parents who did not recall receiving the intervention
High, 1998	-	+	+	+	At least 2 visits	Historical (prior to program implementation)
Golova, 1999	-	+	+	+	At least 3 visits	Alternate day; none in control group reported that doctor talked with them about reading
High, 2000	-	+	+	+	At least 3 visits	Alternate day; 37% of controls recalled receiving guidance, and 12% recalled receiving a book.
Jones, 2000	-	+	+	-	2 yr	Alternate assignment; controls received same anticipatory guidance
Sanders, 2000	+	+	+	+	72% received only 1 book	None; comparison made to parents who did not recall receiving the intervention
Mendelsohn, 2001	+ ^a	+	+	-	Program in place 3 yr	Paired clinic (without ROR); program in place 3 mo
Sharif, 2002	+/- ^b	+	+	-	Program in place 3 yr	Paired clinic (without ROR); no program in place
Silverstein, 2002	+	+	+	-	Study began 17 mo after program start	Historical (prior to program implementation)
Fortman, 2003	+	+	+	+ ^c	Intervention in place 6 mo	Paired clinics (3 pairs of matched clinics); however, doctors in control sites gave books and guidance to 41% and 49%, respectively
Theriot, 2003	+	+	+	+	Intervention began at 2 mo; books given at 2 to 5 visits, guidance at 2 to 8 visits	None

ROR, Reach Out and Read.

^aVolunteers also discussed importance of reading with families.^bReaders noted to be "sporadic."^cAlso, a videotape encouraging reading aloud was given.[†]See Addendum for 12th study.

Table 3. Key Outcome Measures and Findings

	Needlman 1991	High 1998	Golova 1999	High 2000	Jones 2000	Sanders 2000	Mendelsohn 2001	Sharif 2002	Silverstein 2002	Fortman 2003	Theriot 2003
24-Hour activity recall	+							-		-	
One of parent's three favorite activities	+	+	+	+	+	-		-	+		+
One of child's three favorite activities		+	-	+		-		+	+	-	+
Reading aloud at bedtime		+(a,b)		+(a,b)				-(c)	+(d)		
(a) nights/week											
(b) 6 or more nights/week											
(c) as "usual" activity											
(d) at least once/week											
Child-Centered Literacy Orientation (CCLO)		+		+							
Reading aloud frequency		+(b)	+(a)		+(b)	+(a)	-(a)	+(c)	-(d)		
(a) days per week											
(b) 3 or more days/week											
(c) at least 1 time/week											
(d) > 2 hours/week											
Children's books in the home			+(b,c)	+(c)		-(b)	-(a)	+(a)	-(c)		+(a)
(a) number											
(b) 5 or more											
(c) 10 or more											
STIMQ READ subscale							+/- ^a	-*			
Communicative Development Inventory (modif'd) receptive			+	+							
Communicative Development Inventory (modif'd) expressive			-	+							
Receptive One-Word Picture Vocabulary Test							+	+			+
Expressive One-Word Picture Vocabulary Test							+	-			+

^aNegative in the between-group analysis, but positive in the dose-effect analysis.

**p* < .056

+ Indicates statistically significant between-group differences in the predicted direction.

- Indicates a lack of statistically significant differences. (See text for descriptions of outcome measures.)

ROR and increased StimQ scores were not found in either study, although one study came close (*p* < .056).⁹

Indices of Child Language Development

Groups in Providence and New York have both studied the effects of the ROR intervention on children's language development, using different approaches. Golova et al used a modified Spanish-language version of a standardized parent-report measure, the MacArthur Communicative Development Inventory, short form (CDI)⁴ in a quasi-randomized (alternate day) prospective trial comparing a ROR-like intervention with standard pediatric care. The CDI comprises a list of words; for each word, parents report whether it is one their child says (expressive) or understands (receptive). For the study, the CDI was modified to include 50 words from the original test and 50 words contained in the books given to the child. In this way, it was hoped the CDI would provide evidence that the specific study books had been read and had had an effect on the child's language, and that the effect on language was generalized to words not contained in the books. Significant differences were found only for children in the upper half of the age distribution (> 18 months at follow-up) on the receptive scale comprised of words from the books.

Using the same design, High et al⁵ also created a modified MacArthur CDI using both words from the original CDI, and words from books given as part of the study. Among children in the upper half of the age distribution (> 18 months), intervention children scored significantly higher on both the receptive and expressive scales for both original CDI words, and for the words that were added from the distributed books. These differences persisted after controlling for parent education, foreign birth, parents' language proficiency (e.g., in English or Spanish), and child age. Significant differences were not found among younger children.

While the Providence groups relied on parent reports of child vocabulary and a nonvalidated instrument, two New York groups^{8,9} tested child language directly, using the Receptive and Expressive One-Word Picture Vocabulary Tests, which require the child to point to pictures in response to spoken words and to provide verbal labels for pictures, respectively. These tests are validated, with scores highly correlated to standard verbal intelligence tests. Both studies compared children at established ROR clinics with children at clinics that had implemented ROR three months previously (see below for a discussion of study design). Although the studies were similar in design, they were carried out independently by different groups of researchers.

In both studies, substantial differences in the predicted direction were found for receptive vocabulary, without significant differences in expressive vocabulary. However, in Mendelsohn's study⁸ significant differences for both receptive and expressive language appeared in stratified analyses looking only at families identified as Latino. Similarly, both receptive and expressive language differences were found in a multivariable regression analysis controlling for 10 potentially confounding variables including child age and gestational age, and parental education, ethnicity, and language, among others: 9.0 points for receptive, and for expressive 4.5 points. These scores are reported using a standardized scale with 15 points equal to one standard deviation. Effects of the sized observed—approximately 0.25 to 0.50 SD—are likely to be clinically, as well as statistically, significant. Using parental reports of the number of times they had experienced ROR interventions (books, guidance, or volunteer readers), Mendelsohn reported a dose-effect pattern, with each literacy-promoting contact associated with an increase on the receptive test of 0.4 points on average, and on the expressive test of 0.2 points.

Direct tests of child language were also employed by the group in Louisville,¹² in a cross-sectional study of 3-year-old children. Scores on both the Expressive One-Word Picture Vocabulary Test-Revised and the Peabody Picture Vocabulary Test III (similar to the Receptive One-Word Picture Vocabulary Test) were associated with the interaction between the number of anticipatory guidance visits at which books were given and the number of books purchased for the child by the parents.

Effect Size. Because of the heterogeneity of the outcome measures, it isn't possible to construct a single statistic to represent effect size. Table 1 conveys a sense of the magnitude of the most salient results. In general, the interventions are associated with increases in the target measures with odds ratios ranging from two to four. As noted above, increases in language scores associated with the intervention have approached 0.50 SD in size. Effects of this size are likely to be clinically meaningful.

METHODOLOGICAL ISSUES

Seven of the reviewed studies are cross-sectional in design, with independent and dependent variables ascertained simultaneously. Five others are prospective studies, two of which compared dependent variables measured pre- and postintervention, while three used quasirandomized controlled designs. All of the studies used convenience sampling, leaving open the possibility that a biased selection of study subjects may affect the generalizability of results. Among the pre- and postintervention studies, selection bias could also potentially inflate or diminish observed differences.

Cross-Sectional Designs

The initial study by Needlman et al² involved a single convenience sample interviewed in the waiting room. Parents were asked first about their reading-related attitudes

and behaviors, and later about their exposure to the intervention. The reliance on parental recall to establish exposure constitutes a major opportunity for the introduction of bias and error. The main value of this study, therefore, was in stimulating further research.

The subsequent study by Sanders et al⁶ used a similar approach to Needlman's, interviewing a convenience sample of parents, and relying on parental recall to identify those who had been exposed to the intervention. Thus, both recall and reporting biases are potentially problematic in this study. The study adds value in its description of cultural factors affecting reading behaviors, and in replicating a previous finding (in a methodologically superior study) of an association between a ROR-like intervention, and parent report of reading aloud three or more days per week (Table 1).

The studies by Mendelsohn et al⁸ and Sharif et al⁹ are discussed together, as their designs are virtually identical. Both are cross-sectional group comparisons, in which the intervention and control groups were drawn from entirely different clinics, raising the possibility that observed differences were due not to the intervention, but to pre-existing differences in the families making use of the different clinics. In considering this issue, both sets of authors observed that the intervention and control clinics were located within the same neighborhoods and served demographically similar groups of parents. Also, both studies measured relevant demographic variables, including parental education and reading problems, ethnicity, language, and economic status (Hollingshed social economic status (SES) in one study, Medicaid status in the other), and—by these indices—found their groups to be similar. The studies also controlled for potential confounding variables (e.g., the percentage of primarily English-speaking parents).

It is possible, however, that other, unmeasured factors might account for the observed differences in these studies. For example, the intervention clinics may have adopted ROR sooner because they employed doctors and nurses who were particularly committed to promoting cognitive/linguistic development among their young patients. It is also plausible that parents who already were committed to the idea of fostering literacy would have sought care in a clinic that gives out picture books or that other community-based literacy programs were more available in the area served by the intervention clinic.

The finding, in Mendelsohn's study, of a dose-response relationship between exposure to the intervention and child language scores, even after adjusting for relevant confounding factors, provides an argument for causality.⁸ However, it is plausible that the finding could also be accounted for by recall bias. That is, parents who were more supportive of child language development may also have been more likely to recall exposures to readers in the waiting room or books from the doctor, because these events were more salient to them.

The study by Theroit et al¹² also found a relationship between child language measures at age three, and the frequency of health supervision visits at which books were given along with the number of books purchased for the

child. In this study, the problem of parental recall was avoided, by recording in the child's chart the book given at each visit. However, no explanation was given for why some parents received more books than others, opening the possibility that the independent variable may have been influenced by a parent factor (say, interest in reading aloud) that was itself associated with stronger child language development. Similarly, the number of picture books purchased by the parents may have reflected parent attitudes towards reading aloud, that might have affected child language development independent of the intervention. The ability of this study to demonstrate a causal link between the intervention and child language is therefore quite limited.

The study by Fortman et al¹¹ stands apart in two ways: The sample reflects a mainly middle-class, highly educated population, and the study's findings are essentially negative. The authors point out that a large percentage of parents studied reported regular reading aloud. On the other hand, nearly half of parents in the *comparison* clinics also reported receiving anticipatory guidance about books as well as free books (Table 2). Due to this substantial control group contamination, the study's findings are difficult to interpret.

Pre- and Postintervention Designs

The two studies that fall in this category, High et al³ and Silverstein et al¹⁰ both employed separate convenience samples, a comparison or "before" sample interviewed prior to the initiation of the ROR-like intervention, and an intervention or "after" sample interviewed after the program had been up and running for approximately one year. The clear threat to such a study design is that external changes taking place over the course of the study could account for any observed differences. Neither study addresses other community literacy initiatives coincident with the study. Furthermore, changes in the composition of the study sample, from time one to time two, could bias the results in either direction, even if there were little change at the community level. The Silverstein study, however, controlled for changes in the composition of the study sample, and this did not affect the study results.

Interviewer bias is another concern in these studies. Interviewers in both studies were presumably aware of the study hypothesis and were also aware of the exposure status of the respondents. Given that the "favorite things" questions (described above) require a degree of interviewer interpretation to decide whether the parent's response should be counted as indicating reading aloud, the concern about possible interviewer bias is particularly cogent. One study (Silverstein) utilized different interviewers for the two time points, providing another avenue for interviewer bias to enter. Other potential threats inherent in pretest-posttest designs include practice effects when the same subjects take both the pre- and posttest (i.e., giving more "correct" answers the second time around), maturation threats if subjects age between the tests, and regression threats; none of these, however, are salient in the studies reviewed.³⁸

Prospective, Controlled Trials

The ability of prospective, randomized controlled trials to isolate the intervention from potential confounding factors gives these studies the edge, when it comes to establishing a causal connection between an intervention and its outcomes.³⁹ Three of the studies—Golova, et al,⁴ High et al,⁵ and Jones et al⁷—are *quasirandomized* controlled trials, employing alternate-day or alternate-subject group assignment. The choice of alternate day assignment had the methodological benefit of reducing the likelihood that intervention and control parents would meet in the waiting room, resulting in the possible contamination of the control group. However, since subsequent appointments might readily occur on different days of the week, contamination was still quite likely. Furthermore, a downside of alternate day assignment is that it risks introducing systematic bias into which families get put into which study arm (that is, there might theoretically be salient differences between families who visit the clinic on Mondays, say, and those that visit on Tuesdays).

Other sources of error also operate. Table 4 summarizes several of these issues, for the three trials reviewed in this section.^{40,41} One such possibility is attrition of study subjects. Notably, Golova et al had minimal loss to follow-up; High et al had a moderate rate of attrition; while Jones et al had a high rate. Attrition may have introduced bias and resulted in an overestimation of intervention effects if, for example, subjects who were less prone to respond to the intervention were preferentially lost. Alternately, the high attrition rate in Jones et al may have limited the study's ability to detect significant differences. Jones et al is also notable in that the control group was given guidance about reading aloud and was exposed to the waiting room readers. Thus, the modest findings from that

Table 4. Evaluation of Prospective Trials by Criteria Cited in JAMA's Readers' Guide to the Medical Literature

	Golova, 1998	High, 2000	Jones, 2000
Were all patients who entered study accounted for?	yes	yes	yes
Was follow-up complete?	5/135	52/205	175/352
Attrition rate	(3.7%)	(25.3%)	(50%)
Were subjects analyzed in the groups to which they were assigned?	yes	yes	yes
Incomplete intervention: % of intervention group that did not receive intervention ^a			
(a) guidance	14% (a)	23% (a)	not reported
(b) books		9% (b)	
Contamination: % of controls who received the intervention by mistake			
(a) guidance	17% (a)	37% (a)	extensive; see text
(b) books		12% (b)	

^aAccording to parent recall.

study may have resulted from contamination of the control group, which was built into the study design.

Unpublished Studies

Studies with negative findings may be less likely to be published, either because journals do not accept them, or authors decide not to submit them for publication.⁴² Publication bias can thus make the evidence for a particular intervention appear stronger than it is. We identified 11 abstracts that related directly to the question of ROR effectiveness. Of these, two had negative findings for both parent attitudes and child language development,^{43,44} and one found nonsignificant effects on language development but positive effects on parent attitudes.⁴⁵ Eight other abstracts reported mainly positive findings.⁴⁶⁻⁵⁴ On balance, then, publication bias most likely does not account for the predominance of positive findings in the published literature. We decided not to present further details of the unpublished studies, as this would have greatly expanded the present article; also, there is a reasonable presumption that published work is of higher quality.

AREAS FOR FUTURE RESEARCH

Observed Parent-Child Reading Behaviors

"Reading aloud" does not refer to a single activity, but rather to a wide range of possible interactions undertaken by a parent (or other caregiver) and child with a book in front of them. The nature of the interaction—whether relaxed or tense, chatty or nonverbal, one-sided (e.g., parent talking, child listening) or bidirectional—must matter. Indeed, many descriptive studies have looked at parent-child interactions during reading aloud,⁵⁵⁻⁵⁹ and there is evidence that interventions designed to change the *quality* of reading aloud interactions, although not necessarily their quantity, can result in significant gains in verbal language ability.²³ Conversely, it is not unreasonable to assume that interventions aimed primarily at increasing the *quantity* of reading aloud might also have the effect of improving the *quality* of reading aloud interactions. At least one published case study appears to support this concept.⁵⁸

The ROR intervention explicitly seeks to influence both quantity and quality of reading aloud. The waiting room readers are intended to demonstrate appropriate and effective strategies for engaging young children with books, and clinicians are urged not only to encourage reading aloud, but also to demonstrate reading aloud during the visit, and to teach parents about appropriate and effective techniques. However, among the published studies that have evaluated ROR-model interventions, none to date has assessed the quality of the reading aloud interaction, nor has any made use of actual observations of parents reading aloud or looking at books with their children.

Other Unexplored Questions

Although preventing early reading problems supplies the major rationale for the ROR intervention, and therefore frames the questions that have been asked in the studies

reviewed above, there are other salient questions that could be asked. It is possible, for example, that early exposure to reading aloud has effects on children's later reading *comprehension*, since listening comprehension and reading comprehension are closely correlated.¹⁴ These effects might be independent of the child's early facility with word decoding and spelling.³²

There may also be effects on emotional development, as well as on cognitive and linguistic development. Anecdotally, many adults remember being read to with great fondness, and many parents describe story time as a time of special emotional closeness. Bus et al⁵⁹ have reported an association between reading aloud frequency and more positive reading aloud interactions on the one hand, and attachment security as gauged by the Ainsworth Strange Situation on the other. While it seems likely that the attachment relationship would affect parent-child interactions during reading aloud (as indeed it may affect interactions in many different contexts), it is also plausible that the experience of shared interest and partnership during reading aloud would have an effect on the attachment relationship. To date, however, the possible role of ROR programs in strengthening the parent-child relationship has not been investigated.

Finally, it is possible that the ROR intervention may affect the parent-*physician* relationship, by encouraging physicians to ask questions and provide guidance related to an aspect of children's development—their future academic success—that is important to many parents.³⁶ There is anecdotal evidence for such effects, but no systematic data. Jones et al documented that parent ratings of physician "helpfulness" and physician ratings of parents "receptiveness" were both significantly higher when the physician demonstrated reading aloud during the visit and then gave the child the book, compared to merely giving advice about reading aloud.⁷ Similarly, the impact of ROR on adherence to well child visit schedules and family-satisfaction with care is another potentially interesting, unexplored issue.

SUMMARY AND CONCLUSIONS

Twelve published studies looking at the effectiveness of ROR and related interventions were reviewed. Findings with respect to parent attitudes towards reading aloud and reported frequency of reading aloud are predominantly, but not uniformly, positive. The intervention is less consistently found to be linked to increased book ownership. The association between the ROR intervention and improved language development is particularly salient due to the close connection between preschool language ability and later school achievement. In general, the associations reported have been both statistically significant, and large enough to be clinically meaningful (Table 1).

In aggregate, the studies reviewed comprise data from some 1875 subjects, including many single parents with limited educational backgrounds. Over-represented among the ROR study subjects, compared to their frequency in the general population, are parents who were born abroad and Spanish-speaking parents. Relatively under-represented are

African-American families. Non-Hispanic white families are the most under-represented group, probably because this group is a lowest risk for school reading difficulties.⁶⁰

None of the studies is methodologically above reproach. Although the body of evidence includes three prospective, controlled trials, generally considered the "gold standard" for establishing causality, the combination of quasirandomization and convenience sampling opens a door through which bias might have entered. Nonetheless, the consistency of findings across multiple study designs and populations suggests that clinic-based intervention on the ROR model probably has positive effects on parents' attitudes towards reading aloud and in the amount of reading aloud they report doing. It is also likely that the intervention results in improved child language development. All of these outcomes—parent attitudes towards reading aloud, frequency of reading aloud, and child language—are linked in theory to the ultimate goal, which is promotion of literacy and school success.

Recommendations for Future Research

A longitudinal randomized controlled trial could provide definitive evidence of program efficacy, expelling any doubts let in by the less-than-pristine methodology of the existing studies. Long-term follow-up would be required in order to assess the potential of early clinic-based interventions to affect later school performance. However, given the challenge of study attrition and the difficulty of maintaining a control group relatively free of contamination, such a study would be logistically challenging and expensive. Randomized controlled trials with relatively short-term follow-up would be feasible (on the model of Golova⁴ e.g., except with randomized group assignment). In the absence of a long-term prospective study, carefully designed cross-sectional studies may be able to provide additional evidence linking early exposure to ROR and later reading success, although such studies cannot establish causality.

Shorter-term studies should incorporate direct observation of parents and children reading aloud together, as well as observational measures of children's emergent literacy abilities, such as book handling and letter knowledge. Other studies might profitably disaggregate the intervention into component parts, or explore subsets of child and families who may benefit from particular approaches (e.g., interventions for Inuit children, or specific immigrant groups). There is, in addition, a rich field of possible emotional and parent-child relationship outcomes that has yet to be explored.

Finally, since programs to support reading aloud are by no means restricted to medical settings, future research will need to investigate how clinic-based approaches such as Reach Out and Read fit within the wider spectrum of early childhood literacy-promoting interventions.

ADDENDUM

Subsequent to the acceptance of this paper for publication, a 12th relevant study appeared in the literature. Weitzman, et al. recruited parents of 100 children age 18 to 30 months at the Primary Care Center at Yale-New Haven Hospital.⁶¹ Virtually all of the children (90%) were eligible for Medicaid, and most were either African-American (57%) or Hispanic (36%); nearly one third of the parents had not completed high school. Parent-reported literacy-related activities (e.g., reading aloud frequency) were combined with in-home observations to generate the Child Home Literacy Index (CHLI). In a multivariate analysis controlling for parent education and HOME scores, among other factors, the number of ROR encounters accounted for 5% of the variance in CHLI scores ($p < .05$). This study replicates the finding of a dose-response relationship between exposure to ROR and desired literacy-related behaviors, and extends the body of evidence by including observed changes in the home literacy environment. The cross-sectional nature of the research and absence of a control group constitute methodological vulnerabilities, suggesting the need for further study.

REFERENCES

1. Needlman R, Klass P, Zuckerman B. Reach out and get your patients to read. *Contemp Pediatr*. 2002;19:51–69.
2. Needlman R, Fried L, Morley D, Taylor S, Zuckerman B. Clinic-based intervention to promote literacy. *Am J Dis Child*. 1991;145: 881–884.
3. High P, Hopman M, LaGasse L, Linn H. Evaluation of a clinic-based program to promote book sharing and bedtime routines among low-income urban families with young children. *Arch Pediatr Adolesc Med*. 1998;152:459–465.
4. Golova N, Alario A, Vivier P, Rodriguez M, High P. Literacy promotion for Hispanic families in a primary care setting: a randomized, controlled trial. *Pediatrics*. 1999;103:993–997.
5. High P, LaGasse L, Becker S, Ahlgren L, Gardner A. Literacy promotion in primary care pediatrics: can we make a difference? *Pediatrics*. 2000;104:927–934.
6. Sanders LM, Gershon TD, Huffman LC, Mendoza FS. Prescribing books for immigrant children. *Arch Pediatr Adolesc Med*. 2000;154:771–777.
7. Jones VF, Franco SM, Metcalf SC, Popp R, Staggs S, Thomas AE. The value of book distribution in a clinic-based literacy intervention program. *Clin Pediatr (Phila)*. 2000;39:535–541.
8. Mendelsohn A, Mogliner L, Dreyer B, et al. The impact of a clinic-based literacy intervention on language development in inner-city preschool children. *Pediatrics*. 2001;107:130–134.
9. Sharif I, Reiber S, Ozuah PO. Exposure to Reach Out and Read and vocabulary outcomes in inner city preschoolers. *J Natl Med Assoc*. 2002;94:171–177.
10. Silverstein M, Iverson L, Lozano P. An English-language clinic-based literacy program is effective for a multilingual population. *Pediatrics*. 2002;109:E76–6.
11. Fortman KK, Fisch RO, Phinney MY, Defor TA. Books and babies: clinical-based literacy programs. *J Pediatr Health Care*. 2003;17: 295–300.
12. Theriot JA, Franco SM, Sisson BA, Metcalf SC, Kennedy MA, Bada

- HS. The impact of early literacy guidance on language skills of 3-year-olds. *Clin Pediatr (Phila)*. 2003;42:165-72.
13. Teale W, Sulzby E. Emergent literacy as a perspective for examining how young children become writers and readers. In: Teale W, Sulzby E, eds. *Emergent Literacy: Writing and Reading*. Norwood, NJ: Ablex, 1986.
 14. National Research Council. *Preventing Reading Difficulties in Young Children*. Washington, DC: National Academy Press, 1998.
 15. Snow CE. The theoretical basis for relationships between language and literacy development. *Journal of Research in Childhood Education*. 1991;6:5-10.
 16. Walker D, Greenwood C, Hart B, Carta J. Prediction of school outcomes based on early language production and socioeconomic factors. *Child Dev*. 1994;65:606-621.
 17. Whitehurst G, Fischel J. Reading and language impairments in conditions of poverty. In: Bishop DVM, Leonard LB, eds. *Speech and Language Impairments in Children: Causes, Characteristics, Intervention and Outcome*. East Sussex, Britain: Psychology Press; 2000:53-72.
 18. Storch SA, Whitehurst GJ. Oral language and code-related precursors to reading: evidence from a longitudinal structural model. *Dev Psychol*. 2002;38:934-947.
 19. Moerck EL. Picture-book reading by mothers and young children and its impact upon language development. *J Pragmatics*. 1985;9:547-566.
 20. Ninio A, Bruner J. The achievement and antecedents of labeling. *J Child Lang*. 1978;5:1-15.
 21. Snow C. Literacy and language: relationships during the preschool years. *Harvard Ed Rev*. 1983;53:165-189.
 22. Hoff-Ginsberg E. Mother-child conversation in different social classes and communicative settings. *Child Dev*. 1991;62:782-796.
 23. Whitehurst GJ, Falco FL, Lonigan CJ, et al. Accelerating language development through picture book reading. *Dev Psychol*. 1988;24:552-559.
 24. Anderson RC, Hiebert EH, Scott JA, Wilkinson I. *Becoming a Nation of Readers: The Report of the Commission on Reading*. Washington, D.C.: The National Institute of Education, 1985.
 25. International Reading Association, National Association for the Education of Young Children. Learning to read and write: developmentally appropriate practices for young children. *Young Child*. 1998;July:30-46.
 26. Bus AG, van IJzendoorn M, Pelligrini A. Joint book reading makes for success in learning to read: a meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*. 1995;65:1-21.
 27. Miller SA. Parents' beliefs about children's cognitive development. *Child Dev*. 1988;59:259-285.
 28. DeBaryshe B, Binder J. Development of an instrument for measuring parental beliefs about reading aloud to young children. *Percept Mot Skills*. 1994;78:1303-1311.
 29. DeBaryshe B. Maternal belief systems: Linchpin in the home reading process. *J Appl Dev Psychol*. 1995;16:1-20.
 30. DeBaryshe BD. Early Language and Literacy Activities in the Home. U.S. Department of Education Field Initiated Studies Program. Final Report for the Project: North Carolina University, Greensboro Department of Human Development and Family Studies, 1992.
 31. Plomin R, Dale P. Genetics and early language development: A UK study of twins. In: Bishop DV, Leonard LB, eds. *Speech and Language Impairments in Children: Causes, Characteristics, Intervention and Outcome*. Philadelphia: Psychology Press, 2000:35-51.
 32. Whitehurst GJ, Lonigan CJ. Child development and emergent literacy. *Child Dev*. 1998;69:848-872.
 33. Sudman S, Bradburn NM. *Asking Questions*. San Francisco, CA: Jossey-Bass, 1982.
 34. Celano M, Hazzard A, McFadden-Garden T, Swaby-Ellis D. Promoting emergent literacy in a pediatric clinic: predictors of parent-child reading. *Child Health Care*. 1998;27:171-183.
 35. High P, Hopman M, LaGasse L, et al. Child centered literacy orientation: a form of social capital? *Pediatrics*. 1999;103:e55.
 36. Young KT, Davis K, Schoen C, Parker S. Listening to parents. A national survey of parents with young children. *Arch Pediatr Adolesc Med*. 1998;152:255-262.
 37. Dreyer BP, Mendelsohn AL, Tamis-LeMonda CS. Assess the child's cognitive home environment through parental report: reliability and validity. *Early Development and Parenting*. 1997;5:271-287.
 38. Hulley S, Cummings SR, Browner WR, Grady D, Hearst N, Newman TB. *Designing Clinic Research*. Philadelphia: Lippincott Williams and Wilkins; 2001.
 39. Grembowski D. *The Practice of Health Program Evaluation*. Thousand Oaks, CA: Sage Publications; 2001.
 40. Guyatt GH, Sackett DL, Cook DJ. Users' guides to the medical literature. II. How to use an article about therapy or prevention. A. Are the results of the study valid? Evidence-Based Medicine Working Group. *JAMA*. 1993;270:2598-2601.
 41. Guyatt GH, Sackett DL, Cook DJ. Users' guides to the medical literature. II. How to use an article about therapy or prevention. B. What were the results and will they help me in caring for my patients? Evidence-Based Medicine Working Group. *JAMA*. 1994;271:59-63.
 42. Olson CM, Rennie D, Cook D, et al. Publication bias in editorial decision making. *JAMA*. 2002;287:2825-2828.
 43. Rice TD. An intervention to promote sharing books: impact on language and literacy in families with English as their primary or secondary language. Pediatric Academic Societies (Ambulatory Pediatrics Association), Baltimore, 1999.
 44. Rice TD. Language development and literacy behaviors: Does promoting reading make a difference? Paper presented at: Pediatric Academic Societies (Ambulatory Pediatrics Association) Annual Meeting; 2000; Boston, MA.
 45. Needlman R, Lewis B, Singer L, Huang J, Yamashita T. Intervention to promote reading aloud: 25 month outcomes. Paper presented at: Pediatric Academic Societies (APA) National Meeting; May 5, 1997; Washington, DC.
 46. Bethke H, Frasch K, Kuehnert K, et al. Evaluation of a literacy promotion program in a primary care clinic. Paper presented at: Pediatric Academic Societies (APA) National Meeting; 1998; New Orleans, LA.
 47. Hazzard A, McFadden-Garden T, Celano M, et al. Evaluation of a pediatric program designed to encourage children's emergent literacy. Paper presented at: Pediatric Academic Societies Annual Meeting; 1996; Washington, DC.
 48. Lancioni C, Schwartz W. Influence of "Reach Out and Read Program" on Reading Readiness of Kindergarten Students. Paper presented at: Pediatric Academic Societies (APA) National Meeting; 2000; Boston, MA.
 49. Lipper E, Ward M, Disken M, et al. Evaluation of Heads Up!-Children read, listen and learn: A Hospital-based literacy program. Paper presented at: Pediatric Academic Societies (Ambulatory Pediatrics Association); 1999; San Francisco, CA.
 50. Mendelsohn A, Dreyer B, Dinekvich E, et al. Efficacy of a clinic-based literacy intervention in preschool children. Paper presented at: Pediatric Academic Societies (APA) National Meeting; 1998; New Orleans, LA.
 51. Needlman R, Lewis B, Singer L, et al. Intervention to promote reading aloud: Early effects. Paper presented at: Pediatric Academic Societies (APA) National Meeting; 1996; San Diego, CA.
 52. Needlman R, Mendelsohn A, Toker K, Klass P, Dreyer B, APA Special Interest Group on Literacy Interventions. Reach Out and Read Multicenter Evaluation. Paper presented at: Pediatric Academic Societies (APA/APS/SPR); 2002; Baltimore, MD.
 53. Roy L, Weitzman C, Tomlin R, Freudigman K, Walls T. More Evidence for Reach Out and Read: A Home-Based Study. Paper presented at: Reach Out and Read National Meeting; 2003; Boston, MA.

54. Sharif I, Rivera C, Ozuah P. Preliminary Outcomes from a Randomized Clinical Trial of Clinic-Based Literacy Intervention. Paper presented at: Reach Out and Read National Meeting; 2003; Boston, MA.
55. Lamme LL, Packer AB. Bookreading behaviors of infants. 1986; 39:504-509.
56. Resnick MB, Roth J, Aaron PM, et al. Mothers reading to infants: A new observational tool. *Reading Teacher*. 1987;40:886-895.
57. Bus AG, van IJzendoorn MH. Mother-child interactions, attachment, and emergent literacy: A cross-sectional study. 1988;59:1262-1272.
58. Heath SB, Branscombe A. The book as narrative prop is language acquisition. In: Schieffelin B, Gilmore P, eds. *The Acquisition of Literacy: Ethnographic Perspectives*. Norwood, NJ: Ablex; 1986: 16-34.
59. Bus A, Belsky J, van IJzendoorn M, Crnic K. Attachment and bookreading patterns: A study of mothers, fathers, and their toddlers. *Early Child Res Q*. 1997;12:81-98.
60. National Center for Education Statistics. Schools and Staffing Survey, 1993-94; in *Digest of Education Statistics*. Washington, DC: U.S. Department of Education, 1999.
61. Weitzman CC, Roy L, Walls T, Tomlin R. More evidence for reach out and read: a home-based study. *Pediatrics*. 2004;113:1248-1253.