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POPULATION STUDY ARTICLE

Maximizing the impact of reach out and read literacy promotion:anticipatory guidance and modeling

Manuel E. Jimenez[1,2,3 ✉], Nila Uthirasamy[1], Jennifer R. Hemler[2], Alicja Bator[2], Keanaan Malke[1], Daniel Lima[1], Pamela Ohman Strickland[4], Usha Ramachandran[1], Benjamin F. Crabtree[2], Shawna V. Hudson[2], Thomas I. Mackie[5] and Alan L. Mendelsohn[6]

BACKGROUND: Reach Out and Read (ROR) is a multi-component pediatric literacy promotion intervention. However, few studies link ROR components to outcomes. We examine associations between receipt of (1) multiple ROR components and (2) clinician modeling, a potential best practice, with enhanced home literacy environments (EHLEs) among Latino families.
METHODS: We conducted secondary analyses of cross-sectional enrollment data from a randomized clinical trial at three urban community health centers between November 2020 and June 2023. Latino parents with infants 6–<9 months old were surveyed about ROR component receipt (children's book, anticipatory guidance, modeling) and EHLE (StimQ$_2$- Infant Read Scale). We used mixed models with clinician as a random effect, adjusting for covariates.
RESULTS: 440 Latino parent-infant dyads were included. With no components as the reference category, receipt of 1 component was not associated with EHLE. Receipt of 2 components (standardized beta = 0.27; 95%CI: 0.12–0.42) and 3 components (standardized beta = 0.33; 95% CI: 0.19–0.47) were associated with EHLE. In separate analyses, modeling was associated with EHLE (standardized beta = 0.16; 95%CI: 0.06–0.26).
CONCLUSION: Findings support modeling as a core ROR component. Programs seeking to enhance equity by promoting EHLE should utilize such strategies as anticipatory guidance and clinician modeling in addition to book distribution.

IMPACT:

- Reach Out and Read, a multi-component literacy promotion intervention, leverages primary care to promote equity in children's early language experiences. However, few studies link Reach Out and Read components to outcomes. Among Latino parent-infant dyads, we found that implementation of two and three components, compared to none, was associated with enhanced home literacy environments, following a dose response pattern.
- Parent report of clinician modeling was associated with enhanced home literacy environments.
- Literacy promotion programs seeking to enhance equity by promoting enhanced home literacy environments should utilize strategies in addition to book distribution, including anticipatory guidance and modeling, to maximize impact.

INTRODUCTION

Primary care is an ideal platform to address poverty-related inequities in early language experiences.[1] Primary care professionals have near-universal access to children, frequent visits with families, and an opportunity to build trusted relationships with parents to promote optimal child development.[1,2] Reach Out and Read (ROR) is an evidence-based early childhood intervention that has capitalized on this opportunity to promote equity in children's early language experiences at scale by encouraging parent-child shared reading.[3] Several efficacy studies demonstrate that ROR increases shared reading and enhances child language outcomes.[4–6]

The ROR model, according to the national center training, includes providing families with anticipatory guidance, clinician modeling, a new children's book, and a literacy-rich clinical environment; ROR is delivered to children ages 6 months to 5 years.[7] Currently, there is a paucity of research that examines these individual ROR components and empirical evidence linking components to outcomes in general. Differentiating these elements can aid in understanding which components need to be implemented with high fidelity and which components can be tailored based on context.[8] Furthermore, building this evidence base could help identify which ROR components are core to the model, facilitate measurement of ROR implementation, and inform healthcare improvement efforts that can amplify ROR's impact without stifling innovation.[8] Such work could also inform the planning and implementation of literacy promotion programs in other settings.

[1]Department of Pediatrics, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ, USA. [2]Department of Family Medicine and Community Health, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ, USA. [3]Children's Specialized Hospital, New Brunswick, NJ, USA. [4]Rutgers School of Public Health, New Brunswick, NJ, USA. [5]Department of Health Policy and Management, School of Public Health, SUNY Downstate Health Sciences University, Brooklyn, NY, USA. [6]NYU Grossman School of Medicine, New York, NY, USA. ✉email: jimenema@rwjms.rutgers.edu

To date, the existing literature suggests that there is variation in ROR component implementation.[9,10] Previous work suggests that while anticipatory guidance and children's books are delivered consistently, modeling is a specific area of variation.[11–15] Our team's scoping review found that only 30% of research articles included modeling when describing ROR implementation.[12] This is notable since clinician modeling is considered to be a ROR best practice and an efficient way to teach parents how to read with their children.[16] Past work offers insight into how clinician modeling could potentially help encourage shared reading particularly among Latino families and thus be considered a core ROR component. First, Latino parents are more likely to have heard advice to read with their children, but are less likely to engage in this activity compared to other groups, suggesting anticipatory guidance alone may be insufficient.[17] Second, qualitative work with Latino families suggests that some may perceive reading as drills rather than a joyful, interactive experience, as promoted by ROR; thus clinician modeling could be a useful strategy to bring these perspectives into alignment.[18] Third, prior studies have found that literacy promotion that includes observation of parent-child reading and feedback enhances parents' recall of anticipatory guidance on shared reading and increases overall reading activities, further suggesting the need for other activities to reinforce anticipatory guidance.[15,19] Combined, these findings suggest an important role for clinician modeling in ROR implementation, but the extent to which modeling affects parenting and child outcomes remains understudied.

To address these gaps, we examined the extent to which (1) receipt of multiple ROR components and (2) clinician modeling, a potential ROR best practice, are associated with enhanced home literacy environments among Latino families. As part of a planned process evaluation, we used enrollment data from an effectiveness-implementation hybrid type I randomized clinical trial among Latino families from under-resourced communities to test the hypotheses that (1) more components and (2) the presence of clinician modeling would enhance the home literacy environment. Findings could help define ROR's core components and in turn have the potential to inform clinician training and health care improvement efforts that seek to promote equity in children's early language experiences at scale in primary care through ROR.

METHODS
Study design and setting
We analyzed enrollment survey data from an ongoing effectiveness-implementation hybrid type I randomized clinical trial (Clinicaltrials.gov registration number NCT04609553) in three urban community health centers (CHCs) in central New Jersey that serve Latino families from under-resourced communities. ROR is a standard of care for pediatric well visits from 6 months to 5 years. Data were collected between November 2020 and June 2023. This study was approved by the Rutgers Institutional Review Board and all participants provided informed consent. We followed STROBE Reporting Guidelines.

Participants and data collection
Trained bilingual research assistants administered a 60-min survey to parents during the enrollment visit. Parents/caregivers were eligible if they were over 18 years old, identified as Latino, spoke English or Spanish as their primary language, had a child between the ages of 6 and 12 months old, and received regular pediatric care at one of the CHCs. They were ineligible if their child had been diagnosed with multiple congenital anomalies or genetic disorders or had any previously identified developmental disabilities or if they planned to discontinue care at the CHC. For this study, we limited the sample to parent-child dyads in which children were 6– < 9 months old, as this age group would be experiencing their first ROR encounter at the 6-month well visit. On average, parent surveys occurred approximately one week after the ROR visit.

Dependent variable
StimQ[20] is a validated, parent-report measure of the cognitive home environment. We used the Infant Read subscale to represent the home literacy environment, including three components on the quantity, diversity, and quality of book reading between parent and infants. Scores on the infant Read subscale range from 0 to 15. The StimQ is available in English and Spanish and has high internal consistency ($\alpha = 0.86$–0.93), high test-retest reliability, and is significantly associated with cognition, language, and social-emotional outcomes at 36 months. The StimQ was recently updated ($StimQ_2$) to enhance ease of use and allow for utilization of individual components within each scale, which we used here.

Independent variables
ROR components. We asked parents if they received the following ROR components at their last visit: (1) a children's book, (2) anticipatory guidance about reading, (3) clinician modeling of reading, and (4) exposure to a literacy-rich clinic environment. Due to COVID-19 precautions, all CHCs placed restrictions on literacy rich activities, like having readers and books in waiting rooms, during the study period, and as a result we omitted this component.

Covariates
We selected the following covariates *a priori*:

US nativity. We created a binary variable based on responses to a question on parent country of birth and categorized responses as born in the U.S. or not.

English proficiency. Modeled on the census question, we asked parents to self-rate how well they speak English (very well, well, not well, not at all) and categorized responses of less than "very well" as limited English proficiency.[21]

Parental education. We categorized education as a binary variable (high school degree/equivalent or higher versus less than high school degree).

Number of other children in the home. We asked parents how many other children resided in their home and created a binary variable of 0–2 children versus 3 or more.

CHC. We included the CHC where parent-infant dyads received care as a categorical variable.

Analysis
We summarized sample characteristics using descriptive statistics. We tested the extent to which the number of ROR components received had differing effects on the home literacy environment. We used mixed models by receipt of one, two, and three ROR components with no components as the reference category with clinician as a random effect. We ran unadjusted and adjusted analyses, for which we included the covariates described above. We also used mixed models to examine associations between the presence of modeling and $StimQ_2$ Infant Read total scores. We used standardized parameter estimates to allow comparison across models and corresponding 95% confidence intervals. We divided the regression coefficient by the estimated residual variance of the outcome to calculate the standardized parameter estimate. Lastly, we tested the extent to which (1) the number of components received and (2) the presence of modeling had differing effects on the subdomains of the $StimQ_2$, quantity, diversity, and quality of book reading at home between parent and child. We performed all statistical analyses, using a significance level of 0.05, and SAS desktop version 9.4 (©SAS Institute Inc., Cary, NC).

RESULTS
Of the enrolled sample of 630 dyads, the analytic sample included 440 Latino parent-infant dyads with children aged 6– < 9 months. The mean child age was 7 months. On average, parents were 31 years old, 87.0% reported limited English proficiency, and 72.3% ≤ high school diploma (Table 1).

ROR components received
23.6% of parents reported receiving no ROR components at their last visit, 25.1% reported receiving 1 component, 35% reported

receiving 2 components, and 15.9% reported receiving 3 components. The different combinations of ROR components received are summarized in Table 2. Among the 110 participants who received only one component, 79 received only a book and 31 received only anticipatory guidance. Among the 74 cases in which modeling occurred, it occurred with anticipatory guidance in 4 cases and with anticipatory guidance and the children's book in 70 cases. There were no cases where modeling occurred alone.

Table 1. Demographic characteristics of respondent (Caregiver) and child (N = 440)[a].

Caregiver's mean age, years	31
Caregiver's sex	
Male	9 (2.0%)
Female	431 (98.0%)
Caregiver born in US	
Yes	45 (10.2%)
No	395 (89.7%)
Caregiver's country of origin	
Mexico	148 (33.6%)
Dominican Republic	96 (21.8%)
Honduras	68 (15.5%)
Other[b]	128 (29.1%)
Caregiver's English language proficiency	
Speaks very well	57 (13.0%)
Speaks well	71 (16.1%)
Speaks not well	152 (34.6%)
Speaks not at all	158 (35.9%)
Missing	2 (0.5%)
Caregiver's highest level of education	
Less than high school	67 (15.2%)
Some high school	72 (16.4%)
High school graduate	179 (40.7%)
Some college	51 (11.6%)
College graduate	62 (14.1%)
Post-college degree	8 (1.8%)
Refused	1 (0.2%)
Child's mean age, months	7
Child's sex	
Male	223 (50.7%)
Female	217 (49.3%)

[a]Data rounded to one decimal place.
[b]Puerto Rico, Argentina, Columbia, Costa Rica, Ecuador, El Salvador, Guatemala, Panama, Peru, United States, Uruguay, Spain, Nicaragua, Chile, Brazil.

Number of components and home literacy environment

When examining associations between the number of reported ROR components and StimQ2 scores, in the unadjusted model, the association followed a dose response pattern (Table 3). That is, for each additional component, the magnitude and the strength of the association increased. Receipt of three components had the largest estimate (standardized coefficient = 0.26, 95% CI: 0.14–0.38), which represented the addition of modeling since modeling overwhelmingly occurred with the two other components. We did not find a significant association for one component, which was most commonly receiving a children's book. Adjusting for potential confounders minimally affected these estimates. We found a similar pattern for the $StimQ_2$ quantity, quality, and diversity subdomains, except that one ROR component was associated with Reading Quality (standardized coefficient = 0.17, 95% CI: 0.03–0.30) in the adjusted model (eTable 1 in the Supplement).

Presence of modeling and the home literacy environment

Standardized coefficient estimates for mixed models examining the association between presence of modeling and $StimQ_2$ Infant Read total scores are presented in Table 4. In the unadjusted analysis, the presence of modeling during ROR implementation was associated with higher total scores on the $StimQ_2$ Infant Read scale (standardized coefficient = 0.16; 95% CI: 0.06–0.26). Adjusting for potential confounders did not substantively change this estimate. Presence of modeling was associated with higher scores on the $StimQ_2$ quantity (standardized coefficient = 0.14; 95% CI: 0.05–0.24), diversity (standardized coefficient = 0.13; 95% CI: 0.03–0.23), and quality (standardized coefficient = 0.16; 95% CI: 0.06–0.27) components (eTable 2 in the Supplement). As before, adjusting for potential confounders minimally affected the estimates.

DISCUSSION

In this study, a higher number of ROR components and clinician modeling of shared reading specifically were associated with enhanced home literacy environments including quantity, diversity, and quality of parent-infant shared reading. These findings point to the added value of multiple ROR components in enriching Latino children's early language experiences and suggest that clinician modeling makes an important contribution. Given ROR's impact and scale, policymakers and clinicians can use these findings to inform training and healthcare improvement efforts that seek to promote equity in children's early language experiences in primary care, particularly for Latino families from under-resourced communities.

While several studies document ROR's impact on parenting and child development, far fewer studies have examined ROR implementation and how ROR implementation affects outcomes.[9–12] The findings from this study help to begin to address these important knowledge gaps. To our knowledge, this is the first study to identify an association between a higher number of ROR components received and enhanced home literacy environments, including the quantity, diversity, and quality of the

Table 2. Caregiver report of reach out and read components received at last clinic visit (N = 440).

Number of components	Component(s)	N (%)
0	None	104 (23.6%)
1	Book	79 (18.0%)
	Anticipatory guidance	31 (7.1%)
2	Book & Anticipatory guidance	150 (34.1%)
	Anticipatory guidance & Modeling	4 (0.9%)
3	Book, Anticipatory guidance, & Modeling	70 (15.9%)

Table 3. Estimated coefficients from unadjusted and adjusted mixed models of StimQ reading score by parent-report of number of reach out and read components received (N = 440).

Unadjusted			
Variable	**Coefficient**	**95% Confidence Interval**	**p-value**
Reach Out and Read component			
(None)			
One	0.06	−0.07–0.18	0.36
Two	0.20	0.07–0.33	0.003
Three	0.26	0.14–0.38	<0.0001
Adjusted[a]			
(None)			
One	0.12	−0.02–0.26	0.09
Two	0.27	0.12–0.42	0.0005
Three	0.33	0.19–0.47	<0.0001

[a]Adjusted for: clinic, education, English language proficiency, number of children at home, parent born in US. Clinician is treated as a random effect in the mixed model.

Table 4. Estimated coefficients from unadjusted and adjusted mixed models of StimQ reading score by parent-reported receipt of modeling during reach out and read delivery (N = 440).

Unadjusted			
Variable	**Coefficient**	**95% Confidence Interval**	**p-value**
Modeling			
(None)			
Occurred	0.16	0.06–0.26	0.002
Adjusted[a]			
(None)			
Occurred	0.16	0.0–0.26	0.003

[a]Adjusted for: clinic, education, English language proficiency, number of children at home, parent born in US. Clinician is treated as a random effect in the mixed model.

experiences, and to document the specific contribution of clinician modeling. In the adjusted models, the coefficients for total StimQ score were 0.27 and 0.33 for two components and three components respectively, and 0.16 for the presence of modeling specifically. In interpreting the effect sizes, which are comparable to other early childhood interventions including some that are more resource intensive such as home visiting,[22] it is important to consider developmental stage and intervention reach.[23] Given the neuroplasticity during infancy and the national scale of ROR, effects of this magnitude have the potential for high impact.[23,24] These findings have implications for ROR and other literacy promotion programs more generally. For example, previous work found that Latino families appreciated the gift of the ROR book during preventive visits and highlighted the potential for the gift of a children's book to help strengthen the parent-clinician relationship.[25,26] This study points to an added value of other ROR components (i.e., anticipatory guidance, clinician modeling) that can enhance early home language experiences above and beyond giving a book alone. Other literacy promotion programs that rely solely on book-giving may consider adding anticipatory guidance on shared reading and modeling to maximize impact. Consideration should also be given to partnerships between programs focusing on distributing books with ROR to offer these additional components. Future research should also examine to what extent anticipatory guidance and modeling of shared reading can strengthen parent-clinician relationships beyond giving a children's book alone.

The current study provides needed evidence that supports clinician modeling as a core component of literacy promotion. A key tenet of implementation science is to distinguish between the core elements of interventions that are critical for effects on outcomes and those components that lend themselves to the adaptable periphery and are not absolutely necessary.[27] Balance is needed since omission of core elements could dilute intervention effects, but overspecification of the model could diminish the flexibility needed for scale, cultural adaptations, and innovation,[8] which have been distinguishing features of the ROR program. Findings in this study suggest that as clinicians and policymakers continue efforts to encourage high quality implementation of literacy promotion, clinician modeling of shared reading should be emphasized in measurement, trainings, and healthcare improvement initiatives. Future work using observation exemplified in work by Needlman and colleagues[15] is also needed to clarify how clinician modeling and other components are implemented (e.g.,

brief versus comprehensive) and to what degree different approaches to implementation might also affect outcomes. Our findings also underscore the need for work at the systems level that include innovations in visit structure and organization, as well as reimbursement to overcome barriers (e.g., limited visit time) and support full implementation of literacy promotion.

This study is subject to certain limitations. First, we relied on parent reports, which can be subject to recall and social desirability bias. We used a validated measure of the home literacy environment (i.e., StimQ$_2$[20]) to help address this potential source of bias. Still, we cannot exclude the possibility that parents who recall having experienced more components may be more likely to report richer reading experiences at home. Thus, parental predisposition to be interested in literacy or reading aloud could be a confounding factor. Future work using observation and direct assessments would be useful to confirm what components were received and assess to what extent variations in the content and quality of component implementation affect parenting and child outcomes as noted above. Second, we focused on Latino families so our findings may not generalize to all settings. However, Latino families engage in shared reading less often than other groups,[18,28] face pervasive inequities in school readiness and overall wellbeing,[29] and are too often underrepresented in research, serving as motivation for our focus on Latino families in the current study. This work highlights the importance of multiple components and clinician modeling during literacy promotion for Latino families and can serve as a foundation for additional research with other groups. Third, this was a cross-sectional analysis, limiting our ability to draw causal inference. Fourth, this study took place during the COVID-19 pandemic when safety precautions restricted literacy-rich clinic environments like the availability of readers in waiting areas. Future work should examine the extent to which modeling by individuals other than clinicians can enhance home literacy environments. For example, future studies can examine the relative effects of modeling by clinicians compared to waiting room volunteers or others or the potential additive effects of multiple exposures to modeling from different individuals and/or modalities.

CONCLUSION

The current study provides empirical evidence linking multiple ROR components, and clinician modeling in particular, to enhanced home literacy environments. Clinicians and policymakers can use these findings to enhance implementation of primary care literacy promotion and inform training and healthcare improvement efforts that seek to promote equity in children's early language experiences through ROR and other literacy promotion interventions. This study also opens the door

for additional work that further defines the core components of literacy promotion to amplify impact and foster innovation.

DATA AVAILABILITY
Deidentified quantitative data and associated documentation may be made available to interested readers conducting non-profit research consistent with National Institutes of Health policy through the establishment of data sharing agreements. The timeline for release of data will be after the study is completed and main study findings from the final data set are published in peer-reviewed journals. De-identified data will be made available to researchers from accredited institutions who provide a methodologically sound proposal for use in achieving the goals of the approved proposal.

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COMPETING INTERESTS
The authors have no conflicts of interest to disclose. Findings were presented in part at the 2023 Pediatric Academic Societies Meeting in Washington, DC.

CONSENT TO PARTICIPATE
Participant consent was required for study participation.

ADDITIONAL INFORMATION
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Correspondence and requests for materials should be addressed to Manuel E. Jimenez.

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