

Reading Aloud and Child Development: A Cluster-Randomized Trial in Brazil

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abstract

OBJECTIVES: Many children in low- and middle-income countries fail to reach their developmental potential. We sought to determine if a parenting program focused on the promotion of reading aloud enhanced parent-child interactions and child development among low-income families in northern Brazil.

METHODS: This was a cluster-randomized study of educational child care centers randomly assigned to receive an additional parenting program (intervention) or standard child care without a parenting component (control). Parent-child dyads were enrolled at the beginning of the school year and were assessed at enrollment and at the end of the school year. Families in intervention centers could borrow children's books on a weekly basis and could participate in monthly parent workshops focused on reading aloud. We compared parents and children in intervention and control centers 9 months after the start of the intervention on measures of parent-child interaction and child language, cognitive, and social-emotional development.

RESULTS: Five hundred and sixty-six parent-child dyads (279 intervention; 287 control) in 12 child care clusters (26–76 children per cluster) were assessed at enrollment; 464 (86%) contributed follow-up data. Parents in the intervention group engaged in significantly greater cognitive stimulation (Cohen's $d = 0.43$) and higher quantity and quality of reading interactions ($d = 0.52$ – 0.57) than controls; children in the intervention scored significantly higher than controls on receptive vocabulary ($d = 0.33$), working memory ($d = 0.46$), and IQ ($d = 0.33$).

CONCLUSIONS: An innovative program focused on the promotion of parent-child reading aloud resulted in benefits to parent-child interactions and to child language and cognitive development that were greater than those provided by educational child care alone. This promising approach merits further evaluation at scale.



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WHAT'S KNOWN ON THIS SUBJECT: More than 200 million children globally do not reach their developmental potential. There has been limited study in developing countries of programs promoting parent-child reading aloud and of whether such programs result in benefits beyond that of early childhood education.

WHAT THIS STUDY ADDS: A program focused on promotion of parent-child reading aloud and delivered in child care centers in Brazil improved parent-child interactions and child language and cognitive development. Promotion of reading aloud is a promising approach for enhancing child development in low-resource settings.

To cite: Weisleder A, Mazzuchelli D.S.R., Lopez AS, et al. Reading Aloud and Child Development: A Cluster-Randomized Trial in Brazil. *Pediatrics*. 2018;141(1):e20170723

Growing evidence suggests that early child development (ECD) lays the foundation for lifelong health, education, and economic productivity,¹⁻³ yet an estimated 250 million children in low- and middle-income countries (LMICs) are not meeting their developmental potential because of conditions associated with poverty.² Public health interventions have sought to mitigate the effects of poverty on ECD by enhancing children's early experiences, both at home and in child care settings.⁴⁻⁶ A key strategy of ECD interventions in high-income countries is reading aloud (eg, Reach Out and Read) because of its associations with enhanced cognitive and language development.⁷⁻¹³ However, few ECD programs in LMICs have focused on this strategy, in part because of concerns about the cost of books, low parental literacy levels, and cultural acceptability.^{5,14,15}

There is reason to believe that the promotion of reading aloud could be a successful strategy for enhancing child development in LMICs. Observational studies have shown that the presence of books in the home and parental reading activities help explain links between family income and child outcomes in both high- and low-income countries.¹⁶⁻¹⁸ In the United States, programs promoting reading aloud have been shown to enhance parent-child interactions among families with diverse cultural and educational backgrounds.^{11,19,20} Moreover, book-lending programs can enhance access to children's books and parental reading aloud at relatively low cost.²¹⁻²³ Thus, it is important to understand if promotion of parent-child reading aloud is an effective and feasible strategy for enhancing ECD in low-resource settings and across countries and cultures.

Furthermore, there have been calls for comprehensive approaches to supporting ECD through integrating

strategies across sectors and platforms.²⁴ Observational studies have shown that learning experiences at home and in early childhood education are independently associated with developmental outcomes.^{16,25} However, there has been limited study of whether programs focused on promoting parent-child interactions provide additional benefits to child development beyond those of early childhood education.

In this article, we present findings from a cluster-randomized study of a program focused on promoting parent-child reading aloud. We examine the impacts of this program on parent-child interactions and child development among low-income families in northern Brazil. All children were enrolled in educational child care, enabling us to assess additional impacts of this program relative to those of educational child care alone. We hypothesized that families in the intervention group would exhibit (1) enhanced parent-child interactions, particularly in the context of reading aloud, and (2) enhanced child language, cognitive, and social-emotional development.

METHODS

This study was conducted in Boa Vista, a medium-sized city in northern Brazil (population 284 313) with a high poverty rate.²⁶ The intervention under study is a parent education program (Universidade do Bebê [UBB]) delivered in free educational child care centers (Casas-Mãe) serving low-income children ages 2 to 4 years. UBB was implemented as part of an early childhood initiative (Familia que Acolhe [FQA]) led by the mayor of Boa Vista in collaboration with Instituto Alfa e Beto (IAB), a nonprofit organization in Brazil. The study was approved by the New York University School of Medicine Institutional Review Board and the

ethics committee of the Pontifícia Universidade Católica do Rio Grande do Sul in Brazil.

Randomization

This was a cluster-randomized study in which the child care center was the unit of randomization; individual families were not randomly assigned. Cluster randomization occurred before the start of the school year. Twenty-two existing Casas-Mãe (child care centers), with 30 2- to 4-year-old children registered in each, participated in the study. Some centers were built contiguously with a shared playground and were thus considered a single cluster for randomization to avoid contamination. This resulted in 12 randomization clusters, with 1 to 3 child care centers per cluster (see Supplemental Table 4). Six clusters (11 centers) were randomly assigned to the intervention group and 6 clusters (11 centers) were randomly assigned to the control group by using a random number generator in Excel (Fig 1).

Enrollment Process

Study enrollment took place at all 22 Casas-Mãe from March to June 2015 (Fig 2). Children registered for these centers were between 2 and 4 years of age. All children were eligible for the study; the only exclusion criterion was the parent not being available to provide consent.

Sample Size

On the basis of previous research,²⁷ we hypothesized an effect size (ES) of 0.3 to 0.4 SDs for parenting and child outcomes and an intraclass correlation coefficient (ICC) of 0.03 for centers and 0.01 for clusters. With 12 clusters (2 centers per cluster), a sample comprising 25 children in each center achieved 80% power to detect the hypothesized effect.²⁸

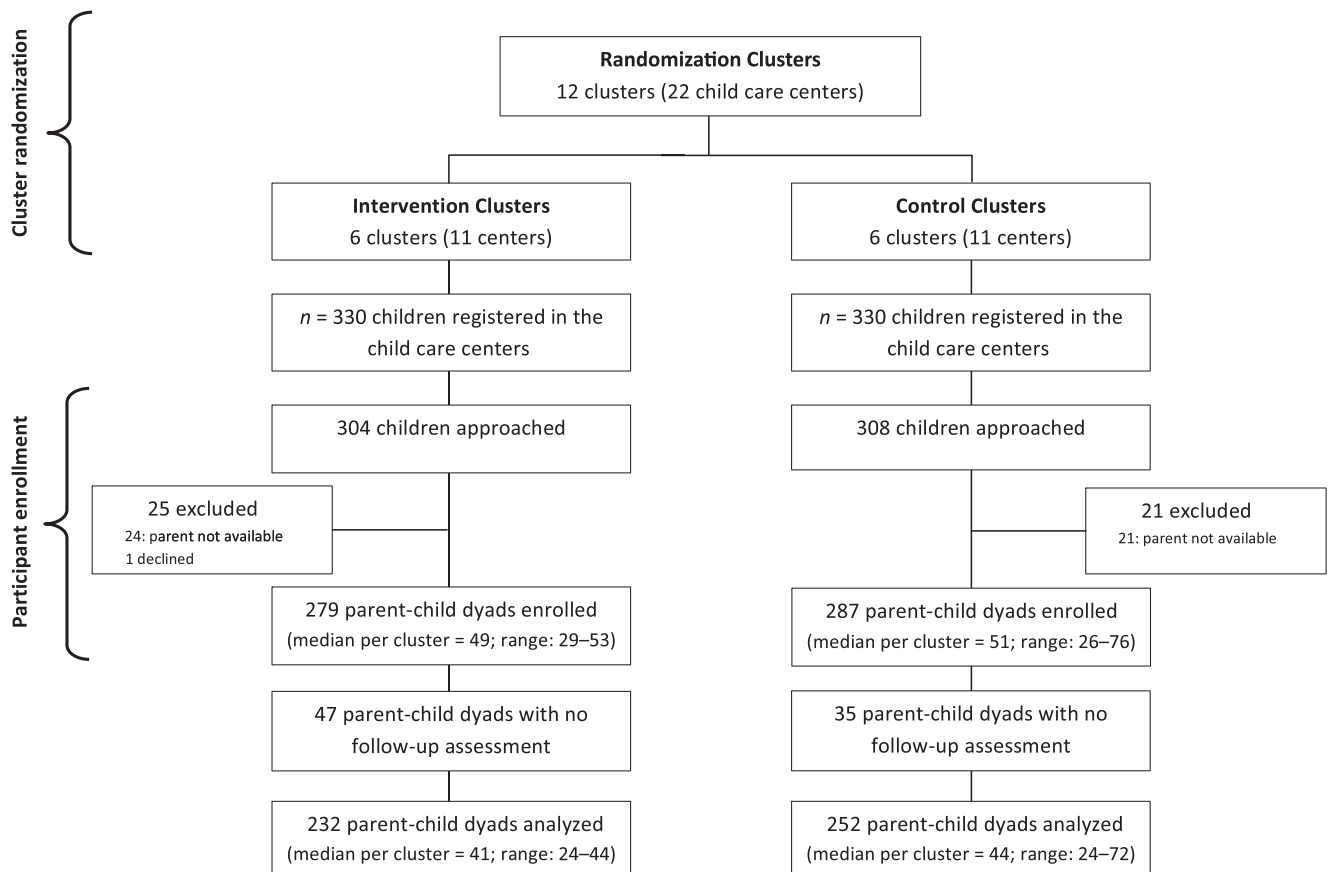


FIGURE 1 Participant flow (Consolidated Standards of Reporting Trials diagram).

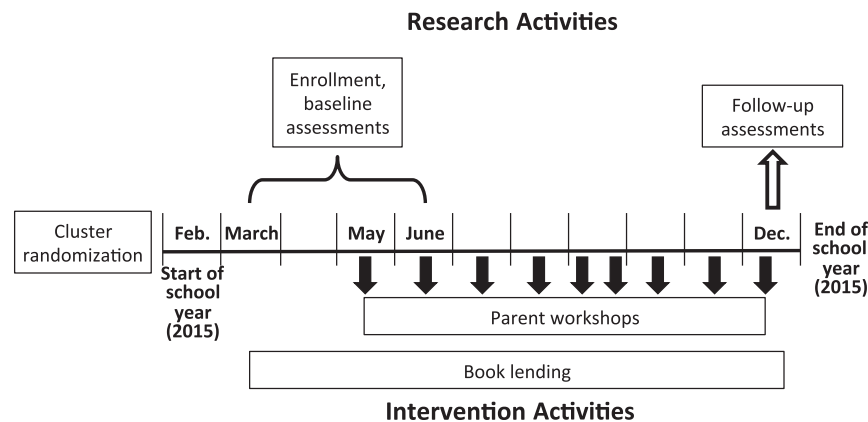


FIGURE 2 Timeline of research and intervention activities. Each solid arrow indicates 1 parent workshop.

Intervention: UBB

A parent education program (UBB²⁹) was developed as an add-on to the standard educational curriculum provided in the Casas-Mãe. This program included the following: (1) a book-lending library, allowing

families to borrow children’s books to take home and exchange them for new ones on a weekly basis and (2) monthly parent workshops with a facilitator who guided discussion about reading aloud and other opportunities for interacting with

children, such as play and talking during everyday routines. The parent workshops were collaboratively developed by IAB and investigators at the New York University School of Medicine. They incorporated strategies from Reach Out and Read and the Video Interaction Project³⁰ and used a group model similar to that of various US programs (eg, Legacy for Children,³¹ Literacy Inc³²). Session plans were developed to structure each workshop, which included tips related to reading aloud and discussion prompts provided by the facilitator (an example session plan is included in the Supplemental Information). During each workshop, parents

1. learned strategies for reading aloud with their child;
2. shared their experiences of reading aloud at home;

3. discussed perceived barriers and solutions to reading aloud, including challenges related to child behavior during reading;
4. engaged in reading aloud with their child by using children's books provided by the program; and
5. reflected on what they liked about reading aloud with their child and received feedback on their reading interactions from the facilitator and/or other parents.

The bulk of each session consisted of back-and-forth discussion between the parents and facilitator. Therefore, although each session followed a standardized plan and structure, the content varied on the basis of parents' goals and concerns.

The study was conducted during the initial implementation phase of UBB, and the program underwent substantial refinement during the course of the study. Book lending took place from March to December 2015 (see Fig 2). Parent workshops took place at the Casas-Mãe (maximum of 30 parents per workshop) approximately every 4 weeks for 1 hour between May and December 2015. Initially, workshops were led by the head teacher of each child care center. However, variability in delivery of the intervention was noted; thus, after the first 2 months of the program, a decision was made for the workshops to be led by FQA and/or IAB staff (individuals with a bachelor of arts degree in psychology or education), to standardize delivery of the workshops across centers for assessing program efficacy. Facilitators were trained and supervised by IAB leadership (D.S.R.M, W.D.N), with periodic review of sessions by NYU investigators (A.W., A.L.M.).

Control

Centers randomly assigned to the control group delivered the standard

educational curriculum in the Casas-Mãe, without the additional parenting program. The child care curriculum focused on language, early literacy, and social-emotional development.³³

Assessments

Assessments were conducted at enrollment (March–June 2015) and at the end of the school year (December 2015; see Fig 2). All assessments took place in the Casas-Mãe and were conducted by research assistants (RAs; undergraduate psychology students) blind to all elements of the study design (including site assignment) and study hypotheses. RAs were trained and supervised by 2 of the study authors (A.S.L, W.D.N). After an initial 2-day training period, groups of 4 to 5 RAs performed assessments at different study clusters. Supervision occurred at least 3 times a week throughout the entire testing period to ensure fidelity of administration across clusters. Assessments included 3 components: parent interviews, observation of parent-child interactions, and direct assessments of child outcomes. Each of the 3 components was conducted by a separate assessor unaware of performance in the other components.

Measures

Most of the measures used in the study had been previously adapted and validated in Brazil. For measures without an available adaptation, instruments were reviewed by 2 bilingual authors to assess relevance for families in Brazil and translated/back-translated between English and Portuguese. Details and psychometric properties for all outcome measures are included in Supplemental Table 5.

Parenting Outcomes

Cognitive stimulation in the home was assessed by using StimQ,³⁴ a structured interview with the caregiver used to assess

parent-child interactions in play, shared reading, and daily routines. Interactive reading was assessed via observations of parent-child interactions while sharing a children's book, coded by using the Adult/Child Interactive Reading Inventory (ACIRI).³⁵ Physical punishment was assessed by using translated questions from the Physical Punishment subscale of the Socolar Discipline Survey,³⁶ which includes questions about the frequency of spanking and slapping the child's hand during the previous 3 months.

Child Outcomes

Receptive vocabulary was assessed by using the Teste de Vocabulário por Imagens Peabody (TVIP),³⁷ a Brazilian adaptation of the Peabody Picture Vocabulary Test.³⁸ Expressive vocabulary was assessed by using the Teste Infantil de Nomeação,³⁹ a Brazilian adaptation of the Boston Naming Test.⁴⁰

IQ was assessed by using 2 subscales from the Brazilian version of the Snijders-Oomen nonverbal intelligence test (SON-R).⁴¹ Standard scores (mean = 100, SD = 15) were used at follow-up. Because standard scores are not available for children <2.5 years of age, we regressed the SON-R score on child age and used the residuals as baseline values for IQ in adjusted analyses (see Statistical Analyses).⁴² Working memory was assessed by using the Teste Infantil de Memória de Trabalho (TIMT).⁴³ Phonological short-term memory was assessed by using a word/nonword repetition task.⁴⁴

Socioemotional competence was assessed by using a translation of the Competence Domain of the Infant-Toddler Social and Emotional Assessment-Revised (ITSEA).⁴⁵ Behavior problems were assessed by using the externalizing problems subscale from the Portuguese version of the Child Behavior Checklist (CBCL)—Parent Report (1 1/2–5

TABLE 1 Sample Characteristics at Baseline

	Full Sample, <i>n</i> = 566	Control Group, <i>n</i> = 287	Intervention Group, <i>n</i> = 279	<i>P</i> ^a
Child characteristics				
Age, mean (SD), mo	37.4 (6.5)	37.6 (6.6)	37.2 (6.6)	.47
Female, %	47.9	46.5	49.3	.57
First born child, %	31.6	34.2	29.0	.26
Race, indigenous, %	2.1	2.5	1.8	.60
Parent characteristics				
Maternal respondents, %	87.1	85.6	88.6	.41
Age <21 y, %	10.8	13.8	7.7	.06
Married or living with a partner, %	66.3	66.2	66.4	.96
Education level				
Less than middle school, %	18.2	17.3	19.2	.73
Graduated middle school, %	22.1	20.9	23.2	.57
Graduated high school, %	41.1	43.0	39.1	.49
Attended college, %	18.6	18.8	18.5	.87
Monthly income, mean (SD), R\$ ^b	1098.8 (660.7)	1075.4 (600.2)	1123.9 (720.2)	.48
Income less than or equal to minimum wage, %	51.3	54.5	47.8	.23
Food insecurity, mean (SD)	1.5 (1.3)	1.5 (1.3)	1.4 (1.3)	.27
Financial hardship, mean (SD)	0.9 (1.0)	1.0 (1.1)	0.8 (1.0)	.07
Met criteria for depression, %	34.0	37.5	30.4	.09

Includes all participants contributing any data at the time of enrollment.

^a *P* values are based on multilevel models.

^b 1 R\$ = ~0.3 US\$; at the time the study was conducted the minimum wage was ~R\$800 per month.

years).^{46–48} Scores were calculated for the externalizing scale and 2 designated syndromes: attention problems and aggressive behavior.

Covariates

Covariates were chosen a priori on the basis of research documenting associations between these variables and study outcomes^{49,50}; these were assessed at enrollment via interviews with the parent. For the child, we determined sex, age, race (dichotomized as indigenous or not indigenous), and birth order. Family characteristics included the parent's age (dichotomized as <21 years or older), educational level, marital status, family income (with mean imputation performed for 55 missing cases), food insecurity, and financial hardship. Parental depressive symptoms were assessed by using a Brazilian adaptation of the Edinburgh Postnatal Depression Scale (met criteria if ≥ 10).^{51,52}

Statistical Analyses

Statistical analyses were performed on the basis of intent-to-treat. Comparisons of groups at baseline were performed by using multilevel

models to account for clustering. Multilevel models included 3 levels: clusters (level 3), centers within clusters (level 2), and dyads within centers (level 1) and were conducted by using the XT MIXED command in Stata version 12.1 (StataCorp, College Station, TX). Comparisons of groups at follow-up were first conducted by using *t* tests for unadjusted analyses. Adjusted analyses were conducted by using multilevel models to account for clustering (as above), covariates (listed above and in Table 1), and the baseline value of each outcome variable. Results are reported before and after Bonferroni correction for multiple comparisons, resulting in an α of *P* < .008 for 6 parent outcomes (0.05/6) and *P* < .005 for 10 child outcomes (0.05/10). Cohen's *d*, which reflects mean differences between groups in SD units, was used as a measure of ES and calculated in 2 ways: (1) on the basis of *t* tests at baseline and follow-up and (2) by calculating a baseline-corrected Cohen's *d*, which was based on analyses of covariance (ANCOVAs) that used the group as the independent variable, the follow-up score as the dependent variable, and

the corresponding baseline score as the covariate.⁵³ Dose-response analyses for significant outcomes were conducted for families in the intervention group by using multilevel models.

RESULTS

In Fig 1 (Consolidated Standards of Reporting Trials diagram), we show the participant flow. Of 660 families enrolled in the 22 Casas-Mãe at the beginning of the school year, consent was obtained for 567 (86%) parent-child dyads. One parent who signed consent later indicated that she did not want to participate in the study, resulting in 566 parent-child dyads assessed at baseline (279 intervention; 287 control). Of these, 484 (86%) dyads (232 intervention; 252 control) had follow-up assessments and composed the analytic sample. Because not all parents and children completed all measures, sample size ranged from 448 to 484. In Supplemental Table 4, we show the number of participants in each cluster at enrollment and follow-up.

Sociodemographic characteristics of the sample at baseline are summarized in Table 1. Although parents in the intervention group reported less financial hardship ($P = .07$), were more likely to be 21 years or older ($P = .06$), and were less likely to meet criteria for depression ($P = .09$), these differences did not reach significance. Dyads assessed at follow-up did not differ from those who were not assessed on any sociodemographic characteristics. However, children assessed at follow-up had higher receptive vocabularies ($P = .06$), expressive vocabularies ($P = .05$), working memory ($P = .01$), and IQ ($P = .02$) at baseline than those lost to follow-up. Critically, the percentage of dyads lost to follow-up did not differ by group (12% control, 17% intervention; $\chi^2_{\text{Yates}}(1) = 2.1$, $P = .15$). Moreover, dyads lost to follow-up were equivalent between intervention and control groups on all baseline measures. Among families in the analytic sample, parents in the intervention group attended a median of 5 (out of 9) workshops, with 97% attending at least 1 workshop; children borrowed a median of 20 books, with 84% borrowing at least 1 book.

In Table 2, we show results for parenting outcomes. Differences between intervention and control groups were seen for cognitive stimulation (mean difference StimQ Total = 2.77, 95% confidence interval [CI], 0.21 to 5.34, $P = .03$), especially in the context of reading activities (mean difference StimQ READ = 1.84, 95% CI: 0.76 to 2.92, $P < .001$), and observed interactive reading (mean difference ACIRI = 2.80, 95% CI: 1.40 to 4.19, $P < .001$). After adjustment, the intervention group also had lower physical punishment scores than the control group (mean difference = -0.33 , 95% CI: -0.01 to -0.04 , $P = .04$). After Bonferroni correction, significant differences between intervention and control

groups were retained for parent report of reading activities (StimQ READ) and observed interactive reading (ACIRI). The ES (baseline-corrected Cohen's d) for outcomes with significant differences ranged from 0.52 to 0.57 SDs.

In Table 3, we show results for child outcomes. After adjustment, children in the intervention group had higher receptive vocabulary scores (mean difference = 2.54, 95% CI: 1.10 to 3.97, $P = .001$), working memory scores (mean difference = 2.20, 95% CI: 1.0 to 3.41, $P < .001$), and IQ scores (mean difference = 5.58, 95% CI: 2.98 to 8.17, $P < .001$) than children in the control group (see Fig 3). Children in the intervention group also had higher interactive reading scores than children in the control group (mean difference = 2.98, 95% CI: 1.91 to 4.10 points, $P < .001$). After Bonferroni correction, all of these impacts remained significant. There were no significant group differences in expressive vocabulary ($P = .24$) or phonological short-term memory ($P = .29$). There were also no significant differences in children's social-emotional competence ($P = .56$) or externalizing behaviors ($P = .24$); children in the intervention group scored lower in attention problems (mean difference = -0.56 points, 95% CI: -1.13 to 0.01 points), but this difference did not reach significance ($P = .053$). The ES for outcomes with significant differences ranged from 0.33 to 0.62 SDs.

In within-group analyses, a dose-response relation was seen between number of workshops attended and 2 parent outcomes: cognitive stimulation ($b = 0.86$, $P < .001$) and reading activities ($b = 0.39$, $P = .001$). When both intervention components (workshops attended and books borrowed, each dichotomized on the basis of a median split) were included as simultaneous predictors, independent associations were found only with parent cognitive stimulation ($b = 1.95$, $P = .03$ for

attendance; $b = 1.81$, $P < .05$ for books borrowed).

DISCUSSION

The current study shows that a program focused on reading aloud and delivered as an add-on to educational child care had meaningful impacts on parent-child interactions and on child language and cognitive development among low-income families in Brazil. The extent of the benefit to children's language and cognitive outcomes was comparable to that of other ECD programs with similar intensity⁵ and approximately half that of a more intensive intervention that was previously evaluated with a similar population in northeastern Brazil.⁵⁴ Notably, IQ scores of children in the intervention group at follow-up were comparable to the population mean of 100, whereas those of children in the control group were ~ 0.5 SDs below the population mean; this suggests that the intervention substantially reduced poverty-related disparities in IQ. This is especially important in light of research revealing that early cognitive development is a strong predictor of school outcomes for children in LMICs.⁵⁵ Although there were no clear benefits from the intervention to children's social-emotional development, enhancements in social-emotional outcomes may emerge later as a result of increases in children's language and cognitive capacities. In a future follow-up of this cohort, this possibility will be investigated.

In our findings, the cross-cultural relevance of reading aloud is supported. Although previous studies in LMICs have shown that interventions promoting cognitive stimulation can enhance child language and cognitive outcomes, few have specifically examined the effects of reading aloud.^{5,6,14} In this study, we contribute key evidence

TABLE 2 Comparison of Parenting Outcomes Between Randomization Groups at Baseline and 1-Year Follow-up for Participants With Follow-up Assessments

Outcome	Unadjusted for Clustering or Covariates			Adjusted for Clustering, Covariates, and Baseline Score					
	Control, Mean (SD) ^a	Intervention, Mean (SD) ^a	<i>P</i> ^b	Cohen's <i>d</i> ^b	Baseline-Corrected Cohen's <i>d</i> ^c	Mean Difference (95% CI) ^d	<i>P</i> ^d	ICC (Cluster)	ICC (Center)
StimQ total	Baseline	20.76 (7.4)	.70	0.03	—	—	—	—	—
	Follow-up	23.04 (7.5)	<.001 ^e	0.38	0.43	2.77 (0.21 to 5.34)	.03	0.097	0.097
StimQ READ	Baseline	5.01 (3.9)	.56	0.05	—	—	—	—	—
	Follow-up	6.10 (4.0)	<.001 ^e	0.53	0.52	1.84 (0.76 to 2.92)	<.001 ^e	0.02	0.06
StimQ PVR	Baseline	8.59 (3.0)	.98	0.00	—	—	—	—	—
	Follow-up	8.89 (3.1)	.01	0.22	0.29	0.67 (−0.20 to 1.53)	.13	0.06	0.06
StimQ PIDA	Baseline	7.20 (2.3)	.89	0.01	—	—	—	—	—
	Follow-up	8.06 (2.0)	.38	0.08	0.09	0.22 (−0.41 to 0.83)	.50	0.06	0.06
Interactive reading (ACIRI)	Baseline	14.10 (6.4)	.14	0.14	—	—	—	—	—
	Follow-up	11.78 (5.2)	<.001 ^e	0.55	0.57	2.80 (1.40 to 4.19)	<.001 ^e	0.03	0.03
Physical punishment	Baseline	4.30 (1.5)	.61	0.05	—	—	—	—	—
	Follow-up	4.33 (1.5)	.06	0.17	0.22	−0.33 (−0.65 to 0.53)	.04	0	0.02

ACIRI, adult/child interactive reading inventory; PIDA, parental involvement in developmental advancement; PVR, parental verbal responsiveness. —, not applicable.

^a Sample size ranges from 234 to 249 in the control arm and 214 to 229 in the intervention arm, depending on the measure.

^b Based on *t* tests with no adjustment.

^c Based on ANCOVA adjusting for baseline score only.

^d Based on multilevel models adjusting for center, cluster, covariates (child's age, sex, firstborn status, race [indigenous]), parent's age, education level, marital status, family income, financial hardship, food insecurity, depression) and baseline score.

^e Significant after Bonferroni correction.

suggesting that reading aloud promotes language and cognitive development in young children from diverse socioeconomic and cultural backgrounds.^{12,13,19,20} Findings also suggest that the promotion of reading aloud can be an effective strategy for enhancing parent-child interactions in low-resource settings. Multiple strategies were used to promote parent-child reading aloud, including book-lending, modeling, group discussion, and feedback. Future work will be needed to determine the role of different strategies in bringing about the observed effects, to optimize program effectiveness and cost.

This study has a number of strengths, including a high rate of enrollment, a high rate of follow-up, and evaluation of intervention impacts across multiple domains of parenting and child development by using multimethod assessments. The study also has a number of limitations. First, there was potential for bias because randomization groups were not equivalent on all measures at baseline and because children assessed at follow-up had higher baseline scores than those lost to follow-up. Importantly, intervention impacts were found after adjusting for baseline differences. Nevertheless, the authors of future studies should consider the inclusion of larger numbers of clusters, which would likely reduce sampling error and enhance group equivalence. Second, selection bias may have occurred as a result of excluding children whose parents were not available at enrollment; this, and the location of the study in a single city, may limit generalizability. Third, although we used measures with evidence of validity in Brazil, a lack of standardization of some of the instruments may limit the interpretation of our findings. In addition, the use of survey instruments for some parent outcomes, together with their

TABLE 3 Comparison of Child Outcomes Between Randomization Groups at Baseline and 1-Year Follow-up for Participants With Follow-up Assessments

Outcome	Unadjusted for Clustering or Covariates			Adjusted for Clustering, Covariates, and Baseline Score					
	Control, Mean (SD) ^a	Intervention, Mean (SD) ^a	<i>p</i> ^b	Cohen's <i>d</i> ^c	Baseline-corrected Cohen's <i>d</i> ^c	Mean Difference (95% CI) ^d	<i>p</i> ^d	ICC (Cluster)	ICC (Center)
Receptive vocabulary	Baseline	7.61 (6.5)	.83	0.02	—	—	—	—	—
	Follow-up	12.74 (8.8)	14.76 (9.9)	.02	0.22	2.54 (1.10 to 3.97)	.001 ^e	0.01	0.01
Expressive vocabulary	Baseline	3.46 (4.1)	4.31 (4.9)	.04	0.19	—	—	—	—
	Follow-up	7.45 (5.7)	8.69 (6.6)	.03	0.20	0.68 (−0.45 to 1.82)	.24	0.04	0.04
Working memory	Baseline	4.32 (4.0)	4.19 (3.9)	.73	0.03	—	—	—	—
	Follow-up	7.16 (4.5)	9.35 (5.8)	<.001 ^e	0.42	2.20 (1.0 to 3.41)	<.001 ^e	0.02	0.04
IQ (standard score)	Baseline ^f	90.76 (13.2)	93.04 (13.9)	.09	0.17	—	—	—	—
	Follow-up	93.39 (13.8)	98.89 (14.5)	<.001 ^e	0.39	5.58 (2.98 to 8.17)	<.001 ^e	0	0
Phonological short-term memory	Baseline	1.65 (1.9)	1.73 (1.9)	.64	0.04	—	—	—	—
	Follow-up	3.21 (2.5)	3.42 (2.4)	.35	0.09	0.25 (−0.21 to 0.72)	.29	0	0.02
Interactive reading	Baseline	12.83 (6.5)	13.83 (6.9)	.11	0.15	—	—	—	—
	Follow-up	11.03 (5.2)	14.41 (5.8)	<.001 ^e	0.61	2.98 (1.91 to 4.10)	<.001 ^e	0	0.01
Social-emotional competence	Baseline	56.79 (9.1)	57.80 (9.3)	.23	0.11	—	—	—	—
	Follow-up	58.98 (8.2)	59.03 (8.2)	.95	0.01	−0.40 (−1.72 to 0.34)	.56	0	0
Externalizing behavior	Baseline	19.99 (9.3)	19.63 (9.4)	.67	0.04	—	—	—	—
	Follow-up	18.99 (9.9)	17.57 (9.6)	.11	0.15	−0.97 (−2.60 to 0.66)	.24	0	0
Attention problems	Baseline	4.12 (2.4)	4.02 (2.6)	.67	0.04	—	—	—	—
	Follow-up	4.06 (2.7)	3.56 (2.5)	.04	0.19	−0.56 (−1.13 to 0.01)	.053	0	0.01
Aggressive behavior	Baseline	15.88 (7.8)	15.61 (7.8)	.71	0.03	—	—	—	—
	Follow-up	14.94 (8.1)	14.01 (8.0)	.21	0.12	−0.75 (−2.08 to 0.57)	.27	0	0

—, not applicable.

^a Sample size ranges from 234 to 251 in the control arm and 214 to 232 in the intervention arm, depending on the measure.

^b Based on *t* tests with no adjustment.

^c Based on ANCOVA adjusting for baseline score only.

^d Based on multilevel models adjusting for center, cluster, covariates (child's age, sex, firstborn status, race [indigenous]; parent's age, education level, marital status, family income, financial hardship, food insecurity, depression) and baseline score.

^e Significant after Bonferroni correction.

^f Includes only children 2.5 y or older, for whom standard scores could be calculated.

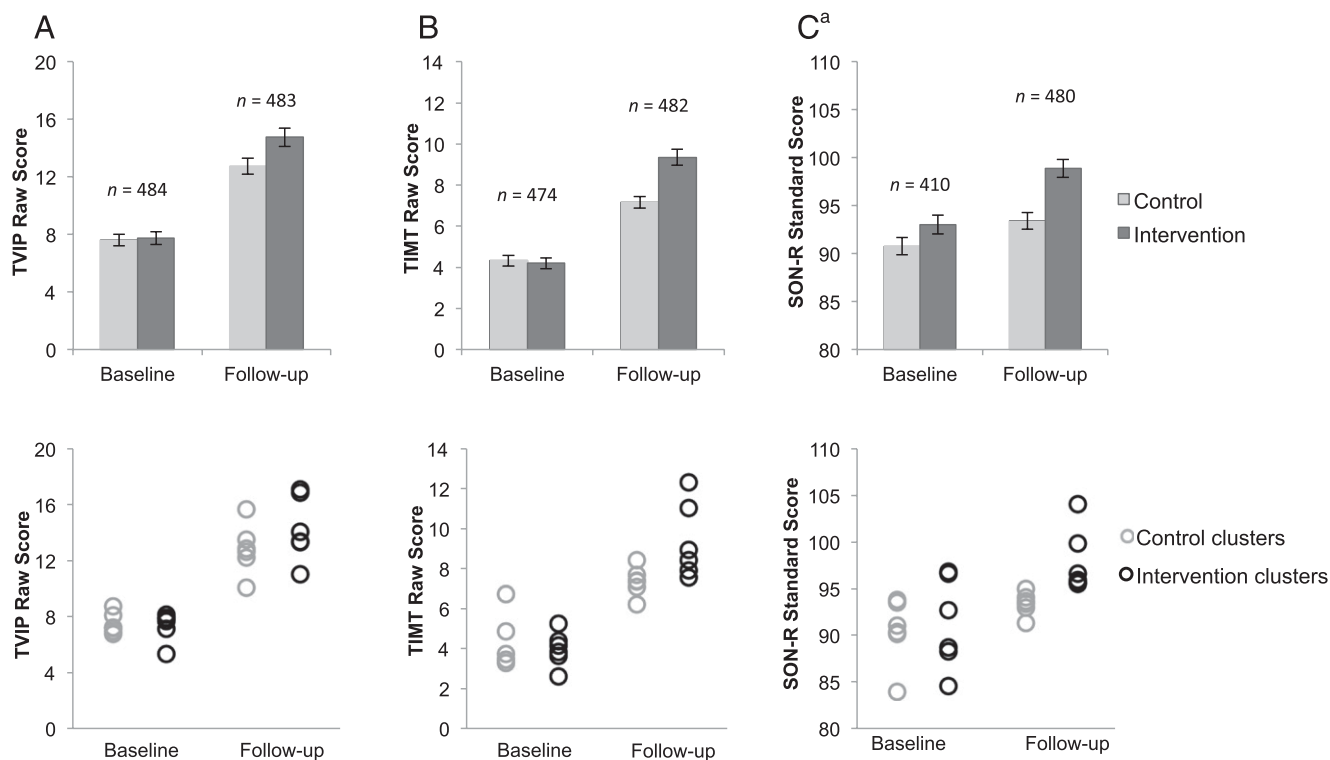


FIGURE 3

Scores at baseline and follow-up for intervention and control groups assessed at both time points on (A) receptive vocabulary, (B) working memory, and (C) IQ. Top panels show unadjusted means over participants, with error bars representing SEM. Bottom panels show unadjusted means for each cluster (6 control clusters, 6 intervention clusters).^a Includes only children 2.5 years or older, for whom standard scores could be calculated.

administration in the intervention location, could have introduced bias. Finally, the intervention was delivered by facilitators with university degrees for assessing program efficacy; further work will be needed to determine the implications for scaling.

CONCLUSIONS

With this study, we advance the evidence on strategies for promoting ECD in LMICs. Results reveal that parenting support for reading aloud can be integrated into educational child care through a book-lending program and monthly parent workshops, leading to benefits in parent-child interactions and in child language and cognitive development that were greater than those provided by educational child care alone. With our findings, we support recent calls for integrated approaches to promoting children's

early learning through synergies between parenting and early childhood education,²⁴ and we provide experimental evidence that the benefits of reading aloud are applicable across countries and cultures. This promising approach merits further evaluation at scale.

ACKNOWLEDGMENTS

We thank the municipality of Boa Vista and the FQA Program for facilitating the study and for their cooperation throughout. We would like to thank the intervention and evaluation teams, as well as the teachers in the Casas-Mãe, for making the study possible. We would especially like to thank Thayssa Pereira Cardoso, Isaura Maria Lobato Lima, Wilma de Oliveira Santos, and Anne Seery, as well as the parents and children who participated.

ABBREVIATIONS

ACIRI: Adult/Child Interactive Reading Inventory
 ANCOVA: analysis of covariance
 CBCL: Child Behavior Checklist
 CI: confidence interval
 ECD: early child development
 ES: effect size
 FQA: Família que Acolhe
 IAB: Instituto Alfa e Beto
 ICC: intraclass correlation coefficient
 ITSEA: Infant-Toddler Social and Emotional Assessment
 LMIC: low- and middle-income country
 RA: research assistant
 SON-R: Snijders-Oomen nonverbal intelligence test
 TIMT: Teste Infantil de Memória de Trabalho
 TVIP: Teste de Vocabulário por Imagens Peabody
 UBB: Universidade do Bebê

study, developed the intervention, designed the data collection instruments, conducted statistical analyses, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

The trial has been registered with the ISRCTN Register (<http://isrctn.org>) (identifier ISRCTN61007982).

DOI: <https://doi.org/10.1542/peds.2017-0723>

Accepted for publication Oct 24, 2017

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: This work was supported by the Instituto Alfa e Beto. A. Weisleder was supported in part by a National Research Service Award from the Health Resources and Services Administration (T32 HD047740).

POTENTIAL CONFLICT OF INTEREST: Ms Mazzuchelli, Dr Lopez, and Mr Neto are employed by the Instituto Alfa e Beto, and Dr Oliveira is the President of Instituto Alfa e Beto, a nonprofit organization; the other authors have indicated they have no potential conflicts of interest to disclose.

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