

Effect of Preschool Home Visiting on School Readiness and Need for Services in Elementary School

A Randomized Clinical Trial

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[+ Supplemental content](#)

IMPORTANCE Home visiting programs targeting the school readiness of preschool children (age range, 4-5 years) show promise in short-term and quasi-experimental studies but rarely are evaluated with rigorous designs and follow-up assessments.

OBJECTIVES To examine the sustained effects of a preschool home visiting program on child and family competencies and on child need for services 4 years later.

DESIGN, SETTING, AND PARTICIPANTS In a randomized clinical trial, individual families with preschool children were assigned to receive the Research-Based and Developmentally Informed-Parent home visiting program (REDI-P) (intervention group) or math home learning games in the mail (control group). Follow-up assessments occurred in third grade. Families were recruited from 24 Head Start centers in 3 Pennsylvania counties serving rural and urban areas. Four-year-old children from 200 low-income families participated. Families were recruited in fall 2008 and fall 2009. The follow-up data used were collected in spring 2013 and spring 2014. The analyses were conducted in 2016 to 2017.

INTERVENTIONS REDI-P visits followed a well-specified curriculum, with 10 home visits during preschool and 6 booster visits in kindergarten. Parents received coaching to enhance parent-child relationships and home learning materials to support child development and school readiness.

MAIN OUTCOMES AND MEASURES Intervention focused on boosting competencies in academic performance and social-emotional adjustment and reducing child problems at home. Direct assessments, teacher ratings, and parent reports were collected. In addition, third-grade teachers recorded all services that children needed and received at school.

RESULTS Two hundred participating children (110 [55.0%] white, 52 [26.0%] black, and 38 [19.0%] Latino; 112 [56.0%] male) had a mean (SD) age of 4.45 (0.29) years at the start of intervention. Third-grade outcomes were available for 153 (76.5%) of the initial sample and revealed statistically significant effects on multiple measures in each competency domain. In addition, REDI-P reduced child need for educational and mental health services at school. Significant effect sizes were small to moderate, averaging approximately one-third of 1 SD (Cohen $d=0.27$ to 0.45). Mediation models demonstrated that intervention effects on services were accounted for by intervention effects on the targeted competencies.

CONCLUSIONS AND RELEVANCE REDI-P produced sustained benefits evident 4 years after intervention, significantly reducing child need for school services. The results of this study appear to validate the value of preschool home visiting as a strategy to help close the gap in school readiness and child well-being associated with poverty.

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Increasingly, home visiting programs are being used to deliver services to low-income parents, who face multiple challenges that compromise their parenting efficacy, including low levels of formal education, elevated stress exposure, financial insecurity, and social isolation.¹ Most home visiting programs target the first few years of life (age range, 0-3 years), with the expectation that improving maternal well-being and parenting skills from the start will provide a foundation for long-term gains in child development and health.²⁻⁵ Research suggests that early home visiting can promote sensitive, responsive parenting and reduce the risk for maltreatment.^{2,3,6} However, there is little evidence that early home visiting improves children's later school adjustment or academic performance.^{7,8} Simply extending early home visiting programs for longer periods does not appear to reliably boost child school readiness either, probably because these programs are not tailored to address the specific learning needs of children entering elementary school.^{9,10}

Little research exists on home visiting programs designed for older preschool children (age range, 4-5 years) that emphasize the specific parenting practices that support child school readiness skills. Longitudinal research has demonstrated that school readiness skills predict later academic attainment^{11,12} and mental and physical health,^{13,14} fostering longevity and overall well-being.^{15,16} Hence, a better understanding is needed of the potential public health benefits of preschool home visiting programs.

In our randomized clinical trial, we examined the sustained effects of the Research-Based and Developmentally Informed-Parent home visiting program (REDI-P), initiated when children were in preschool, on child outcomes in third grade (4 years after intervention). In addition to direct effects on child academic performance, social-emotional adjustment, and home problems (ie, the 3 domains targeted by the intervention), this study also assessed child needs for educational and mental health services and the extent to which intervention-related improvements in the targeted competencies reduced the need for future services.

Home Visiting Programs Designed for Older Preschool Children

Home visiting programs designed to enhance the school readiness of preschool children often focus on specific parent-child learning activities and home teaching strategies.¹⁷⁻¹⁹ For example, parents are taught how to: engage children in conversations while book reading, boosting child language skills²⁰; make explicit references to print, promoting letter knowledge²¹; and play learning games, enhancing early literacy skills.²² Preschool parenting programs have also focused on promoting positive parenting skills to create nurturing and predictable home environments that support child social-emotional and self-regulatory skills.²³ Although promising, rigorous evaluations of these programs with longitudinal follow-up assessments are rarely conducted, limiting information about their sustained effect on school functioning or reduced need for services.

The design of REDI-P was informed by previous home visiting programs but with a more expansive and integrated fo-

Key Points

Question Were the benefits of a preschool home visiting program sustained through third grade, and did they reduce the need for educational and mental health services?

Findings In this randomized clinical trial that included 200 families ($n = 200$ children), preschool home visiting promoted gains in child academic performance, social-emotional adjustment, and reduced home problems in third grade. Intervention-related improvements in these 3 domains mediated significant reductions in child need for educational and mental health services.

Meaning Promoting the school readiness of children from low-income families with preschool home visiting programs may be a strategic way to improve public health and well-being.

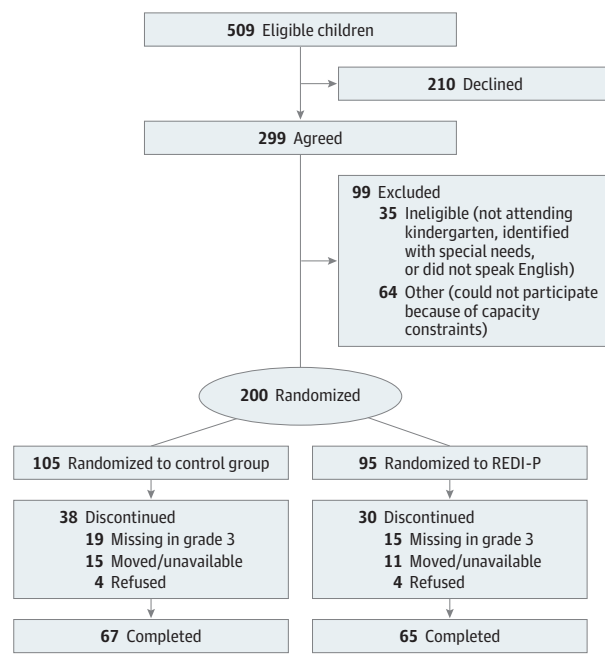
cus, targeting the dual child skill domains of language-literacy and social-emotional development. This focus corresponded closely to and reinforced what children were learning in preschool in a similar intervention delivered by Head Start teachers (ie, the REDI-Classroom [REDI-C] program).²⁴ REDI-P provided parents with a developmentally sequenced set of strategically selected learning materials, along with coaching and support in how to use them effectively. Through the use of stories, parent-child dramatic play, conversation games, and literacy activities, parents were shown how to introduce and reinforce skills associated with emotion regulation, positive social interaction, concentration, and goal-oriented attention, as well as language-literacy and numeracy skills.

Immediate program benefits were evident as parents in the intervention group engaged in more joint reading and richer parent-child conversations, and children showed significantly better early literacy skills, academic performance, and social competence in kindergarten, with average scores roughly one-fourth of 1 SD higher than the control group, who received the REDI-C program alone (Cohen $d = 0.25$ to 0.29).²⁵ An initial follow-up study²⁶ revealed sustained benefits in second grade in areas of child academic performance and social-emotional adjustment ($d = 0.30$ to 0.50).

Study Aims

This study extended the follow-up analyses of REDI-P, testing for intervention effects when children were finishing third grade, expanding the scope of assessment to include adjustment at home and at school, and evaluating the association with school service needs. The first aim was to evaluate the sustained effects of REDI-P on the following 3 primary outcome domains: child academic performance, child social-emotional adjustment, and home problems. The second aim was to examine intervention effects on costly outcomes that might support the return on investment in this program, focusing on child needs for educational and mental health services. The third aim was to test the hypothesis that the tripartite focus of the intervention, targeting competencies in academic, social-emotional, and home problem domains, would account for the reduced need for child services.

Figure 1. Participant Flow Diagram



Because of budgetary and staffing constraints, the maximum study capacity was 200 families. REDI-P indicates Research-Based and Developmentally Informed-Parent home visiting program.

Methods

Participants

Over 2 successive years, letters were sent to 509 parents whose children were eligible to attend kindergarten the following fall. Of those, 299 agreed, 210 declined, and 35 were later deemed ineligible (either because the child was not attending kindergarten in the fall, was identified with special needs, or did not speak English). Preintervention assessments were completed until the maximum study capacity of 200 low-income families was reached (100 each year) and no more families could be accommodated. The lead methodologist (R.L.N.) conducted the randomization process within each classroom, assigned individual families to intervention or control conditions, and conveyed this information to the intervention team status (Figure 1 shows the enrollment process). Trained research assistants who conducted assessments and preschool and elementary schoolteachers who provided ratings remained naive concerning child intervention or control group status. Families were followed up longitudinally as children transitioned into elementary school. All parents provided written informed consent, and all research procedures were approved by the institutional review board at the Pennsylvania State University, University Park.

Intervention

The REDI-P intervention included 10 home visits in the spring of the prekindergarten year and 6 booster visits in the fall after kindergarten entry. Home visitors followed a manualized

protocol. During visits, they delivered REDI-P activity boxes of play materials and stories, designed to promote the development of child cognitive skills (eg, language and emergent literacy and numeracy) and social-emotional skills (eg, cooperation, emotion regulation, and self-control). Parents watched videotapes illustrating material use, featuring interactive reading and positive parenting strategies to support child social-emotional learning (eg, specific praise, emotion coaching, and collaborative problem-solving). Each session began with a check-in to encourage parental self-reflection and ended with personalized goal setting. On 3 occasions, home visitors reviewed videotapes of parents interacting with their children to provide feedback and individualize the program. On average, parents completed 12 home visits (mean [SD], 12.42 [5.12]; range, 0-16). Additional details about the intervention, home visitor selection and training, implementation quality, and associations with outcome are available in the article describing initial outcomes.²⁵

Outcomes

Preintervention assessments occurred in preschool; follow-up assessments were collected at the end of third grade. At each time, trained research assistants visited schools to deliver teacher ratings and conduct child assessments and visited homes to interview parents.

Academic Performance

The sight word fluency subtest of the Test of Word Reading Efficiency²⁷ required children to read a list of words as quickly as they could; scores represented the number read correctly in 45 seconds (test-retest reliability, 0.85-0.90 reported by test developers). In addition, teachers completed the Academic Competence Evaluation Scales²⁸ to rate the academic achievement of students in reading (11 items on a 5-point scale, $\alpha = .97$) and math (8 items, composite measure $\alpha = .98$). These ratings were highly correlated ($r = 0.78$) and were standardized and averaged for a single score.

Social-Emotional Adjustment

Research assistants administered the pragmatic judgment scale of the Comprehensive Assessment of Spoken Language²⁹ to measure children's social understanding (12 vignettes scored as correct or incorrect, $\alpha = .79$). After testing, the research assistants completed a revised version of the Adapted Leiter-R Assessor Report,³⁰ which assessed task orientation, including attention, impulse control, and mastery motivation (13 items on 4-point scale, $\alpha = .89$).

Home Problems

Parents rated child problems at home using the Strengths and Difficulties Questionnaire,³¹ with total problems reflecting emotional symptoms, peer problems, conduct problems, and hyperactivity (20 items on a 3-point scale, $\alpha = .84$). Parents also rated the difficulties they experienced in parenting their child using the Parenting Daily Hassles Scale³² (12 items on a 4-point scale, $\alpha = .76$) and a subset of the highest-loading items on the childrearing stress subscale from the Parenting Stress Index-

Short Form³³ (9 items on a 6-point scale, $\alpha = .82$); these scores were standardized and averaged ($r = 0.44$).

Service Needs

Teachers rated child need for and use of services at school. Items asked about specific services (eg, having an individual education plan, receiving speech-language services, and taking medication for attention or behavior) and general intervention support at school (eg, mental health counseling or behavioral support) (12 items rated as yes or no, $\alpha = .83$).

Sample Size Determination

The sample size of 200 families was selected to attain 80% power to reliably detect intervention effects in the small to medium range ($d = 0.35$) as computed using Optimal Design Software (<http://hlmssoft.net/od/>) for 2-tailed analyses of covariance with type I error rate set at .05 and .20 variance accounted for by the pretreatment covariates. Monte Carlo simulations indicated that only 148 families were needed for 0.80 statistical power to reliably detect bootstrapped mediated effects when the 2 paths constituting the mediated effects were each small to medium in size ($\beta = 0.26$).³⁴

Plan of Statistical Analysis

Analyses reported herein are intent to treat and included all families randomized to intervention and control conditions. Primarily because of family mobility, attrition was approximately 5% to 6% per year, with 23.5% ($n = 47$) of the sample missing third-grade data. Missingness was divided evenly between intervention and control groups and was not significantly associated with any of the preintervention measures studied herein (eTable in the Supplement). All analyses were carried out on 40 multiply-imputed data sets.

The first set of analyses evaluated the REDI-P intervention effects on third-grade outcomes using hierarchical linear models (HLMs) with children nested within their Head Start classrooms. Most outcomes were unaffected by the child's original Head Start classroom placement, but a few showed notable intraclass correlations (mean, 0.09; range, 0-24), so models nested children within their Head Start classrooms. Because families were randomized individually to intervention or control groups within the same Head Start classrooms, intervention status was a level 1 predictor in this study. Level 1 control variables included family demographics (eg, maternal education, employment, child minority status, and parental warmth) and the preintervention assessment of the outcome variable or (when unavailable) a closely related construct; urban vs rural site was included as a level 2 control variable. These covariates closely align with those associated with REDI-P implementation quality. All outcomes showed normal distributions, meeting the assumptions necessary for HLMs.

The second set of analyses then tested mediation to determine whether the effect REDI-P had on the proximal child outcomes it targeted (eg, child academic performance, social-emotional adjustment, and home problems) accounted for children's reduced need for school services. Outcomes representing each targeted domain were averaged together as follows:

(1) academic domain (direct assessments of sight word fluency and teacher-rated academic performance [$r = 0.66$]), (2) social-emotional domain (observer ratings of task orientation and direct assessment of social understanding [$r = 0.49$]), and (3) home problems (parent-rated child problems and parenting hassles and stress [$r = 0.63$]). This mediation model controlled for the preintervention assessments of the proximal and distal outcomes. Bootstrapped 95% CIs from imputed data sets were used to test mediation.³⁵ Analyses were conducted in SAS 9.4 (SAS Institute Inc) and Mplus 7.4 (Muthén & Muthén).³⁵

Results

Participants included 200 children (110 [55.0%] white, 52 [26.0%] black, and 38 [19.0%] Latino; 112 [56.0%] male), with a mean (SD) age of 4.45 (0.29) years at the start of intervention, who were attending 24 Head Start centers in 3 Pennsylvania counties serving rural and urban areas when the study started. Most primary caregivers were mothers (178 [89%]), fathers (8 [4%]), or grandmothers (10 [5%]); many were single parents (72 [36%]) and unemployed (108 [54%]). Almost all families were living in poverty (median family income, \$18 000). Table 1 lists baseline demographics.

REDI-P Effects on Third-Grade Outcomes

Third-grade outcomes were available for 153 (76.5%) of the initial sample. Correlations among outcomes are summarized in Table 2. Intervention effects emerging from HLM analyses and group means are listed in Table 3. All continuous measures were grand-mean centered and standardized, so that coefficients for intervention effects are comparable to effect sizes (Cohen d) and represent group differences as a proportion of 1 SD.

REDI-P promoted improvements in direct assessments of child sight word reading fluency ($d = 0.28$) and teacher-rated academic performance in third grade ($d = 0.29$). REDI-P also promoted sustained improvements in the social-emotional domain, reflected in significantly higher scores on observer ratings of task orientation ($d = 0.45$) and direct assessments of social understanding ($d = 0.31$). In the home problems domain, REDI-P produced reductions in the home problems that parents reported ($d = -0.28$) and in their corresponding levels of parenting stress and hassles ($d = -0.27$). In addition, analyses of third-grade school services revealed an intervention effect ($d = -0.30$), with children in the REDI-P intervention group needing and using fewer school services than children in the control group.

Mediation Analyses

A preliminary path model tested the direct effect of intervention on services in grade 3, replicating the HLM findings ($\beta = -0.32$, 95% CI, -0.58 to -0.04). In the path analyses at the top of Figure 2, the standardized β reflects the approximate effect size. A second path model added the composites reflecting academic performance, social-emotional adjustment, and child problems at home as parallel mediators, shown at the bottom of Figure 2. With all 3 outcome domains considered together, the REDI-P intervention was associated with third-

grade academic performance, social-emotional adjustment, and reduced child problems at home, which in turn predicted a reduced need for services. The total indirect effect of REDI-P on children's reduced need for services was $\beta = -0.26$ (95% CI, -0.43 to -0.10), as determined using bootstrapped errors. Al-

together, the 3 mediators accounted for 79% of the total effect of REDI-P on reduced need for services. The relative contributions to reduced need for services were as follows: 50% for improved academic performance ($\beta = -0.13$, 95% CI, -0.28 to -0.02), 33% for improved social-emotional adjust-

Table 1. Baseline Demographics of Families in the Intervention and Control Conditions^a

Variable	Mean (SD)		P Value
	Intervention	Control	
Demographics, %			
Child sex female	44.21 (0.50)	44.76 (0.50)	.88
Race/ethnicity, black/Latino	44.21 (0.50)	42.85 (0.50)	.87
High school education or less	63.65 (0.48)	60.95 (0.50)	.69
Full-time employment	23.16 (0.42)	25.71 (0.43)	.67
Urban county	62.11 (0.49)	61.90 (0.49)	>.99
Outcome Baseline Covariates			
Emergent literacy skills	0.06 (1.03)	0.05 (0.98)	.95
Applied problems	11.52 (4.34)	12.08 (4.06)	.40
Task orientation	2.63 (0.48)	2.71 (0.40)	.23
Social understanding	0.06 (0.59)	0.04 (0.55)	.84
Home problems	10.64 (5.33)	10.03 (5.16)	.47
Parenting stress	0.05 (0.94)	-0.02 (0.75)	.62
Need for services	0.19 (0.27)	0.16 (0.24)	.46

^a Scores represent the percentage of children in each condition who were female and nonwhite and the percentage of primary caregivers who at baseline were employed full time, had some post-high school training or education, and lived in the urban county site. P values for the percentages in the top half of the table are based on χ^2 tests; P values for the continuous values in the bottom half of the table are based on t tests.

Table 2. Correlations Among Third-Grade Outcomes^a

Variable	Sight Words	Academic Performance	Task Orientation	Social Understanding	Child Home Problems	Parenting Stress
Academic Performance						
Academic performance (T)	0.65					
Social-Emotional Adjustment						
Task orientation (O)	0.37	0.35				
Social understanding (C)	0.37	0.46	0.49			
Home Problems						
Child home problems (P)	-0.23	-0.27	-0.23	-0.25		
Parenting stress (P)	-0.03	-0.09	-0.15	-0.04	0.62	
Child Need for Services						
Service needs or use (T)	-0.51	-0.60	-0.48	-0.49	0.44	0.24

Abbreviations: C, child assessment; O, observer rating; P, parent rating; T, teacher rating.

^a Correlations with an absolute value above 0.14 are significant at the $P < .05$ level.

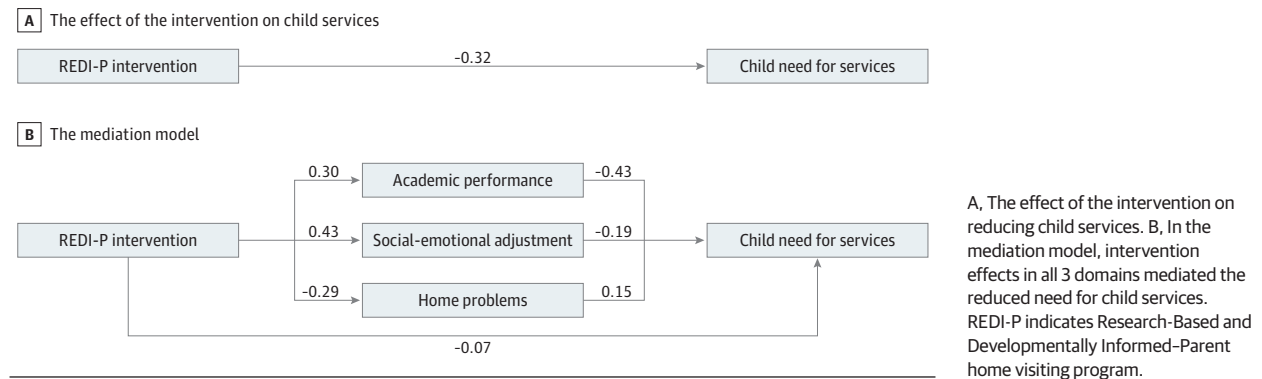
Table 3. REDI-P Intervention Effects on Targeted Outcomes^a

Variable	Mean (SD)		Intervention Effect Cohen d (SE) [95% CI]
	Intervention	Control	
Academic Performance			
Sight words (C)	57.95 (12.20)	54.24 (15.89)	0.28 (0.15) [-0.02 to 0.58]
Academic performance (T)	2.77 (0.73)	2.54 (0.73)	0.29 (0.14) [0.01 to 0.57]
Social-Emotional Adjustment			
Task orientation (O)	2.95 (0.34)	2.81 (0.46)	0.45 (0.15) [0.16 to 0.73]
Social understanding (C)	0.63 (0.14)	0.57 (0.20)	0.31 (0.13) [0.05 to 0.57]
Home Problems			
Child home problems (P)	9.77 (6.30)	10.92 (6.26)	-0.28 (0.13) [-0.54 to -0.01]
Parenting stress (P)	-0.09 (0.87)	0.10 (0.82)	-0.27 (0.14) [-0.55 to 0.01]
Child Need for Services			
Service needs or use (T)	0.22 (0.25)	0.29 (0.24)	-0.33 (0.13) [-0.59 to -0.07]

Abbreviations: C, child assessment; O, observer rating; P, parent rating; REDI-P, Research-Based and Developmentally Informed-Parent home visiting program; T, teacher rating.

^a For descriptive purposes, raw scores are given (except for the parenting stress composite variable, which is a standardized score). Analyses used standardized scores and covariates.

Figure 2. Mediated Intervention Effects on the Reduced Need for Child Services



ment ($\beta = -0.08$, 95% CI, -0.20 to -0.02), and 17% for reduced home problems ($\beta = -0.04$, 95% CI, -0.14 to -0.00).

Discussion

Although most home visiting programs target very young children (age range, 0-3 years), the findings of this study demonstrate that home visiting programs timed around children’s transition into kindergarten may also be powerful, producing sustained effects on child well-being across academic and social-emotional domains of functioning and across school and home settings. These results further suggest that providing preschool home visiting that boosts child school readiness can reduce the need for remedial academic, mental health, and behavioral supports in the later elementary school years.

Prior studies^{22,36} have reported short-term findings that reflect the promise of preschool home visiting programs that provide parents with learning materials and coach parents in teaching strategies. REDI-P expanded on these programs with a dual focus on activities and parenting strategies supporting child academic learning, as well as social-emotional skills, and demonstrated sustained effects through third grade. Including a social-emotional emphasis may be particularly important for children growing up in poverty because they are often exposed to adverse life events and chronic stressors that undermine their emotional and behavioral health.⁵ The results of longitudinal studies^{13,14} suggest that the early childhood development of prosocial and self-control skills boosts physical health and educational attainment and reduces antisocial behavior and substance use in adulthood. Notably, the mediation analyses conducted in this study documented synergistic effects for the tripartite focus of the REDI-P intervention with intervention benefits in academic, social-emotional, and home problem domains all making unique contributions to the reduced need for child services evident in third grade.

In addition to its multidomain focus, REDI-P may have been particularly useful to parents because it included strategically selected and carefully designed home learning activities.²⁵ These activities were easy, playful, and enjoy-

able for parents and children, and they exposed children to learning content that was organized developmentally and sequenced from easier foundational concepts to more difficult content. The timing at the transition into kindergarten may have motivated parents to get involved because they were both apprehensive and hopeful about their children’s entry into school.

Strengths and Limitations

Key strengths of this study included its rigorous, randomized design and the collection of multimethod longitudinal follow-up assessments (eg, direct child assessments and teacher and parent reports). The findings extend prior reports of REDI-P²⁵ documenting sustained effects on multiple measures of child academic and social-emotional functioning at school, along with new effects on home problems and school-based service use. They also clarify mechanisms of intervention action.

Our study had some limitations. First, 210 (41.2%) of the parents who were invited to participate in the study declined to do so, likely contributing to a self-selected sample of motivated participants. Further research is needed to determine the effect of this self-selection on child outcomes and to determine whether alternative approaches might engage more parents. Second, this intervention included sessions in preschool and kindergarten. It is unclear how program timing may have affected outcomes and what the effects of a shorter program timed either in preschool or kindergarten might have been. Third, it is unclear whether REDI-P would be equally successful in a different context (eg, as a stand-alone program) without the foundational platform of the enriched Head Start REDI-C program. In this study, all children in both the intervention and control groups received the REDI-C program in their Head Start classrooms. This classroom experience with the REDI-C activities may have primed children to respond positively to the stories and games used at home. Further research could determine whether coordinating school and home school readiness programs (as was done herein) has synergistic effects beyond the delivery of either school or home programs by themselves.

Conclusions

Overall, the present findings suggest that investing in preschool home visiting programs that promote child school readi-

ness may be strategic for public health. The sustained benefits evident through third grade suggest that REDI-P and programs like it may leverage upward socioeconomic mobility and promote improved health and well-being in later years.^{37,38}

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Study concept and design: Bierman, Welsh, Nix. **Acquisition, analysis, or interpretation of data:** Bierman, Heinrichs, Nix.

Drafting of the manuscript: Bierman, Welsh. **Critical revision of the manuscript for important intellectual content:** Bierman, Heinrichs, Nix. **Statistical analysis:** Heinrichs, Nix. **Obtained funding:** Bierman, Nix. **Study supervision:** Bierman.

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