

Enduring Effects of Prenatal and Infancy Home Visiting by Nurses on Children

Follow-up of a Randomized Trial Among Children at Age 12 Years

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Objective: To test the effect of prenatal and infancy home visits by nurses on 12-year-old, firstborn children's use of substances, behavioral adjustment, and academic achievement.

Design: Randomized controlled trial.

Setting: Public system of obstetric and pediatric care in Memphis, Tennessee.

Participants: We studied 12-year-old, firstborn children (n=613) of primarily African American, economically disadvantaged women (743 randomized during pregnancy).

Intervention: Program of prenatal and infancy home visits by nurses.

Outcome Measures: Use of cigarettes, alcohol, and marijuana; internalizing, externalizing, and total behavioral problems; and academic achievement.

Results: By the time the firstborn child was 12 years of age, those visited by nurses, compared with those in the control group, reported fewer days of having used ciga-

rettes, alcohol, and marijuana during the 30-day period before the 12-year interview (0.03 vs 0.18, $P=.02$) and were less likely to report having internalizing disorders that met the borderline or clinical threshold (22.1% vs 30.9%, $P=.04$). Nurse-visited children born to mothers with low psychological resources, compared with their control group counterparts, scored higher on the Peabody Individual Achievement Tests in reading and math (88.78 vs 85.70, $P=.009$) and, during their first 6 years of education, scored higher on group-administered standardized tests of math and reading achievement (40.52 vs 34.85, $P=.02$). No statistically significant program effects were found on children's externalizing or total behavioral problems.

Conclusions: Through age 12, the program reduced children's use of substances and internalizing mental health problems and improved the academic achievement of children born to mothers with low psychological resources.

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HOME VISITING BY NURSES for low-income, at-risk families has been promoted as a means of preventing child abuse and neglect, children's mental health problems, and adolescent crime.¹⁻³ Much of this interest has stemmed from an adolescent (age 15 years) follow-up of mothers and children enrolled in the first trial of

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the Nurse-Family Partnership (NFP) in Elmira, New York,^{4,5} with a primarily low-income, white sample.^{4,5} We have been conducting a replication trial of the NFP with low-income African Americans living in a major urban area^{6,9}; the present study examines the effect of the NFP with this sample at a child age of 12 years. This re-

port focuses on the functioning of the children, and a companion report¹⁰ focuses on maternal life course. We hypothesized that the effect of the program on child outcomes would be greater for children born to mothers who had few psychological resources to manage living in poverty and caring well for their children.¹¹

METHODS

We conducted a randomized controlled trial of the NFP in a public system of obstetric and pediatric care in Memphis, Tennessee, with registration of the original sample completed from June 1, 1990, through August 31, 1991. A total of 1139 of the 1290 eligible women (88.3%) completed informed consent forms and were randomized to a treatment or control group. We describe only those participants who were involved in the postnatal aspect of the trial (N=743).⁶ Given the high rates of access to the study population for recruitment and of par-

participant acceptance and retention, the study can be considered an effectiveness trial from the perspective of enrolling and retaining the target population.

We enrolled primarily African American women at less than 29 weeks of gestation, with no previous live births, and with at least 2 of the following sociodemographic risk characteristics: unmarried, less than 12 years of education, and unemployed. Sample size and assignment ratios were derived from statistical power calculations conducted for outcomes in the original phases of the trial. Of the women enrolled, 92.1% were African American, 98.1% were unmarried, 64.1% were 18 years or younger at registration, and 85.1% came from households with annual incomes below the US federal poverty guidelines. We randomly assigned participants to receive nurse home visits (n=228) or comparison (control group) services (n=515) using a procedure that concealed randomization from individuals directly involved with study participants.⁶

In the current phase of follow-up after the child's 12th birthday (mean [SD] age, 12.95 [0.45] years), we conducted interviews with mothers (or guardians) and children, assessed children's sustained attention and academic achievement, abstracted data from children's school records, and obtained teachers' reports of children's behavior. **Table 1** gives the numbers of participants (1) randomized to the 2 conditions in which follow-up was conducted after the child's birth, (2) lost to follow-up because of death or maternal refusal to participate at earlier phases, and (3) evaluated with parent interviews, child assessments, and reviews of school and state administrative records.

TREATMENT CONDITIONS

Women in the control group were provided free transportation for scheduled prenatal care plus developmental screening and referral for the child at 6, 12, and 24 months of age. Women in the nurse-visited group were provided the same services as those in the control group, plus prenatal, infancy, and child home visitation through the child's second birthday.

The nurses followed detailed visit-by-visit guidelines but adapted them to the needs of individual families in their efforts to (1) improve the outcomes of pregnancy by promoting women's prenatal health behaviors, (2) improve the health and development of the child by promoting parents' competent care of their children, and (3) enhance parents' life-course development by encouraging parents to plan subsequent pregnancies, complete their education, and find work. The nurses helped families make use of needed health and human services and attempted to involve other family members and friends (particularly the children's fathers and grandmothers) in the pregnancy, birth, and early care of the child.

The program was conducted by the Memphis/Shelby County Health Department during a nursing shortage in which some nurses left the program before the intervention was completed (37% of the visited families had discontinuity in nurse visitors).^{6,11,12} The nurses visited a maximum of 25 families each and completed a mean of 7 home visits (range, 0-18) during pregnancy and 26 home visits (range, 0-71) during the first 2 years after birth. This represents approximately 50% of the 62 visits included in the program, assuming women register at 16 weeks of gestation. The difference between recommended and completed visits is explained mostly by participant attrition from the program. The study is thus similar to an effectiveness trial from the standpoint of program implementation. The relationship between program implementation and early outcomes has been reported.^{13,14}

DATA GATHERING AND CHILD OUTCOMES

Interviews and assessments of the children were conducted by staff members masked to women's and children's treatment as-

Table 1. Sample Composition Over Time by Treatment

Variable	No. (%)	
	Control Group (n=515)	Nurse-Visited Group (n=228)
Miscarriages	19 (3.7)	8 (3.5)
Stillbirths	5 (1.0)	2 (0.9)
Infant and childhood deaths, 0-12 y	10 (1.9)	2 (0.9)
Maternal deaths (through child age of 12 years)	8 (1.6)	2 (0.9)
Refusals or dropouts (through child age of 12 years)	17 (3.3)	10 (4.4)
Completed 12-year assessments		
Maternal interviews	407 (79.0)	187 (82.0)
Other custody interviews (nonmaternal)	15 (2.9)	4 (1.8)
Maternal or other custody	422 (81.9)	191 (83.8)
Child interview	398 (77.3)	180 (78.9)
Teacher reports (firstborn child)	378 (73.4)	170 (74.6)
School records (firstborn child)	439 (85.2)	196 (86.0)
Social service records ^a	422 (81.9)	191 (83.8)

^aData used in accompanying article.¹⁰

signments. Variables were constructed without reference to this information.

Child outcomes were derived from tests of children's academic achievement and attention, interviews with children and parents, reviews of children's school records, and teachers' ratings of child behavior. Data for this report were derived primarily from the intake⁶ and 12-year assessments, although data from previous assessments⁷⁻⁹ also were used to create longitudinal data sets for examination of program effects over time.

Primary outcomes were those that either were significant in other trials of the NFP with participants of similar ages or had been significant at earlier phases of the current trial. Secondary outcomes are presented elsewhere.¹⁵ The primary outcomes follow:

- Use of cigarettes, alcohol, and marijuana was assessed by interview for the 30-day interval preceding the 12-year interview: any substance use (yes or no), count of substances used (0-3), and count of days of substance use (theoretical range, 0-90).
- Reading and math achievement using the Peabody Individual Achievement Tests (PIATs).¹⁶
- Reading and math end-of-year grade point averages (GPAs) in grades 1 through 6 (score range, 0-4).
- Reading and math achievement derived from the Tennessee Comprehensive Assessment Program¹⁷ test scores (percentiles) for grades 1 through 6.
- Externalizing and total behavioral problems.¹⁸ We scored parents', teachers', and children's reports. Externalizing problems (eg, aggression and breaking rules) and total problems (eg, externalizing, internalizing, and other maladaptive behaviors) were scored as positive whenever at least 2 of the 3 reporters gave the children a score in the borderline or clinical range.
- Internalizing problems.¹⁸ We relied on children's self-report in defining internalizing problems (eg, anxiety and depression) because parents and teachers are less likely to observe children's internal emotional states accurately. We classified as positive those scores that crossed the borderline or clinical threshold.
- Arrests reported by the age of 12 years using maternal and child report.

Four outcomes reported here do not meet the definition of a primary outcome:

- Special-education placement in grades 1 through 6 (yes or no) abstracted from school records.
- Grade retention in grades 1 through 6 (yes or no) abstracted from school records.
- Conduct grades abstracted from children's school records, scored from 1 (unsatisfactory) to 4 (honors).
- Sustained attention, using the Leiter-R Sustained Attention test.¹⁹

STATISTICAL MODELS AND METHODS OF ANALYSIS

Statistical analyses were conducted with all mothers randomized, insofar as outcome data were available. The core statistical model consisted of a 2-level treatment factor, a 2-level factor reflecting mothers' psychological resources (above vs below the sample median), a 2-level factor for the child's sex, all interactions among these 3 factors, and 2 covariates (household poverty and maternal child rearing attitudes associated with child maltreatment). Estimates and tests were adjusted for all covariates. We analyzed pared-down models when data were sparsely distributed.

For quantitative outcomes on which we had multiple assessments for each child (eg, GPAs), we analyzed mixed models that included, in addition to the variables from the primary model, children as levels of a random factor, a fixed repeated-measures classification factor for time of assessment, and all interactions of time with the other fixed classification factors. For school performance outcomes (eg, GPAs), grade level was the repeated measure over time. When more than 1 subject area was analyzed jointly, the model included an additional repeated-measures factor for area (ie, math vs reading).

Continuous dependent variables were analyzed in the general linear model and dichotomous outcomes in the logistic linear model. For low-frequency count outcomes (eg, counts of substances children used), we analyzed the data in generalized linear models with negative binomial error assumptions.

The key tests focused on the treatment effect averaged over all other fixed classification variables, including those within subjects, and the same treatment effect restricted to the group defined by low psychological resources. The tables show the means over time, which also are averaged over other fixed classification effects. We report results averaged for the entire period for which we have data and the interval between 10 and 12 years (grades 4-6) of the first child's life because the 10- to 12-year period reflects the time covered by this phase of follow-up. We show results for the entire period for which we have data because this allows a more complete examination of the full longitudinal effects of the program on outcomes.

We present outcomes as treatment main effects and effects for the group defined by mothers with low psychological resources. The text includes estimates of effect size (ES) for continuous outcomes (mean differences divided by pooled SDs) to facilitate comparison of intervention effects with different outcome measures and in different trials.

RESULTS

BASELINE EQUIVALENCE OF TREATMENT GROUPS

The treatment groups were similar with regard to background characteristics for those participants with whom 12-year follow-up assessments were conducted (**Table 2**), with the following exceptions: at intake,

nurse-visited women, compared with control individuals, lived in households with less discretionary income, higher person-per-room density, and higher scores on the household poverty index. They also had higher scores with regard to child rearing attitudes associated with child maltreatment.

CHILD OUTCOMES

In the 30-day period preceding the 12-year interview, as indicated in **Table 3**, nurse-visited children, compared with controls, were less likely to have used cigarettes, alcohol, or marijuana (odds ratio, 0.31; $P = .04$), to have used fewer of these substances (incidence ratio, 0.22; $P = .02$) and to have used these substances for fewer days (incidence ratio, 0.15; $P = .02$). As indicated in **Table 4**, nurse-visited children reported fewer internalizing disorders than did children in the control group (odds ratio, 0.63; $P = .04$).

Table 5 indicates that nurse-visited children born to low-resource mothers had higher PIAT scores in reading and math at age 12 (ES, 0.25; $P = .009$), higher GPAs and group-based achievement test scores in reading and math in grades 1 through 6 (ES, 0.18; $P = .03$ and ES, 0.22; $P = .02$, respectively), and higher GPAs in reading and math in grades 4 through 6 (ES, 0.18; $P = .047$). No statistically significant program effects were found on children's sustained attention, externalizing or total behavioral problems, or conduct grades.

COMMENT

The program effect on early-starting substance use is important despite the infrequency of its occurrence because early initiation of substance use increases the risk of later health problems, including substance use disorders, risky sexual behavior, suicide, psychopathological disorders, and violence.²¹⁻²³ The program effect on internalizing disorders is important because early-onset internalizing disorders are risk factors for mood disorders²⁴ and use of addictive substances.^{25,26} Among urban African American adolescents, symptoms of depression increase risk of violence.²⁷

As in other studies,²⁸ internalizing disorders and substance use were strongly associated ($P < .001$). Of the controls who reported using substances, 60.0% also reported having internalizing disorders in the borderline or clinical range, and among those with internalizing disorders, substance use was 3 times higher (9.5%) than among those without internalizing disorders (3.0%). These overlapping phenotypes (especially for children who use substances early in life) point to shared developmental risks and increased likelihood of later psychopathological disorders and antisocial behavior.²⁹⁻³¹

Since the earliest phases of follow-up in this trial, we have found that controls born to mothers with low psychological resources were compromised in a variety of ways and many of the effects of the program on child outcomes were greater for children born to lower-resource mothers.^{6,8,9,11} Consistent with earlier phases of follow-up and with children's cognitive and language outcomes in a third trial of the NFP in Denver, Colo-

Table 2. Background Characteristics of Those Participants for Whom 12-Year Assessments Were Completed

Characteristic	No. (%)	
	Control Group (n=422) ^a	Nurse-Visited Group (n=191) ^a
Married		
Entire sample	6 (1.4)	2 (1.0)
Low-resource sample	2 (0.9)	2 (1.9)
Maternal ethnicity other than African American		
Entire sample	24 (5.7)	16 (8.4)
Low-resource sample	11 (5.0)	9 (8.7)
Head of household employed		
Entire sample	234 (55.6)	94 (49.5)
Low-resource sample	116 (52.5)	50 (48.5)
Drank alcohol in past 14 days		
Entire sample	17 (4.0)	9 (4.7)
Low-resource sample	12 (5.4)	7 (6.7)
Used cigarettes in past 3 days		
Entire sample	34 (8.1)	20 (10.5)
Low-resource sample	18 (8.1)	13 (12.5)
Used marijuana in past 14 days		
Entire sample	7 (1.7)	2 (1.0)
Low-resource sample	4 (1.8)	2 (1.9)
Any drug use (measured by urine screen)		
Entire sample	9 (4.4)	4 (4.3)
Low-resource sample	8 (7.8)	3 (6.1)
Any sexually transmitted disease before randomization		
Entire sample	146 (34.7)	71 (37.2)
Low-resource sample	77 (34.8)	41 (39.4)

(continued)

rado,^{32,33} nurse-visited children born to low-resource mothers in the Memphis trial had higher GPAs and group achievement test scores in reading and math in the first 6 years of school. They also had higher PIAT scores in reading and math at the age of 12 years than did their control group counterparts. The larger program effects observed for direct tests of children's achievement (ES, 0.25 in SD units for the PIAT; ES, 0.22 for the Tennessee Comprehensive Assessment Program) than with GPAs (ES, 0.18) suggest that GPAs are less reliable measures of reading and math skills than standardized tests. Overall, these results suggest that nurses were able to improve low-resource mothers' care of their children and help them reduce their children's exposure to damaging early experiences in this especially high-risk group.¹¹ The implications of these findings for children's long-term functioning have yet to be determined.

We conducted analyses to help us understand why treatment effects on special education and grade retention were not consistent with our hypotheses. Given that these outcomes are affected in part by parental awareness of their children's needs and advocacy for them, we wondered whether nurse-visited parents might have observed their children's developmental needs and advocated for them at lower thresholds of severity than their control group counterparts. In support of this interpretation, nurse-visited children in special education and those who had been retained, as trends, had higher PIAT scores at age 12 than did their control group counterparts (78.00 vs 73.10; ES, 0.40; $P = .06$ and 83.78 vs 80.79;

Table 2. Background Characteristics of Those Participants for Whom 12-Year Assessments Were Completed (continued)

Characteristic	Mean (SD)	
	Control Group (n=422) ^a	Nurse-Visited Group (n=191) ^a
Maternal age, y		
Entire sample	18.05 (3.21)	18.05 (3.27)
Low-resource sample	18.14 (3.34)	18.13 (3.82)
Gestational age at randomization, wk		
Entire sample	16.47 (5.83)	16.61 (5.64)
Low-resource sample	16.37 (5.91)	16.90 (5.62)
Psychological resources index ^{b,c}		
Entire sample	99.86 (9.65)	99.66 (10.91)
Low-resource sample	92.46 (5.64)	91.73 (6.77)
Highest grade completed for mother		
Entire sample	10.25 (1.86)	10.07 (2.02)
Low-resource sample	9.95 (1.94)	9.52 (2.04)
Discretionary annual household income, \$ ^d		
Entire sample	1595.08 (6812.00)	-16.23 (6543.00)
Low-resource sample	17.73 (6424.00)	-1201.90 (6173.00)
Census tract residents with incomes below poverty, mean % ^e		
Entire sample	34.80 (21.38)	35.73 (20.18)
Low-resource sample	36.00 (21.29)	34.99 (21.25)
Housing density ^f		
Entire sample	0.94 (0.48)	1.02 (0.56)
Low-resource sample	1.02 (0.53)	1.11 (0.50)
Conflict with mother ^{c,g}		
Entire sample	100.01 (10.60)	100.67 (9.20)
Low-resource sample	101.80 (12.86)	101.34 (10.04)
Conflict with partner ^{c,g}		
Entire sample	99.62 (10.20)	100.43 (9.47)
Low-resource sample	100.06 (11.67)	101.95 (10.96)
Attitudes toward child rearing associated with child maltreatment ^c		
Entire sample	99.92 (9.55)	101.35 (10.77)
Low-resource sample	102.82 (8.94)	104.65 (9.72)
Household poverty index ^{c,h}		
Entire sample	99.62 (9.85)	101.93 (9.95)
Low-resource sample	101.66 (10.02)	103.74 (9.59)
Age of study child at interview, y		
Entire sample	12.95 (0.42)	12.98 (0.51)
Low-resource sample	12.93 (0.39)	12.99 (0.57)
Neighborhood disadvantage index ⁱ		
Entire sample	2.34 (1.59)	2.41 (1.81)
Low-resource sample	2.51 (1.53)	2.26 (1.70)

^a For the low-resource group, 222 in the control group and 104 in the nurse-visited group.

^b Average z scores of women's sense of mastery/self-efficacy, mental health, and intellectual functioning.

^c Standardized to a sample mean (SD) of 100 (10).

^d Household income derived from administrative records used to determine eligibility for indigent prenatal care.⁶

^e Percentage of residents in participants' census tracts whose incomes were below federal poverty level.

^f Persons per room.

^g Locally developed scale that assesses degree to which individual provides emotional and material support to mother.

^h Average z scores of discretionary household income, housing density, and whether head of household was employed.

ⁱ Average of variables calculated in SD units from the national means of components that comprise an index of concentrated social disadvantage (percentage of block group residents below the federal poverty level, receiving public assistance, unemployed, headed by single women, or black).²⁰

Table 3. Adjusted Estimates of Program Effects on Children's Emergent Use of Substances

Outcome for the Entire Sample	Control Group	Nurse-Visited Group	Treatment Contrast ^a for Control Group vs Nurse-Visited Group	
			P Value	OR or IR (95% CI)
Used cigarettes, alcohol, or marijuana in the past 30 days, % ^b	5.1	1.7	.04	OR=0.31 (0.09-1.07)
Incidence of number of substances used in the past 30 days ^b	0.08	0.02	.02	IR=0.22 (0.06-0.83)
Incidence of days of substance use in the past 30 days ^b	0.18	0.03	.02	IR=0.15 (0.04-0.65)

Abbreviations: CI, confidence interval; IR, incidence ratio; OR, odds ratio.

^aThe CIs are estimated from Wald tests, whereas the P values are based on likelihood ratio tests.

^bAnalyses based on a model that included treatments only.

Table 4. Adjusted Estimates of Program Effects on Children's Behavior and Mental Health

Outcome	Control Group	Nurse-Visited Group	Treatment Comparison for Control Group vs Nurse-Visited Group	
			P Value	OR or Mean Difference (95% CI)
Dichotomous outcomes, % ^a				
Ever arrested ^b (entire sample)	3.1	3.1	.97	OR=0.99 (0.41 to 2.38)
Internalizing disorders (self-report)				
Entire sample	30.9	22.1	.04	OR=0.63 (0.40 to 1.00)
Low-resource sample	36.2	31.5	.42	OR=0.81 (0.48 to 1.36)
Externalizing disorders (teacher, parent, self-report)				
Entire sample	17.8	19.7	.60	OR=1.13 (0.71 to 1.81)
Low-resource sample	21.6	23.6	.71	OR=1.12 (0.62 to 2.01)
Total problems (teacher, parent, self-report)				
Entire sample	19.8	23.7	.31	OR=1.26 (0.81 to 1.97)
Low-resource sample	26.5	29.6	.57	OR=1.17 (0.68 to 2.00)
Continuous outcomes, mean (SE)				
Conduct grades (grades 1-6) ^c				
Entire sample	2.89 (0.03)	2.95 (0.04)	.20	Mean difference=0.06 (-0.03 to 0.16)
Low-resource sample	2.86 (0.04)	2.93 (0.05)	.29	Mean difference=0.07 (-0.06 to 0.20)
Conduct grades (grades 4-6) ^c				
Entire sample	2.88 (0.03)	2.95 (0.05)	.22	Mean difference=0.07 (-0.04 to 0.19)
Low-resource sample	2.86 (0.05)	2.91 (0.06)	.49	Mean difference=0.05 (-0.10 to 0.21)

Abbreviations: CI, confidence interval; OR, odds ratio.

^aThe percentages are adjusted for covariates in the model.

^bAnalyses based on a model that included treatments only.

^cOutcome examined with repeated measures.

ES, 0.29; $P=.06$, respectively). The point estimates of these differences, although relatively large, were imprecise because of small sample sizes.

There were 2 unexpected subgroup effects for special education placement and grade retention. Among girls born to high-resource mothers, those in the control group had lower rates of special education placement than their nurse-visited counterparts (2.5% vs 16.7%, $P=.01$), and among children born to high-resource mothers irrespective of sex, those in the control group had lower rates of retention than did those born to nurse-visited mothers (15.4% vs 27.5%, $P=.04$). We examined baseline differences in background characteristics for these subgroups and found that the treatment-control difference in household poverty at registration during women's pregnancies favored the control group and was particularly pronounced. Our current judgment is that these differences are owing to chance.

The positive findings from this phase of follow-up are encouraging but must be interpreted in light of their

limitations. One of these is that the program effect on achievement was present among children born to low-resource but not high-resource mothers. Given that academic achievement effects were predicted to be more pronounced for children born to low-resource mothers and that this pattern of program effects is consistent across trials and populations,^{11,32,33} such concerns are mitigated. In addition, some of the effects of the program were based on self-report (eg, use of substances and internalizing disorders). The reports of these behaviors were associated in predictable ways with other behaviors, however, which supports their validity. Moreover, we examined several correlated outcomes within some domains, such as children's substance use and academic achievement. These measures are not separate outcomes so much as different aspects of the same finding. Finally, we examined a number of outcome domains and did not make statistical adjustments for multiple comparisons. Our primary criterion for determining the significance of any single finding, given

Table 5. Adjusted Estimates of Program Effects on Children's Academic Performance

Outcome	Control Group	Nurse-Visited Group	Treatment Contrast for Control Group vs Nurse-Visited Group	
			P Value	OR or Mean Difference (95% CI)
Dichotomous outcomes, % ^a				
Ever placed in special education (grades 1-6)				
Entire sample	9.8	14.8	.11	OR=1.61 (0.89 to 2.90)
Low-resource sample	15.1	14.7	.925	OR=0.97 (0.51 to 1.85)
Ever retained				
Entire sample	20.8	24.9	.30	OR=1.26 (0.81 to 1.97)
Low-resource sample	27.3	22.5	.35	OR=0.77 (0.44 to 1.34)
Continuous outcomes, mean (SD)				
PIAT scores (reading and math) at 12 years ^b				
Entire sample	87.96 (0.49)	89.24 (0.72)	.14	Mean difference=1.27 (-0.44 to 2.98)
Low-resource sample	85.70 (0.67)	88.78 (0.99)	.009	Mean difference=3.07 (0.76 to 5.39)
GPA (reading and math) (grades 1-6) ^b				
Entire sample	2.39 (0.04)	2.48 (0.05)	.19	Mean difference=0.09 (-0.04 to 0.22)
Low-resource sample	2.27 (0.05)	2.46 (0.07)	.03	Mean difference=0.20 (0.02 to 0.37)
GPA (reading and math) (grades 4-6) ^b				
Entire sample	2.20 (0.04)	2.28 (0.06)	.24	Mean difference=0.08 (-0.06 to 0.23)
Low-resource sample	2.08 (0.06)	2.27 (0.08)	.047	Mean difference=0.19 (0.00 to 0.38)
Group achievement test scores (reading and math) (grades 1-6), percentile ^b				
Entire sample	39.79 (1.03)	42.34 (1.52)	.17	Mean difference=2.55 (-1.05 to 6.15)
Low-resource sample	34.85 (1.44)	40.52 (2.07)	.02	Mean difference=5.67 (0.80 to 10.55)
Group achievement test scores (reading and math) (grades 4-6), percentile ^b				
Entire sample	38.27 (1.05)	39.37 (1.56)	.56	Mean difference=1.09 (-2.61 to 4.80)
Low-resource sample	33.67 (1.46)	36.86 (2.14)	.21	Mean difference=3.19 (-1.83 to 8.21)
Leiter-R Sustained Attention test scaled score				
Entire sample	8.75 (0.14)	8.68 (0.21)	.79	Mean difference=-0.07 (-0.58 to 0.44)
Low-resource sample	8.72 (0.20)	8.63 (0.29)	.79	Mean difference=-0.09 (-0.77 to 0.59)

Abbreviation: CI, confidence interval; GPA, grade point average; OR, odds ratio; PIAT, Peabody Individual Achievement Test.

^aThe percentages are adjusted for covariates in the model.

^bOutcome examined with repeated measures.

the extraordinarily large sample sizes required to examine multiple outcome domains in single trials, is replication across trials that sample different populations.^{34,35} In general, the effects of the program on children's emergent use of substances, internalizing disorders, and academic achievement among those born to low-resource mothers support the hypothesis that the program will continue to affect children's health and behavior, as found in an earlier trial.⁵

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Author Contributions: Drs Kitzman, Olds, Cole, Arcoleo, Luckey, and Henderson had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Kitzman, Olds, Cole, Arcoleo, Henderson, and Holmberg. *Acquisition of data:* Kitzman, Cole, Hanks, Anson, and Arcoleo. *Analysis and interpretation of data:* Kitzman, Olds, Cole, Hanks, Anson, Arcoleo, Luckey, Knudtson, Henderson, and Holmberg. *Drafting of the manuscript:* Olds, Hanks, Anson, Arcoleo, and Henderson. *Critical revision of the manuscript for important intellectual content:* Kitzman, Olds, Cole, Hanks, Arcoleo, Luckey, Knudtson, Henderson, and Holmberg. *Sta-*

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A characteristic of the normal child is he doesn't act that way very often.

—Author unknown