

The Baby Books Project: Evaluating 18-Month Outcomes for First-time Mothers and Their Children

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1 Introduction

Overview

This randomized control study examined the impact of providing targeted, anticipatory guidance about parenting to first-time mothers. Guidance was provided via Baby Books that contained parenting-relevant information across a range of topics, including but not limited to nutrition, safety, discipline, baby’s development, and parenting skills. Measures of mothers’ knowledge of each topic were taken at baseline (prenatal period or 0 months of age) and baby’s age at 2, 4, 6, 9, 12, and 18 months. Changes in knowledge of baby’s development, parenting, and total knowledge (a comprehensive assessment across all topics) between baseline and 18-month follow-up were analyzed in this report.

1.1 Theory of Change

The experiment provided anticipatory guidance through the use of Baby Books in which educational material was embedded in the text. It was hypothesized that as mothers read the books, their knowledge of children’s development, parenting strategies, and other parenting-relevant topics would increase. This increase in knowledge, in turn, was expected to lead to positive changes in actual parenting behaviors and practices. Actual changes in parenting behaviors and practices were the primary, final outcome of interest in the experiment.

2 Methodology

2.1 Recruitment and Assignment to Study Conditions

Visibly pregnant women were approached in the waiting room of the Vanderbilt University Obstetrics Clinic and, if interested in participating, screened for eligibility. Only first-time mothers at least 17 years of age and able to read were eligible to participate. Eligible women who provided written consent to participate were recruited to the study but not assigned to one of three study conditions (more below) until after baseline data were collected during a visit to their homes. Waiting to assign subjects to conditions helped to ensure that assignments were not affected by differential attrition prior to the commencement of treatment.

The final study population contained 167 women across three randomly assigned conditions: the Baby Books treatment ($n = 53$), a commercial book control condition ($n = 56$),

and a no book control condition ($n = 58$).

2.2 Participant Characteristics

The majority of mothers who participated in the study had relatively low socioeconomic status (77% received some form of public assistance) and education levels (25% had not completed high school; 31% had completed high school but had no college education; only 8% had a bachelor's or graduate degree); 77% had never been married; and 80% had not planned to become pregnant. The racial and ethnic composition of the sample included African-American (58%), White (30%), Other races (12%), and Hispanic (8%) women. Table 1 contains a detailed breakdown of participant characteristics.

2.3 Distribution of Participant Characteristics Across Study Conditions

Chi-square tests were used to check for significant differences in categorical (i.e., non-continuous) demographic characteristics across the three study groups at baseline. No differences among groups were found for the following participants characteristics: highest level of education, self-reported health, marital status, Hispanic ethnicity, race, cohabitation status (e.g., lives alone, lives with father), receipt of public assistance, type of public assistance received, having regular childcare, and having had parenting classes. A moderately significant difference ($p = .054$) among participants who planned (Y/N) to become pregnant across groups was found. A one-way ANOVA test indicated that there were no significant differences in mothers' ages across groups. T-statistics as well as p-values for the chi-square tests are shown in Table 1.

Because the randomization procedure distributed participants' observed characteristics nearly equally among all study groups, we can infer that participants' unobserved characteristics were also evenly (or nearly evenly) distributed across the groups. In expectation, then, the only difference between the groups was the receipt versus non-receipt of treatment. Statistical equivalence of groups prior to receipt of treatment meant that any significant effect(s) of treatment could be attributed to treatment alone. This characteristic of the study (i.e., internal validity) allowed us to interpret significant outcomes as bona fide treatment effects that were free of systematic bias.

While the effective randomization of study participants to study conditions permitted significant outcomes to be interpreted as treatment effects, these estimates of treatment

impact should not be generalized to the larger population of relatively uneducated, relatively low-income first-time mothers. The study sample was not randomly drawn from the larger population, hence treatment effects observed among the sample are not expected to reflect treatment outcomes that would be observed if the same treatment were provided to the larger population of similar mothers. This lack of generalizability (i.e., external validity) is a feature of the study’s design that is not explained in the grant proposal.

2.4 Attrition and Participation Rates

We define attrited mothers as the set of mothers who left the study at a given baby’s age and did not return to the study for interviews conducted at any of the subsequent baby’s ages. Of the 167 mothers at baseline, we find that 23 mothers attrited over the course of the study. Using chi-square, Fisher, and one-way ANOVA tests, we found no significant differences in characteristics between the attrited and non-attrited mothers except average mother’s age ($p < .05$). (Simple descriptive statistics indicate that the mothers who attrited were, on average, 1.43 years younger than those who did not attrite, though the omnibus tests described above do not have directional interpretations.) We also did not find significant differences in attrition status across the three treatment groups.

2.5 Operationalization of Treatment-on-Treated

The experiment was designed to include a timer that counted the number of minutes that each book was opened by mothers. Had the timer worked, the data could have been used to distinguish mothers in the treatment group who actually received the treatment (i.e., who read the books) from those who did not. Such data would have been the ideal foundation for a treatment-on-treated (TOT) analysis of treatment effects.

We attempted to conduct TOT analyses in the absence of timer data by operationalizing “receiving treatment” as a characteristic of changes in total knowledge between baseline and 18 months. After computing the total knowledge score difference between baseline and 18 months for all mothers, we graphed the distribution of changes and chose the (visibly) most substantial “natural break” in the data as the point of distinction between mothers who actually received the treatment and those who did not. The break coincides with a total knowledge increase of 21 percentage points or greater between baseline and 18 months. This method is subject to critique, including the critique that knowledge change is correlated with

mother’s initial level of education and is therefore not independent of actual treatment effects. Such critiques are noted, but we believe our method (which is based on empirical characteristics of the data) is preferred over choosing a random cutoff point for total knowledge (or total knowledge change). The final ”treated” subsample of mothers consists of 27 mothers from the treatment group; the remaining 21 mothers in the treatment group are considered ”untreated” in TOT analyses.

2.6 Data Cleaning and Handling of Missing Values

The original data set contained errors that would have affected participation rate calculations and visualizations. The largest error concerns interview dates. At each discrete interview point, a non-redundant interview date should have been recorded. Some mothers, however, have the same interview date recorded for multiple interviews, even when these interviews are clearly marked as corresponding to different waves of data collection. This is problematic because interview dates were used to compute the baby’s age in months at each interview point and these ages, in turn, were used in participation rate calculations and graphs that cover the entire study period. Because some mothers have redundant/duplicate interview dates for multiple waves of data collection, their baby’s age is also redundant across waves and would have led to some mothers’ contributing multiple rows of data to calculations based on baby’s age. (The errors with interview dates were only found for ages 2 - 12 months, hence they did not affect treatment estimates, all of which are based on ages 0 and 18 months.) A total of 76 rows with interview date errors were excluded from 1) participation rate calculations and 2) graphs in order to avoid distortions in these calculations and visualizations.

The original data set contained no values for parenting scores that correspond to the interviews conducted at 4 and 6 months of age. (This appears to be explained by the fact that no parenting-related questions were asked during these same interviews.) To avoid observations being dropped during modeling, we imputed parenting scores for both of these time periods. Specifically, parenting scores for age 4 months were imputed as duplicates of scores obtained at 2 months (the previous interview) and scores for age 6 months were imputed as duplicates of scores obtained at 9 months (the subsequent interview). We reasoned that scores imputed with this method were as close in time as possible to actual scores obtained from mothers and therefore less likely to be subject to exogenous drivers of parenting knowledge like maturation.

Finally, several covariates we deemed relevant to outcomes of interest were subject to

change over the study period (e.g., cohabitation status and whether a mother had regular access to child care). To simplify modeling, the value that mothers reported most frequently across all interviews (i.e., the mode for each variable) was used in analyses of treatment effects.

3 Results

3.1 Development Knowledge

“Total Development” refers to a mother’s overall score on the baby’s development assessment at each time. Figure 1 shows how the average development score outcomes changed by group over the study period. While all study groups had very similar total development scores at baseline, the treatment group (Group 1) scored higher on average than either comparison group in the final follow-up period. We also see a sharp decline in average development scores for all three groups at age 6 months. We believe this is because the interview questions asked at baby’s age 6 months were on topics that had not been covered in the baby books provided to the mothers for earlier interview dates. As this was new information on that baby’s development, the mothers did not learn as much when tested on this new information.

Intention-to-treat Estimates of Development Knowledge

Table 3, Table 4 and Table 5 show estimates of total development outcomes for the treatment and no book control groups (Group 1 and Group 3, respectively, in Figure 1) using an intention-to-treat (ITT) design. Table 3 contains estimates based on pre/post total knowledge outcome differences for the treatment group alone; Table 4 contains estimates based on 18-month total development outcome differences between mothers based on their random assignment to the treatment or control conditions, and Table 5 contains estimates based on the total development outcome difference-in-differences between mothers in the treatment and control conditions.

Regarding Table 3, we know that impact estimates based on pre/post outcome differences for treated subjects are subject to different forms of bias (e.g., maturation bias). For these reasons we do not interpret the coefficients in Table 3 as treatment effects. Rather, we simply note that all are statistically significant ($p < .05$) and in the direction we would expect them to be (i.e., positive) if the treatment is effective.

Regarding Table 4, we know that impact estimates based on the difference at follow-up between subjects randomly assigned to treatment and control conditions are valid in expec-

tation as long as the counterfactual is valid. Because randomization produced a valid counterfactual for the treatment group (as there are no significant differences between mothers characteristics by treatment groups at baseline), the estimates in Table 4 can be interpreted as treatment effects. More specifically, across all three specifications in Table 4, the ITT effect of receiving the Baby Book treatment was non-significant ($p > .05$), hence we conclude that the treatment did not impact mothers' knowledge of development.

Regarding Table 5, which contains estimates based on the total development outcome difference-in-differences between mothers in the treatment and control conditions, the ITT treatment effect estimate (11 percentage point increase in total total development, on average, among treated mothers) is also statistically insignificant and therefore not distinguishable from zero. Since we are unable to assess whether total development trends between treated and control condition mothers were parallel in the pre-treatment period, however, we would not have been able to interpret the coefficients in Table 5 as bona fide evidence of treatment effects even if they had been statistically significant.

Treatment-on-Treated Estimates of Development Knowledge

Table 6, Table 7, and Table 8 show estimates of total development outcomes for the treatment and no book control groups (Group 1 and Group 3, respectively, in Figure 1) using a treatment-on-treated (TOT) design. As in the above section, Table 6 contains estimates based on pre/post total development outcome differences for the treatment group alone; Table 7 contains estimates based on 18-month total development outcome differences between mothers based on their random assignment to the treatment or control conditions; Table 8 contains estimates based on the total development outcome difference-in-differences between mothers in the treatment and control conditions. For reasons noted in the previous section, only the estimates in Table 7 can be interpreted as treatment effects for the TOT subset of mothers. For the models we simply note that all results are statistically significant ($p < .05$) and in the direction (i.e., positive) we would expect if actually receiving the Baby Book treatment increased total knowledge of development topics relative to not actually receiving treatment.

Relative to treatment estimates based on the intention-to-treat subjects (regardless of whether those same subjects actually received treatment), Table 7 shows that actually receiving the treatment is associated with larger impacts on total development knowledge: the magnitude of effects in Table 7 is between 31 - 32 percentage points across the three specifications. This larger impact of treatment is expected, as the estimate excludes mothers

assigned to the treatment group who don't seem to have actually received the treatment according to our operationalization of receiving treatment.

Finally, Figure 2 shows the rate of change of total development for all three groups included in the experiment. The rate of increase in total development among mothers who received the Baby Book treatment (Group 1) is approximately two times larger than the increase for mothers in the commercial book and no-book control groups.

3.2 Parenting Knowledge

Mothers' parenting knowledge about best practices in parenting, including best practices around discipline such as avoiding spanking. Parenting knowledge also emphasizes the important of modeling good behavior for children as they grow and having a good attitude about discipline, mistakes, and so on.

Figure 3 illustrates the progress of a mother's parenting knowledge over the course of a baby's first 18 months.

Intention-to-Treat Estimates of Parenting Knowledge

Table 9, Table 10 and Table 11 show estimates of total parenting outcomes for the treatment and no book control groups (Group 1 and Group 3, respectively, in Figure 3) using an intention-to-treat (ITT) design. Table 9 contains estimates based on pre/post total parenting outcome differences for the treatment group alone; Table 10 contains estimates based on 18-month total parenting outcome differences between mothers based on their random assignment to the treatment or control conditions, and Table 11 contains estimates based on the total parenting outcome difference-in-differences between mothers in the treatment and control conditions.

Table 9, shows the pre/post intention-to-treat (ITT) analysis results where mothers parenting knowledge increased (24 percentage points; $p < .01$) for treated group. Column two and three also shows a statistically significant results in parenting knowledge at ($p < .01$) whereas this estimates differences are subject to different forms of biases and hence we just not use this estimates for interpretation of the treatment effects.

The results of the ITT randomization on parenting knowledge are shown in Table 10, and we found a statistically significant result with a (8 percentage points; $p < .05$) *decrease* in parenting knowledge for the treatment group; the rest of the specifications in Table 10 did not show a statistically significant impact of receiving the treatment. The results in Table 10

can be interpreted as treatment effects for reasons noted previously, although the negative impact of treatment on parenting knowledge is not in the expected direction and gives us cause for concern.

With the results from Table 11, which represents the Diff-if-Diff (ITT) results on mothers' total parenting score between control and treatment groups at the baby's age of 0 and 18 months, we found no significant impact of treatment at 18 months ($p < .01$).

Treatment-on-Treated Estimates of Parenting Knowledge

Table 12, Table 13, Table 14, show estimates of total parenting outcomes for the treatment and no book control groups (Group 1 and Group 3, respectively, in Figure 3) using a treatment-on-treated (TOT) design. As in the above section, Table 12 contains estimates based on pre/post total Parenting outcome differences for the treatment group alone; Table 13 contains estimates based on 18-month total parenting outcome differences between mothers based on their random assignment to the treatment or control conditions; Table 14 contains estimates based on the total parenting outcome difference-in-differences between mothers in the treatment and control conditions. For reasons noted in the previous section, only the estimates in Table 13 can be interpreted as treatment effects for the TOT subset of mothers. For the models we simply note that all results are statistically significant ($p < .01$) and in the direction (i.e., positive) we would expect if actually receiving the Baby Book treatment increases total knowledge of parenting-relevant topics relative to not actually receiving treatment.

The results shown in Table 12 are at some extent similar to of ITT pre/post results with a round variable on the treatment group is statistically significant at (26 percentage points; $p < .05$) in specifications one and two. However, these effects attenuate and became non-significant ($p > .01$) with the inclusion of multiple demographic covariates in specification three. This indicates that simply accounting for the heterogeneity of the sample's parenting scores reduces the variance in the model enough to render the previously observed "treatment effects" non-significant.

The results of the TOT randomization and Diff-in-Diff from Table 13 & Table 14 for overall parenting knowledge, on the other hand, did not show any significant results with any of the models. And an explanation for this could be interpreted from the similar analysis results that we obtained for the ITT randomization and Diff in Diff earlier, as the intervention of baby books did not contribute to change in mothers' parenting knowledge on the treated group compared to the control group.

Figure 4, depicts the rate of change in mothers’ parenting knowledge across all three groups. When comparing the rate of change among the control and study groups, they practically change at the same rate per month.

3.3 Total Knowledge

Figure 5 shows total knowledge outcomes by group over the study period.

“Total knowledge” refers to a mother’s overall score on the assessment at each time period (i.e., her total score across all items on the assessment; items concerned a range of parenting-relevant topics like nutrition, safety, and discipline. The total knowledge score also contains items related to parenting and baby’s development, both of which were analyzed separately above.)

As seen in Figure 5, all study groups had very similar total knowledge scores at baseline. The treatment group (Group 1) then consistently scored higher, on average, at every follow-up point after treatment began and was noticeably higher than either comparison group in the final follow-up period.

Intention-to-Treat Estimates of Total Knowledge

Table 15, Table 16, and Table 17 show estimates of total knowledge outcomes for the treatment and no book control groups (Group 1 and Group 3, respectively, in Figure 5) using an intention-to-treat (ITT) design. Table 15 contains estimates based on pre/post total knowledge outcome differences for the treatment group alone; Table 16 contains estimates based on 18-month total knowledge outcome differences between mothers based on their random assignment to the treatment or control conditions; Table 17 contains estimates based on the total knowledge outcome difference-in-differences between mothers in the treatment and control conditions.

Regarding Table 15, we previously noted that impact estimates based on pre/post outcome differences for treated subjects are subject to different forms of bias, hence here, too, we do not interpret the coefficients in Table 15 as treatment effects. Rather, we simply note that all are statistically significant ($p < .05$) and in the direction we would expect them to be (i.e., positive) if the treatment is effective.

The estimates in Table 16, however, can be interpreted as treatment effects for reasons noted above. Across all three specifications in Table 16, the ITT effect of receiving the

Baby Book treatment is associated with a positive and statistically significant ($p < .05$) change in total knowledge between baseline and follow-up; the magnitude of the effect across specifications is between 8 – 11 percentage points. The consistency of the treatment effects with regard to 1) statistical significance, 2) direction, and 3) magnitude suggests that the estimates are robust to any arbitrary modeling choices and therefore credible. We note that the treatment estimates in Table 16 might very well also be considered practically significant considering that a score of around 50% (shown by the constants in the models) is the point of comparison.

In Table 17, which contains estimates based on the total knowledge outcome difference-in-differences between mothers in the treatment and control conditions, the ITT treatment effect estimate (11 percentage point increase in total knowledge, on average, among treated mothers) is very close to the bona fide treatment effect estimates shown in Table 16. However, we do not interpret the coefficients in Table 17 as treatment effects for reasons previously noted. (At best, the estimates in Table 17 might serve to triangulate the results in Table 16, the only rigorous type of model employed in the study.)

Treatment-on-Treated Estimates of Total Knowledge

Table 18, Table 19, and Table 20 show estimates of total knowledge outcomes for the treatment and no book control groups (Group 1 and Group 3, respectively, in Figure 5) using a treatment-on-treated (TOT) design. As in the above section, Table 18 contains estimates based on pre/post total knowledge outcome differences for the treatment group alone; Table 19 contains estimates based on 18-month total knowledge outcome differences between mothers based on their random assignment to the treatment or control conditions; Table 20 contains estimates based on the total knowledge outcome difference-in-differences between mothers in the treatment and control conditions. For reasons noted in the previous section, only the estimates in Table 19 can be interpreted as treatment effects for the TOT subset of mothers. For the models we simply note that all results are statistically significant ($p < .01$) and in the direction (i.e., positive) we would expect if actually receiving the Baby Book treatment increases total knowledge of parenting-relevant topics relative to not actually receiving treatment.

Relative to treatment estimates based on the intention-to-treat subjects (regardless of whether those same subjects actually received treatment), Table 19 shows that actually receiving the treatment is associated with larger impacts on total parenting knowledge: the magnitude of effects in Table 19 is between 22 - 25 percentage points across the three specifications. This larger impact of treatment is expected, as the estimate excludes mothers

assigned to the treatment group who don't seem to have actually received the treatment according to our operationalization of receiving treatment.

Finally, Figure 6 shows the rate of change of total knowledge for all three groups included in the experiment. The rate of increase in total knowledge among mothers who received the Baby Book treatment (Group 1) is approximately three times larger than the increase for mothers in the commercial book and no-book control groups.

4 Conclusion and Discussion

Overview

This study examined the impact of providing targeted, anticipatory guidance about parenting to first-time mothers. Outcomes of interest were changes to mothers' 1) knowledge of baby development, 2) knowledge of parenting, and 3) total knowledge of multiple parenting-relevant topics. Baseline measures were taken in the prenatal period; final follow-up measures were taken when baby's were approximately 18 months; intermediate follow-up measures were taken at 2, 4, 6, 9, and 12 months.

Results

The intervention produced positive effects on mothers' total knowledge of parenting-relevant topics. The magnitude of effects based on differences between treatment and control conditions (ITT analysis) was 8 - 11 percentage points; this increase in total knowledge between baseline and 18-month follow-up among the treated mothers is statistically significant ($p < .05$), practically significant, and robust to modeling choices like the inclusion of few or many relevant covariates. Our finding that the Baby Book intervention produces a positive impact on mothers' total knowledge is a replication of results found in prior studies of the Baby Book experiment (e.g., Reich et al., 2010; Reich et al., 2011; Reich et al., 2012).

Improvements to total knowledge were even more positive among mothers who actually received the treatment relative to those who do not appear to have received the treatment, though this finding is expected to be sensitive the operationalization of "actually receiving treatment." In our TOT models, the magnitude of impact for mothers who were actually treated relative to others ranged from 22 - 25 percentage points, which is a statistically significant increase ($p < .01$). Though this impact is positive and promising, it is the results for the ITT analysis not the TOT analysis that are likely to be the most meaningful for the Baby Book intervention. More specifically, this type of effort-intensive treatment is always likely to result in some amount of non-compliance (i.e., failing to participate in treatment)

among subjects who are made eligible to participate, hence estimates that include only those who choose to participate are likely to exaggerate effects.

Impacts on parenting knowledge and baby’s development were either non-significant or mixed across model specifications and therefore inconclusive. Future research may investigate why the treatment produced a positive impact on some parenting-relevant topics but not others.

Recommendations

Given that our analysis looked only at treatment impact on intermediate rather than final outcomes, we cannot make an overall recommendation for the intervention based on these results alone. Although it is promising that the intervention produces a significant effect on mothers’ total knowledge of parenting-relevant topics, the intervention is not intended simply to increase mothers’ knowledge. If complementary studies of final outcomes indicate that increasing mothers’ total knowledge of parenting-relevant topics leads to significant changes in these outcomes, we would consider recommending the intervention for targeted rollout depending on the magnitude and practical significance of the effects. If increasing mothers’ knowledge does not produce changes to final outcomes, we would recommend that investigators revisit the theory of change that underlies the intervention in order to diagnose this failure within the results chain.

5 Figures and Tables

Table 1: Participant Characteristics and Distribution Across Study Conditions

Characteristics	Respondents		t-statistic	p-value
	N	%		
Highest Education Completed	167		13.954	0.175
Less than High school	42	25.1%		
High school education	51	30.5%		
Some college	49	29.3%		
Associate's degree	11	6.6%		
Bachelor's degree	5	3.0%		
Graduate degree	9	5.4%		
Hispanic Ethnicity	166		0.057	0.972
Not Hispanic	152	91.6%		
Hispanic	14	8.4%		
Self-reported Health	167		7.348	0.500
Excellent	47	28.1%		
Very good	54	32.3%		
Good	57	34.1%		
Fair	8	4.8%		
Poor	1	0.6%		
Current Marital Status	166		6.600	0.581
Never married	128	77.1%		
Now married	28	16.9%		
Living as married	5	3.0%		
Divorced	2	1.2%		
Separated	3	1.8%		
Was Pregnancy Planned	167		5.845	0.054
No	134	80.2%		
Yes	33	19.8%		
Race	167		9.429	0.307
African-American	99	59.3%		
Asian	1	0.6%		
White	50	29.9%		
Other	11	6.6%		
Multi-racial	6	3.6%		
Cohabitation Status	156		4.856	0.302
Live alone	35	22.4%		
Co-habitate with other adults	56	35.9%		
Co-habitate with baby's father	65	41.7%		
Receipt of Public Assistance	166		1.148	0.563
No	39	23.5%		
Yes	127	76.5%		
Type of Public Assistance Received	166		10.655	0.222
Tennessee Women, Infants and Children's Program	39	23.5%		
Food Stamps	63	38.0%		
Social Security Insurance	41	24.7%		
Family First	21	12.7%		
Disability Income	2	1.2%		
Having Parenting Classes	87		3.932	0.140
No	78	89.7%		
Yes	9	10.3%		
Having Regular Childcare	154		0.951	0.622
No	58	37.7%		
Yes	96	62.3%		

Table 2: Mothers' Attrition Over the Study

	0 months	2 months	4 months	6 months	9 months	12 months	18 months	Total Attrition
Treatment Group	100%	89%	85%	92%	87%	89%	81%	19%
Commercial Books	100%	82%	95%	86%	82%	89%	84%	16%
Control Group	100%	91%	91%	93%	88%	95%	93%	7%
Total	100%	87%	90%	90%	86%	91%	86%	14%

Figure 1: Average Development Knowledge Scores by Treatment Group and Baby's Age

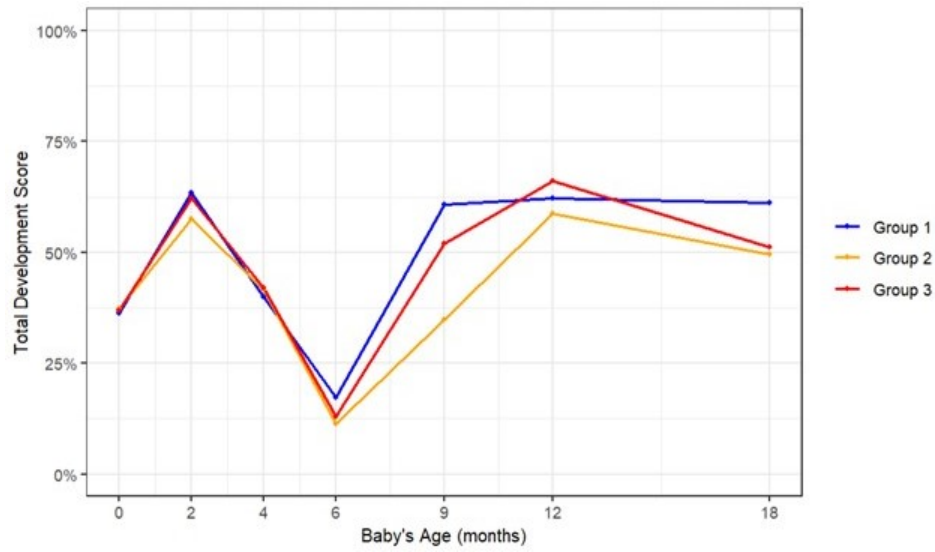


Figure 2: Development Knowledge Score Rates of Change by Treatment Group

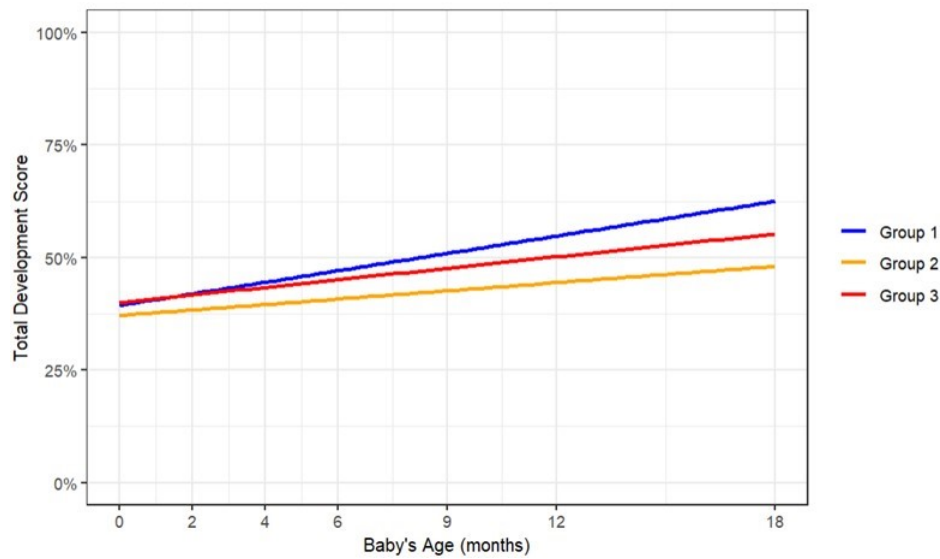


Table 3: ITT Pre/Post Development Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Round	0.25***	0.25***	0.22***
	(0.049)	(0.049)	(0.055)
Planned Pregnancy		-0.01	-0.01
		(0.080)	(0.120)
Mother's Age			0.01
			(0.006)
Receives Public Assistance			0.00
			(0.077)
Regular Childcare			-0.06
			(0.064)
Baby's Gender			-0.06
			(0.064)
Spanish or Hispanic Origin			0.03
			(0.140)
Marital Status			ref.
Never Married or Single			0.00
			(.)
Now Married			0.11
			(0.081)
Living as Married			0.34*
			(0.181)
Divorced			-0.06
			(0.256)
Race			ref.
African-American			-0.08
			(0.079)
White			0.00
			(.)
Other			-0.09
			(0.168)
Multi-racial			-0.21
			(0.204)
Cohabiting Status			ref.
Live Alone			0.00
			(.)
Cohabitate with other Adult			-0.05
			(0.092)
Cohabitate with Father			-0.07
			(0.082)
Highest Education			ref.
Some high school			0.00
			(.)
Completed high school or GED			-0.02
			(0.095)
Some college			0.09
			(0.092)
Associate degree			-0.02
			(0.116)
Bachelor's degree			0.11
			(0.128)
Graduate degree			0.20
			(0.213)
Constant	0.36***	0.36***	0.31
	(0.033)	(0.034)	(0.200)
Observations	96	96	83
Adjusted R^2	0.210	0.202	0.237

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: ITT Randomized Development Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Treatment	0.10*	0.10	0.10
	(0.060)	(0.062)	(0.065)
Planned Pregnancy		-0.02	-0.15
		(0.076)	(0.088)
Mother's Age			0.02**
			(0.007)
Receives Public Assistance			0.02
			(0.086)
Regular Childcare			0.00
			(0.066)
Baby's Gender			-0.11*
			(0.064)
Spanish or Hispanic Origin			0.01
			(0.146)
Marital Status			ref.
Never Married or Single			0.00
			(.)
Now Married			-0.03
			(0.093)
Living as Married			-0.02
			(0.148)
Divorced			-0.01
			(0.308)
Separated			0.05
			(0.304)
Race			ref.
African-American			-0.23***
			(0.076)
White			0.00
			(.)
Other			-0.05
			(0.161)
Multi-racial			-0.35**
			(0.163)
Cohabiting Status			ref.
Live Alone			0.00
			(.)
Cohabitate with Other Adult			-0.06
			(0.085)
Cohabitate with Father			-0.06
			(0.089)
Highest Education			ref.
Some high school			0.00
			(.)
Completed high school or GED			0.08
			(0.114)
Some college			0.26**
			(0.119)
Associate degree			0.27**
			(0.132)
Bachelor's degree			0.29*
			(0.158)
Some grad school			0.00
			(.)
Graduate degree			0.33*
			(0.168)
Constant	0.51***	0.52***	0.17
	(0.040)	(0.046)	(0.222)
Observations	97	97	91
Adjusted R^2	0.018	0.009	0.245

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: ITT Diff-in-Diff Development Outcome

	(1) Model 1
Treatment x Round Interaction	0.11* (0.063)
Treatment	-0.01 (0.043)
Round	0.14*** (0.042)
Constant	0.37*** (0.030)
Observations	208
Adjusted R^2	0.158

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: TOT Pre/Post Development Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Round	0.43*** (0.053)	0.43*** (0.052)	0.43*** (0.057)
Planned Pregnancy		0.20 (0.138)	0.15 (0.243)
Mother's Age			0.01 (0.008)
Receives Public Assistance			0.04 (0.076)
Regular Childcare			-0.01 (0.070)
Baby's Gender			-0.02 (0.071)
Spanish or Hispanic Origin			0.01 (0.144)
Marital Status			ref.
Never married/ Single			0.00 (.)
Now married			0.08 (0.096)
Living as married			0.63** (0.241)
Divorced			0.05 (0.195)
Race			ref.
African-American			0.01 (0.082)
White			0.00 (.)
Other			0.00 (.)
Cohabiting Status			ref.
live alone			0.00 (.)
co-habitate other adult			0.10 (0.105)
co-habitate father			0.08 (0.086)
Highest Education			ref.
Some high school			0.00 (.)
Completed high school or GED			0.01 (0.113)
Some college			0.03 (0.109)
Associate degree			-0.36** (0.153)
Bachelor's degree			0.12 (0.132)
Graduate degree			0.19 (0.193)
_cons	0.35*** (0.037)	0.34*** (0.037)	-0.00 (0.238)
Observations	54	54	46
Adjusted R^2	0.557	0.565	0.670

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: TOT Randomized Development Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
TOT	0.31*** (0.060)	0.32*** (0.062)	0.31*** (0.064)
Planned Pregnancy		0.04 (0.068)	-0.06 (0.079)
Mother's Age			0.02*** (0.006)
Receives Public Assistance			0.02 (0.075)
Regular Childcare			0.03 (0.058)
Baby's Gender			-0.07 (0.057)
Spanish or Hispanic Origin			0.01 (0.128)
Marital Status			ref.
Never married/ Single			0.00 (.)
Now married			-0.09 (0.083)
Living as married			-0.04 (0.130)
Divorced			0.03 (0.271)
Separated			-0.02 (0.268)
Race			ref.
African-American			-0.23*** (0.067)
White			0.00 (.)
Other			-0.04 (0.141)
Multi-racial			-0.25* (0.145)
Cohabiting Status			ref.
live alone			0.00 (.)
co-habitate other adult			-0.00 (0.076)
co-habitate father			-0.02 (0.079)
Highest Education			ref.
Some high school			0.00 (.)
Completed high school or GED			0.10 (0.101)
Some college			0.24** (0.105)
Associate degree			0.25** (0.116)
Bachelor's degree			0.25* (0.138)
Some grad school			0.00 (.)
Graduate degree			0.33** (0.147)
Constant	0.47*** (0.031)	0.46*** (0.037)	0.04 (0.198)
Observations	97	97	91
Adjusted R^2	0.210	0.204	0.415

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: TOT Diff-in-Diff Development Outcome

	(1) totaldev_sum
TOT_round	0.33*** (0.065)
TOT_group	-0.03 (0.046)
round	0.10*** (0.033)
Constant	0.37*** (0.023)
Observations	208
Adjusted R^2	0.289

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 3: Average Parenting Knowledge Scores by Treatment Group and Baby's Age

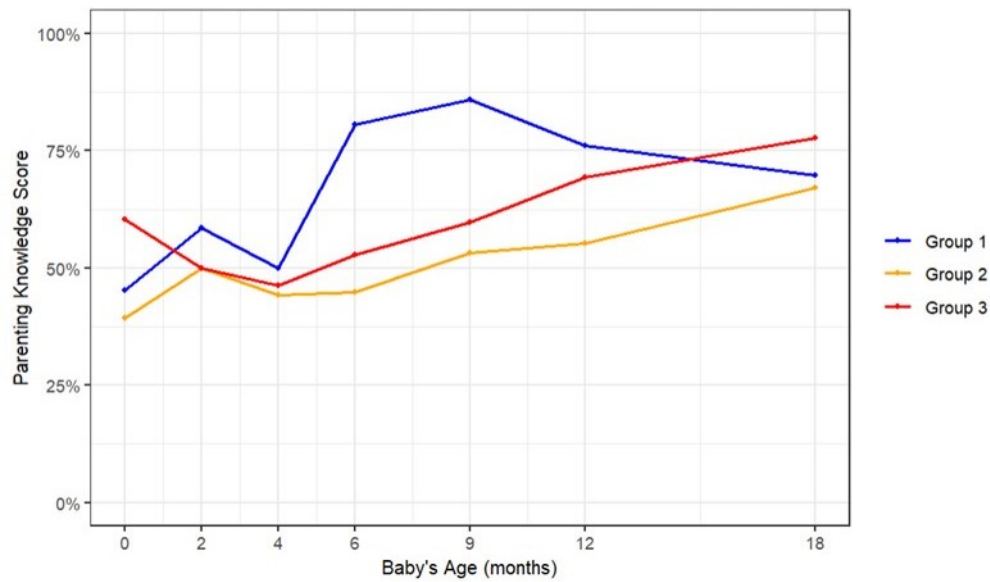


Figure 4: Parenting Knowledge Score Rates of Change by Treatment Group

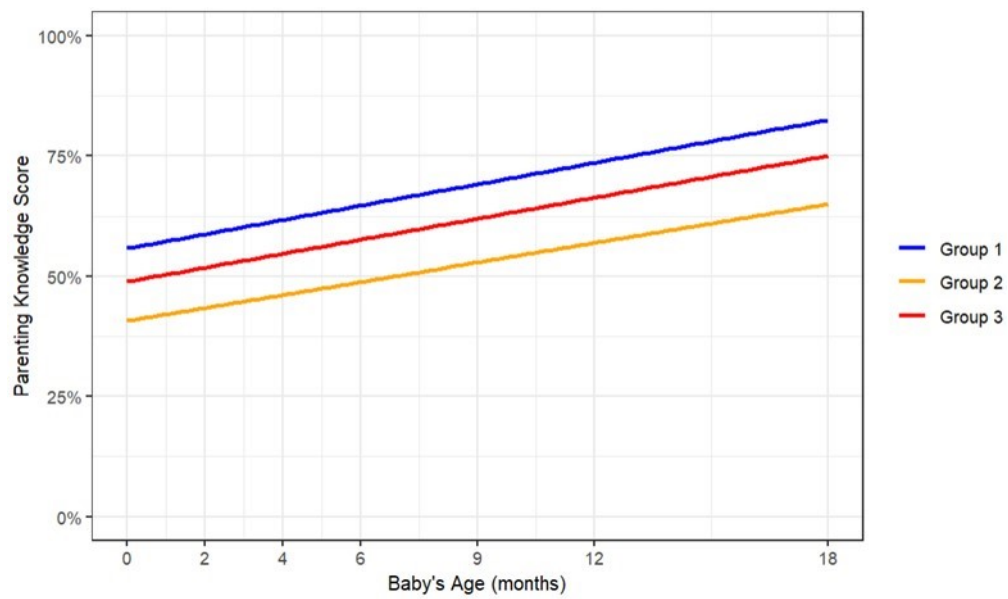


Table 9: ITT Pre/Post Parenting Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Round	0.24***	0.24***	0.20**
	(0.080)	(0.081)	(0.089)
Planned Pregnancy		-0.08	-0.24
		(0.131)	(0.194)
Mother's Age			-0.00
			(0.010)
Receives Public Assistance			-0.13
			(0.124)
Regular Childcare			0.18*
			(0.102)
Baby's Gender			0.06
			(0.103)
Spanish or Hispanic Origin			-0.47**
			(0.226)
Marital Status			ref.
Never Married or Single			0.00
			(.)
Now Married			0.32**
			(0.130)
Living as Married			-0.32
			(0.292)
Divorced			0.78*
			(0.412)
Race			ref.
African-American			0.05
			(0.128)
White			0.00
			(.)
Other			0.57**
			(0.271)
Multi-racial			0.65*
			(0.329)
Cohabiting Status			ref.
Live Alone			0.00
			(.)
Cohabitate with Other Adult			0.14
			(0.148)
Cohabitate with Father			-0.09
			(0.133)
Highest Education			ref.
Some high school			0.00
			(.)
Completed high school or GED			0.18
			(0.154)
Some college			0.12
			(0.148)
Associate degree			0.21
			(0.187)
Bachelor's degree			-0.00
			(0.206)
Graduate degree			-0.13
			(0.343)
Constant	0.45***	0.46***	0.32
	(0.054)	(0.056)	(0.321)
Observations	96	96	83
Adjusted R^2	0.080	0.074	0.122

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: ITT Randomized Parenting Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Treatment	-0.08**	-0.07*	-0.05
	(0.037)	(0.038)	(0.040)
Planned Pregnancy		0.05	0.05
		(0.047)	(0.054)
Mother's Age			-0.01
			(0.004)
Receives Public Assistance			-0.15***
			(0.052)
Regular Childcare			0.01
			(0.040)
Baby's Gender			0.06
			(0.039)
Spanish or Hispanic Origin			-0.19**
			(0.089)
Marital Status			ref.
Never Married or Single			0.00
			(.)
Now married			0.13**
			(0.057)
Living as Married			0.23**
			(0.090)
Divorced			-0.28
			(0.188)
Separated			0.04
			(0.185)
Race			ref.
African-American			0.09**
			(0.047)
White			0.00
			(.)
Other			0.20**
			(0.098)
Multi-racial			0.31***
			(0.099)
Cohabiting Status			ref.
Live Alone			0.00
			(.)
Cohabitate with Other Adult			0.05
			(0.052)
Cohabitate with Father			0.03
			(0.054)
Highest Education			ref.
Some high school			0.00
			(.)
Completed high school or GED			-0.09
			(0.070)
Some college			-0.02
			(0.073)
Associate degree			-0.08
			(0.080)
Bachelor's degree			-0.14
			(0.096)
Some grad school			0.00
			(.)
Graduate degree			-0.13
			(0.102)
Constant	0.78***	0.76***	0.88***
	(0.025)	(0.028)	(0.135)
Observations	97	97	91
Adjusted R^2	0.036	0.038	0.252

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: ITT Diff-in-Diff Parenting Outcome

	(1) Model 1
Treatment x Round Interaction	0.07 (0.107)
Treatment	-0.15** (0.073)
Round	0.17** (0.073)
Constantt	0.60*** (0.050)
Observations	208
Adjusted R^2	0.079

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: TOT Pre/Post Parenting Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Round	0.26** (0.103)	0.26** (0.103)	0.18 (0.132)
Planned Pregnancy		0.27 (0.272)	-0.00 (0.563)
Mother's Age			0.00 (0.019)
Receives Public Assistance			-0.11 (0.175)
Regular Childcare			0.13 (0.163)
Baby's Gender			0.01 (0.165)
Spanish or Hispanic Origin			0.08 (0.333)
Marital Status			ref.
Never married/ Single			0.00 (.)
Now married			0.27 (0.223)
Living as married			-0.45 (0.559)
Divorced			0.81* (0.451)
Race			ref.
African-American			0.04 (0.190)
White			0.00 (.)
Other			0.00 (.)
Cohabiting Status			ref.
live alone			0.00 (.)
co-habitate other adult			0.35 (0.244)
co-habitate father			-0.10 (0.200)
Highest Education			ref.
Some high school			0.00 (.)
Completed high school or GED			0.54** (0.263)
Some college			0.27 (0.252)
Associate degree			0.54 (0.355)
Bachelor's degree			0.26 (0.306)
Graduate degree			0.03 (0.448)
Constant	0.48*** (0.073)	0.47*** (0.073)	0.06 (0.552)
Observations	54	54	46
Adjusted R^2	0.092	0.092	0.062

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: TOT Randomized Parenting Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
TOT	-0.00 (0.042)	0.02 (0.043)	0.04 (0.044)
Planned Pregnancy		0.08 (0.048)	0.08 (0.055)
Mother's Age			-0.01 (0.004)
Receives Public Assistance			-0.16*** (0.052)
Regular Childcare			0.02 (0.040)
Baby's Gender			0.06 (0.039)
Spanish or Hispanic Origin			-0.18** (0.089)
Marital Status			ref.
Never married/ Single			0.00 (.)
Now married			0.12** (0.057)
Living as married			0.23** (0.090)
Divorced			-0.26 (0.188)
Separated			0.03 (0.186)
Race			ref.
African-American			0.08* (0.046)
White			0.00 (.)
Other			0.20** (0.098)
Multi-racial			0.33*** (0.101)
Cohabiting Status			ref.
live alone			0.00 (.)
co-habitate other adult			0.07 (0.053)
co-habitate father			0.03 (0.055)
Highest Education			ref.
Some high school			0.00 (.)
Completed high school or GED			-0.08 (0.070)
Some college			-0.02 (0.073)
Associate degree			-0.09 (0.080)
Bachelor's degree			-0.16* (0.096)
Some grad school			0.00 (.)
Graduate degree			-0.12 (0.102)
Constant	0.74*** (0.022)	0.72*** (0.026)	0.86*** (0.137)
Observations	97	97	91
Adjusted R^2	-0.010	0.006	0.248

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: TOT Diff-in-Diff Parenting Outcome

	(1)
	totalpar_sum
TOT_round	0.06 (0.123)
TOT_group	-0.07 (0.086)
round	0.20*** (0.063)
Constant	0.55*** (0.042)
Observations	208
Adjusted R^2	0.058
Standard errors in parentheses	
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$	

Figure 5: Average Total Knowledge Scores by Treatment Group and Baby's Age

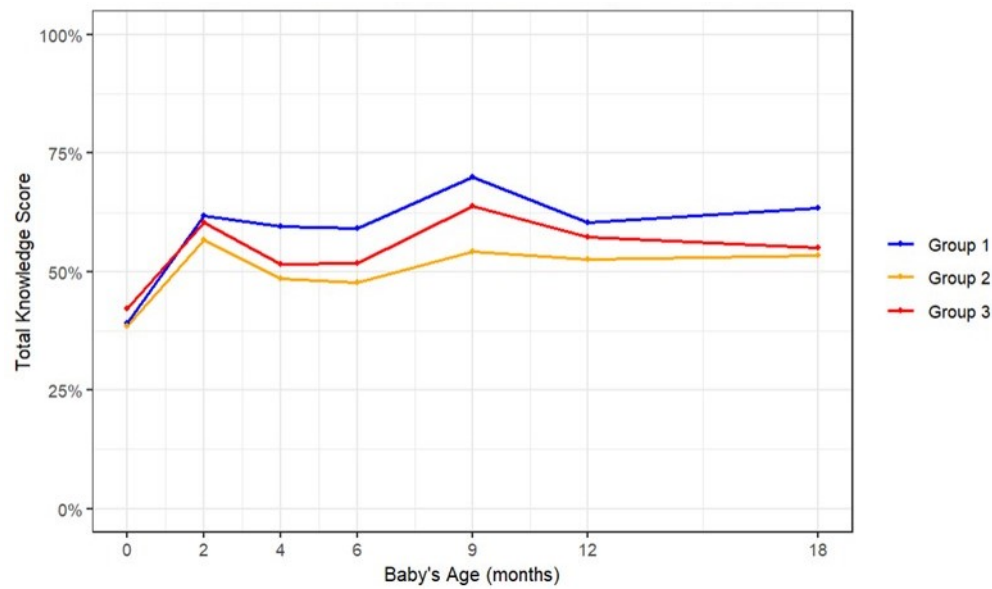


Figure 6: Total Knowledge Score Rates of Change by Treatment Group

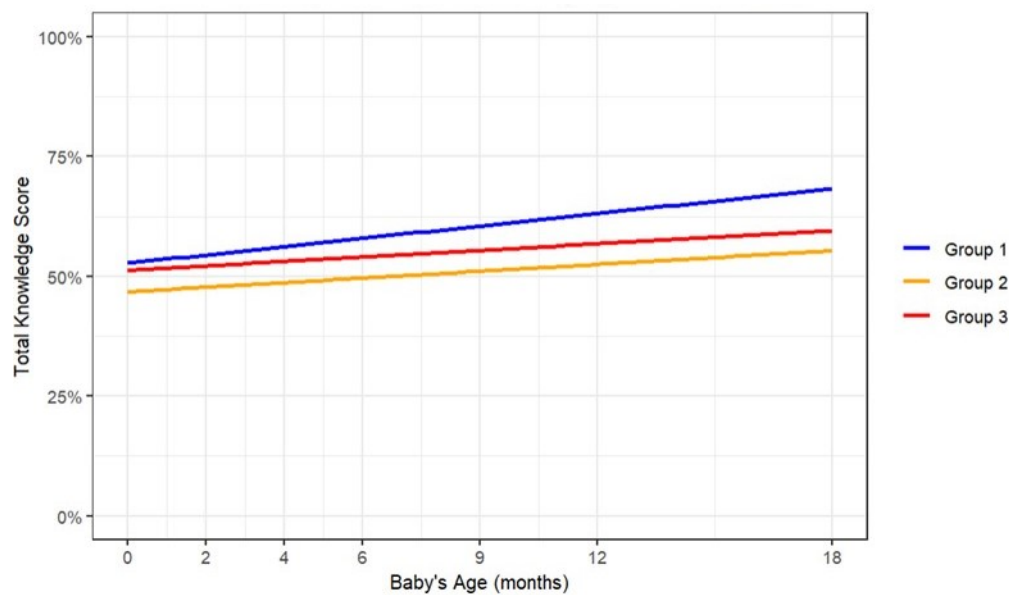


Table 15: ITT Pre/Post Total Knowledge Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Round	0.24***	0.24***	0.21***
	(0.030)	(0.030)	(0.030)
Planned Pregnancy		-0.01	0.00
		(0.049)	(0.065)
Mother's Age			0.00
			(0.003)
Receives Public Assistance			-0.09**
			(0.041)
Regular Childcare			0.01
			(0.034)
Baby's Gender			-0.02
			(0.035)
Spanish or Hispanic Origin			0.03
			(0.076)
Marital Status			ref.
Never Married or Single			0.00
			(.)
Now Married			0.09**
			(0.043)
Living as Married			0.12
			(0.098)
Divorced			0.01
			(0.138)
Race			ref.
African-American			-0.05
			(0.043)
White			0.00
			(.)
Other			0.04
			(0.091)
Multi-racial			-0.15
			(0.110)
Cohabiting Status			ref.
Live Alone			0.00
			(.)
Cohabitate with Other Adult			-0.03
			(0.049)
Cohabitate with Father			-0.03
			(0.044)
Highest Education			ref.
Some high school			0.00
			(.)
Completed high school or GED			0.05
			(0.051)
Some college			0.12**
			(0.050)
Associate degree			0.06
			(0.063)
Bachelor's degree			0.12*
			(0.069)
Graduate degree			0.13
			(0.115)
Constant	0.39***	0.39***	0.43***
	(0.020)	(0.021)	(0.107)
Observations	96	96	83
Adjusted R^2	0.411	0.405	0.541

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16: ITT Randomized Assignment Total Knowledge Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Treatment	0.08**	0.09***	0.11***
	(0.033)	(0.034)	(0.037)
Planned Pregnancy		0.03	-0.00
		(0.041)	(0.050)
Mother's Age			0.00
			(0.004)
Receives Public Assistance			-0.05
			(0.048)
Regular Childcare			0.03
			(0.037)
Baby's Gender			-0.03
			(0.036)
Spanish or Hispanic Origin			-0.03
			(0.082)
Marital Status			ref.
Never Married or Single			0.00
			(.)
Now Married			0.05
			(0.052)
Living as Married			0.08
			(0.083)
Divorced			0.08
			(0.174)
Separated			0.10
			(0.172)
Race			ref.
African-American			-0.08*
			(0.043)
White			0.00
			(.)
Other			0.09
			(0.091)
Multi-racial			-0.03
			(0.092)
Cohabiting Status			ref.
Live Alone			0.00
			(.)
Cohabitate with Other Adult			0.03
			(0.048)
Cohabitate with Father			-0.02
			(0.050)
Highest Education			ref.
Some high school			0.00
			(.)
Completed high school or GED			0.05
			(0.064)
Some college			0.15**
			(0.067)
Associate degree			0.06
			(0.074)
Bachelor's degree			0.18**
			(0.089)
Some grad school			0.00
			(.)
Graduate degree			0.13
			(0.094)
Constant	0.55***	0.54***	0.46***
	(0.022)	(0.025)	(0.125)
Observations	97	97	91
Adjusted R^2	0.055	0.050	0.208

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: ITT Diff-in-Diff Total Knowledge Outcome

	(1)
	Model 1
Treatment x Round Interaction	0.11*** (0.037)
Treatment	-0.03 (0.025)
Round	0.13*** (0.025)
Constant	0.42*** (0.018)
Observations	208
Adjusted R^2	0.333

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: TOT Pre/Post Total Knowledge Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Round	0.35*** (0.031)	0.35*** (0.031)	0.33*** (0.027)
Planned Pregnancy		0.10 (0.082)	-0.05 (0.117)
Mother's Age			0.01** (0.004)
Receives Public Assistance			-0.05 (0.036)
Regular Childcare			0.07* (0.034)
Baby's Gender			-0.02 (0.034)
Spanish or Hispanic Origin			0.11 (0.069)
Marital Status			ref.
Never married/ Single			0.00 (.)
Now married			0.09* (0.046)
Living as married			0.25** (0.116)
Divorced			0.10 (0.094)
Race			ref.
African-American			-0.00 (0.039)
White			0.00 (.)
Other			0.00 (.)
Cohabiting Status			ref.
live alone			0.00 (.)
co-habitate other adult			0.09* (0.051)
co-habitate father			0.08* (0.042)
Highest Education			ref.
Some high school			0.00 (.)
Completed high school or GED			0.01 (0.055)
Some college			-0.02 (0.052)
Associate degree			-0.16** (0.074)
Bachelor's degree			0.03 (0.064)
Graduate degree			-0.00 (0.093)
Constant	0.39*** (0.022)	0.39*** (0.022)	0.17 (0.115)
Observations	54	54	46
Adjusted R^2	0.703	0.706	0.846

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: TOT Randomized Assignment Total Knowledge Outcome

	(1)	(2)	(3)
	Model 1	Model 2	Model 3
TOT	0.22*** (0.030)	0.23*** (0.031)	0.25*** (0.031)
Planned Pregnancy		0.07* (0.034)	0.06 (0.039)
Mother's Age			0.00 (0.003)
Receives Public Assistance			-0.04 (0.037)
Regular Childcare			0.05* (0.029)
Baby's Gender			0.00 (0.028)
Spanish or Hispanic Origin			-0.03 (0.063)
Marital Status			ref.
Never married/ Single			0.00 (.)
Now married			0.00 (0.041)
Living as married			0.06 (0.064)
Divorced			0.10 (0.133)
Separated			0.05 (0.132)
Race			ref.
African-American			-0.08** (0.033)
White			0.00 (.)
Other			0.11 (0.069)
Multi-racial			0.05 (0.071)
Cohabiting Status			ref.
live alone			0.00 (.)
co-habitate other adult			0.07* (0.037)
co-habitate father			0.02 (0.039)
Highest Education			ref.
Some high school			0.00 (.)
Completed high school or GED			0.07 (0.049)
Some college			0.12** (0.052)
Associate degree			0.05 (0.057)
Bachelor's degree			0.16** (0.068)
Some grad school			0.00 (.)
Graduate degree			0.13* (0.072)
Constant	0.53*** (0.016)	0.51*** (0.018)	0.35*** (0.097)
Observations	97	97	91
Adjusted R^2	0.342	0.361	0.533

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: TOT Diff-in-Diff Total Knowledge Outcome

	(1)
	totalknow_sum
TOT_round	0.23*** (0.038)
TOT_group	-0.02 (0.026)
round	0.12*** (0.019)
Constant	0.41*** (0.013)
Observations	208
Adjusted R^2	0.464

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 Attributions of Work

Study Overview - Zhiyin Deng

Baseline Participant Characteristics & Table - Zhiyin Deng

Sample Attrition Analysis & Table - Kalika Likhi

Development Knowledge Analysis -Kalika Likhi

Parenting Knowledge Analysis -Rohit Walthare

Total Knowledge Analysis - Meredith Meadows

Conclusions & Recommendations - Rohit Walthare & Meredith Meadows

Figures - Meredith Meadows

Report and Latex Formatting - Rohit Walthare & Kalika Likhi

7 References

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2. Reich SM, Penner EK, Duncan GJ, Auger A. Using baby books to change new mothers' attitudes about corporal punishment. *Child Abuse Negl*. 2012 Feb;36(2):108-17. doi: 10.1016/j.chiabu.2011.09.017.3.
3. Reich SM, Penner EK, Duncan GJ. Using baby books to increase new mothers' safety practices. *Acad Pediatr*. 2011 Jan-Feb;11(1):34-43. doi: 10.1016/j.acap.2010.12.006.