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Reading And Play Frequency In The Early Head Start Program On Parent And Child Outcomes

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READING AND PLAY FREQUENCY IN THE EARLY HEAD START PROGRAM ON PARENT AND CHILD OUTCOMES

by

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This thesis submitted by Zach Flaten in partial fulfillment of the requirements for the Degree of Master of Science in Applied Economics from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Title	Reading and Play Frequency in the Early Head Start Program on Parent and Child Outcomes
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Zachary Flaten
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ABSTRACT

This study examines the channels that Early Head Start (EHS) influences cognitive development in toddlers and successful parenting skills. I use a fixed effects model, incorporating individual fixed effects and time fixed effects, with longitudinal panel data from the EHS Research and Evaluation Project. By employing these methods and running separate regressions on a pooled, control and treated group, I find that when parents nightly read to their child, Bayley Mental Development Index (MDI) and Home Observation for Measurement of Environment (HOME) scores increase. When parents engage in play interactions with their child, I uncover a positive influence on child development rather than parenting. Specifically, for the treated group, reading nightly provides a 1.91-point increase in the MDI, the child's cognitive development score, and a 0.54-point increase in the HOME score, which measures the influence of the home environment on school readiness. A one-point increase in the parent-child play scale yields a 1.63-point increase in the MDI, while producing a non-differential effect on HOME scores for the treated group. My study is unique and contributes to existing work by displaying which parental strategies influence both child and parenting outcomes since the parenting outcomes and implications for parent-child play had previously been ignored in the early child intervention literature.

CHAPTER I

INTRODUCTION

Growing evidence supports expanding pre-schools and early child intervention for economically disadvantaged families across the US (Garces, Thomas, and Currie, 2001; Heckman, Pinto, and Savelyev, 2013; Carneiro and Ginja, 2014). Much of the work has been done about Head Start, a federal program started in 1965 that aims to provide early child intervention education services from children of ages three to five. Nonetheless, there is evidence that anywhere from 80 to 90% of the brain's development and growth occurs in the first two years of a person's life (Pfefferbaum, Mathalon, Sullivan, Rawles, Zipursky, and Lim, 1994; Knickmeyer, Gouttard, Kang, Evans, Wilber, Smith, Hamer, Lin, Gerig, and Gilmore, 2008). Few works have addressed these earlier years of development.

Early Head Start (EHS) is another federally funded program that began in 1995 from the Administration for Children, Youth, and Families, a department under the Department of Health and Human Services, addressing low-income infants and toddlers from birth to age three. The EHS program aims to provide better relationships between the parents and their child, through higher engagement, increased attention to the child, and encouraging learning during play and other social activities. Expanding literature in this field can demonstrate the urgency of increasing funding for early intervention programs from birth all the way until compulsory public school begins at age five.

In this thesis, I investigate answers to the following three questions; Which channels or mechanisms lead to EHS influencing both child and parenting outcomes? Does reading nightly influence the child's development and parenting skills, and do we see any beneficial effects from engaging the child in play?

To this end, I use Bayley Mental Development Index (MDI) and Home

Observation for Measurement of Environment (HOME) as dependent variables. The Bayley MDI is a cognitive and language development test for infants, toddlers, and children that measures cognitive functions such as memory, problem solving, language, and social skills, derived from the Bayley Scales of Infant Development (Encyclopedia of Children's Health, 2017; Bayley, 1993). The MDI has been shown to be related to early intelligence too, with the 12-month MDI scores being 40% correlated with IQ at age 5 and 48% correlated with the IQ at age 6 (Bornstein and Kasnegor, 1989). Some studies have verified the link between EHS and child's cognitive development through the MDI (Duursma, 2014; Chang, Park, Singh, Sung, 2009). It is unclear, however, through which channel that EHS causes these positive effects in the MDI. My study illuminates the channel by attributing the parent's nightly reading and parent-child play interactions as the causal key independent variables that influence these gains.

In addition to the MDI, I employ the HOME score through which little has been done to examine the effect of EHS on successful parenting skills. The HOME score measures how the home environment influences school readiness, and it consists of questions derived from observations, interview, and a combination of both to calculate a composite score (Bradley and Caldwell, 1976).

To investigate through which parental strategies EHS leads to successful outcomes for both the child's development and the parenting skills, I employ time and individual fixed effects to compare a control and treated group (participating in EHS) using panel data from the EHS Research and Evaluation dataset during 1997 to 1999. The separation of two groups, from a random assignment, allows us to observe the differential effects of EHS on each outcome of interest.

I find that having a bedtime reading routine with the child and engaging in parent-child play significantly and positively affect the MDI more than HOME scores for families enrolled in EHS, relative to the control group. Particularly, for the treated group, reading nightly to the child significantly increases the MDI by 1.91 points and HOME scores by 1.61 points. A one-point increase in the parent-child play only significantly affects the MDI by 0.54 points. These results are robust to proxies for both nightly reading and parent-child play.

I contribute to the literature by examining MDI and HOME scores through beneficial strategies, such as reading and playing with the child, that EHS facilitates and encourages to foster learning. Previously, no study has explored which particular channels influence both outcomes of interest in an EHS sample (e. g., Love, Kisker, Ross, Costantine, Boller, Chazan-Cohen, Brady-Smith, Fuligni, Raikes, Brooks-Gunn, Tarullo, Schochet, Paulsell, and Vogel, 2005). This study fills the gap by connecting parental strategies to HOME scores, while confirming the positive effects of parent-child play on the MDI.

First, I introduce the literature that's related to my study. In the second chapter, I discuss the data, methods, and the specification. Third, I report regression results for both the control and treated groups to evaluate the differential effects of EHS, as well as the successes of nightly parental reading and parent-child play. Finally, in the last chapter, I explain the implications of my results, and discuss any shortcomings or limitations to my study.

Literature Review

My study relates to studies that have examined the positive effects of EHS on the MDI (Chang, Park, Sing, Sungh, 2009; Love et al., 2005). Chang et al. (2009) find that more involved and supportive parents within EHS had higher MDI scores. Love et al. (2005) reveal that participating in EHS led to a 1.20-point increase on average on the MDI at age 3. While these studies have examined the connection between EHS and MDI scores, neither of them have specifically attributed which parental strategies learned in EHS that lead to these positive outcomes as in my study.

In addition, my work is related to the literature that studies a positive link between reading daily to the child and child's later cognitive development outcomes (Kalb and van Ours, 2014; Duursma, 2014; Cline and Edwards, 2013). Kalb and van Ours (2014) show that parental reading before compulsory schooling begins at ages 4 and 5 contributes to positive cognitive outcomes, literacy and numeracy skills, at ages 10 and 11 in Australian children. I expand upon this study by examining the effect of nightly reading to children from birth to age three for American families. This allows me, unlike Kalb and van Ours, to explore the earliest effect of reading on cognitive outcomes. Duursma (2014) observes that parental reading influences the MDI and the Peabody Picture Vocabulary Test (PPVT), a vocabulary recognition test, at ages 24 and 36 months, while I examine the effect of nightly reading on both MDI and HOME scores. In doing so, I can confirm Duursma's results while uncovering the effect of nightly reading on HOME scores as well. Previously, no studies had estimated the effect of parental reading or parent-child play on HOME scores. Cline and Edwards (2013) explored positive effects from parental reading with only 81 families in the rural Midwest, and I improve upon this by exploiting variation across 17 EHS centers all across the US with over 800 families. Expanding the variation across the US eliminates concern about the results being sensitive to a particular region and allows us more confidence in the results.

Finally, my work relates to the literature that explores the effect of engagement in play on child outcomes. Fantuzzo and McWayne (2002) examine the positive behavioral effects of sociable peer-play interactions on pre-school readiness and behavior at school within Head Start, while my study uncovers the effects of parent-child play within EHS. Parent-child play interactions have largely been ignored, and my study contributes to the literature by unveiling the effect of play at the family level, rather than peer level. Roggman, Boyce, Cook, Christiansen, and Jones (2004) find that father-toddler play positively influences the child's social development at 14 and 24 months in EHS. I contrast this by utilizing a parent-child play scale to affect both MDI and HOME scores for all three years of EHS within a panel data format. Specifically, this study highlights the effect of parent-child play on parenting skills rather than social development. Also, utilizing the final year of EHS is important to observe that any cognitive gains do not immediately fade before EHS services are discontinued at age 3. Tamis-LeMonda, Shannon, Cabrera, and Lamb (2004) explore parental responsiveness during play to predict the MDI, but do not compare control and treated groups within EHS as my study does. This comparison allows us to observe the differential effects of EHS in order to confirm the positive effects on MDI and HOME scores. No study so far has evaluated the casual effect of parent-child play on both the child's cognitive development and parenting outcomes.

In summary, the pre-existing works in the early child intervention field have broadly focused on EHS on child development outcomes. Few studies have explored parenting outcomes as a response variable within EHS. Even fewer have discussed the channels that improve both child development and parenting. I solve these issues by prescribing two channels, nightly reading and parent-child play interactions, which are key independent variables that EHS has been proven to influence and strengthen.

CHAPTER II

METHODOLOGY

The data I have acquired is from the Interuniversity Consortium for Political and Social Research (ICPSR) database, which tracked children throughout the EHS program as a longitudinal study from 1996 to 2010. The EHS Research and Evaluation Project was launched by the Administration for Children, Youth, and Families under the Department of Health and Human Services in 1996 to better evaluate the structure of EHS. The Administration for Children, Youth, and Families organized the study in an attempt to better understand the effects of attending EHS all across the US. This longitudinal panel data was collected from a sample of families in seventeen EHS programs across the US. These were located in Arkansas, California, Colorado (two programs), Iowa, Kansas, Michigan, New York, Missouri, Pennsylvania, South Carolina, Tennessee, Utah, Virginia, Washington (two programs), and Vermont. The survey followed the children from birth until the end of the 5^{th} grade. Since the EHS program lasts from birth to age three, and I focus on child's data from age one to three, I will only use the years 1997 to 1999 from the study. I do this in order to examine the differential effects of EHS, which takes place from birth to age three. The 2,977 applicants enrolled in EHS were randomly assigned from a computer generation, with 1,503 enrolled in the program and 1,474 assigned into the control group. Data is recorded when the child is fourteen months old (wave 1 of the survey), two years old (wave 2 of the survey), and three years old (wave 3 of the survey). Of these applicants, only about 800 appeared to record data for waves one, two, and three for all of the variables of interest, and hence the data is limited by the availability of the control variables.

As discussed above, there are ultimately two dependent variables, the MDI and HOME scores, to use in the model to explain either child or joint parent-child outcomes.

These outcome variables are derived from observations and tests that the children and parents take during the 3 years of the study. The MDI score, a measure of infant development and mental capacity of cognitive and language skills, will be the proxy for early child cognitive development. The positive effects of EHS on the child's mental development is a central question that will be confirmed in my results.

My study captures additional variation besides this early mental development score, the HOME score. The HOME scores are moderately related to the MDI and strongly related to Stanford Binet IQ test (Bradley and Caldwell, 1976), but only in a correlational fashion. This displays the huge significance in exploring the causal factors that determine the HOME score since very few works have devoted effort to discovering which parental strategies have positive impacts on HOME scores. One study (Sugland, Zaslow, Smith, and Brooks-Gunn, 1995) has found HOME scores causally predicted positive behavioral and reading recognition outcomes for pre-school children. While some studies have used this measure in studying children and families, it has rarely been used in the literature as an outcome to predict the effectiveness of early child intervention programs and parental strategies, like reading to their child at bedtime or engaging in play, particularly in EHS.

Table 1 from below shows EHS providing advantages in both MDI and HOME scores. Specifically, Table 1 shows that the control children scored on average 98.60 on the MDI in wave one, while the treatment group had a mean 98.28 score in wave one. By wave three, both groups mean MDI scores fell, but the mean MDI of the control group was 90.45, while the mean MDI of the treated group was 91.73. One possible explanation for the drop in MDI scores across waves is the lower test-retest reliability for

14 month old infants (74% reliability), rather than at 24 months (88%) and 36 months (81%) (Ruiter, Spelberg, van der Meulen, and Nakken, 2008). The test reliability, which measure correlation of repeating test scores of the MDI, did not fall below 74% reliability after the child turned 14 months old.

Across the two years of the sample, the treated group maintains a 1.60-point edge over the control group. We see that the control group had a mean 26.28 HOME score, while the treated group had a 26.17 score, on average, in wave one. At wave three, the treated group mean HOME score surpasses the control, with mean scores of 27.90 and 27.32, respectively. Over this time, the treated group gained a 0.69-point edge over the control group for mean HOME scores. As seen by Table 1, EHS produces gains because the treated group, on average, has higher HOME and MDI scores at wave 3. Table A.1 of the Appendix displays the mean, standard deviation, and range of values for the MDI and HOME scores for each group.

Table 1: Differences in Mean MDI and HOME scores at Waves 1 and 3

Bayley MDI

Group	Wave 1	Wave 3	Wave Difference
Control	98.60	90.45	-8.15
Treated	98.28	91.73	-6.55
Between Difference	-0.32	1.28	1.60

HOME Score

Group	Wave 1	Wave 3	Wave Difference
Control	26.28	27.32	1.04
Treated	26.17	27.90	1.73
Between Difference	-0.11	0.58	0.69

Table 2 reports the differences between the control and treated groups across two years of time, at waves 1 and 3. Wave 2 statistics are in the Appendix in Table A.2.

Table 2: Waves 1 and 3 Summary Statistics of Covariates

			Read Nightly			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.19	0	0.39	0	1
Treated Group	443	0.17	0	0.38	0	1
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.29	0	0.46	0	1
Treated Group	443	0.35	0	0.48	0	1
			Read Daily			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.51	1	0.5	0	1
Treated Group	443	0.51	1	0.5	0	1
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.54	1	0.5	0	1
Treated Group	443	0.58	1	0.49	0	1
			Parent-Child Play Scale			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	4.52	4.56	0.77	2.11	6
Treated Group	443	4.54	4.56	0.77	2.22	6
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	4.41	4.4	0.81	2	6
Treated Group	443	4.53	4.57	0.86	2	6
			Sustained Attention During Play			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	4.97	5	1.08	2	7
Treated Group	443	5.04	5	1	2	7
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	4.82	5	0.98	2	7
Treated Group	443	5	5	0.89	2	7
			Parental Distress Scale			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	27.32	26.2	8.91	12	53
Treated Group	443	26.62	25	9.25	12	59
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	24.87	24	9	12	54
Treated Group	443	24.62	22.91	9.49	12	56

Table 2 Continued

Parental Distress Scale						
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	27.32	26.2	8.91	12	53
Treated Group	443	26.62	25	9.25	12	59
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	24.87	24	9	12	54
Treated Group	443	24.62	22.91	9.49	12	56

Parents Used Mild Discipline						
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.56	1	0.5	0	1
Treated Group	443	0.59	1	0.49	0	1
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.44	0	0.5	0	1
Treated Group	443	0.45	0	0.49	0	1

Mother Married to Biological Father						
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.41	0	0.49	0	1
Treated Group	443	0.38	0	0.49	0	1
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.4	0	0.49	0	1
Treated Group	443	0.37	0	0.48	0	1

Family Received AFDC/TANF During Survey						
Wave 1	Obs	Mean	Median	SD	Min	Max
Control Group	355	0.24	0	0.43	0	1
Treated Group	394	0.29	0	0.46	0	1
Wave 3	Obs	Mean	Median	SD	Min	Max
Control Group	355	0.19	0	0.4	0	1
Treated Group	394	0.23	0	0.42	0	1

Within my model, the key variables of central interest are nightly reading and parent-child play scale since they demonstrate parental involvement focused around developing both the child’s language development and the parent’s teaching skills. First, I include a binary variable equal to one if the parent reads to the child consistently (four to five times a week) at night, and zero if they do not establish this bedtime routine. The

EHS improves parenting behaviors, including reading frequency, which strongly facilitates the child's development. At wave 1, in Table 2, the treated group family reads nightly to their child 2 % less than the control group. By wave three, the treated group, receiving EHS services, read to their child nightly 6% more than the control group on average (Table 3).

Next, my other variable of interest is the scale for positive parent-child play activities, recorded from videotaped footage of the parents showing sensitivity, engaging the child in a cognitive manner, or responding favorably during play. Sensitivity includes acknowledging the child's activity, facilitating the child's play, and changing the pace of play when the child appears under-stimulated. The engagement in cognitive stimulation involves facilitating learning by encouraging the child to talk about the materials or play in ways that teach concepts, such as colors or sizes. Positive regard includes praising the child, smiling or laughing with the child, showing empathy for the child's distress, and showing clear enjoyment of the child during play.

In Table 2, for wave 1, we observe that the parent-child play scale with the median for both groups at 4.56. At wave 3, the treated group median for play activity jumps to 4.57, while the control group falls to 4.40.

Figures 1 and 2 below display the distribution of the parent-child play scale in waves 1 and 3 for the control and treated groups, respectively. Figure 1 illustrates the control and treated groups with normal distributions in wave 1, with the skewness of the control group's parent-child play scale at -0.35 and the treated group at -0.58.

In Figure 2, we observe the treated group is more negatively skewed towards the upper end of the distribution of parent-child play, with a skewness of -0.71 to the control's skewness of -0.39.

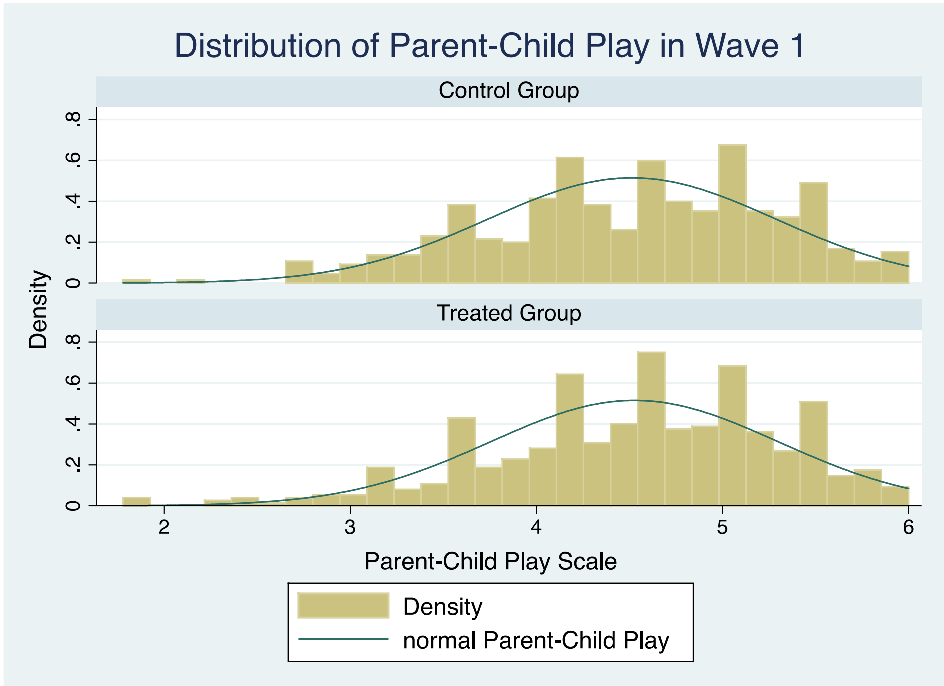

Figure 1: Distribution of Parent-Child Play Scale in Wave 1: Control and Treated Groups

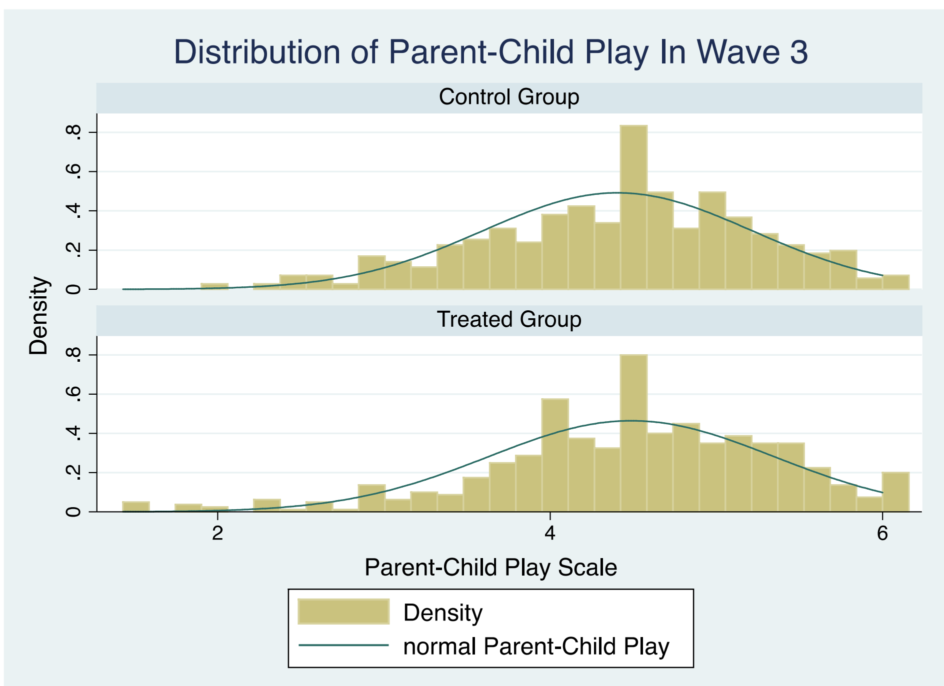

Figure 2: Distribution of Parent-Child Play Scale in Wave 3: Control and Treated Groups

Figure 2 reveals that the treated group is more involved in positive parent-child play activities, especially given the larger median for the treated group, relative to the control. This increase is expected to positively influence both MDI and HOME scores.

The third variable, the parental distress scale, captures stress and anxiety through the Parenting Stress Index (PSI) Subscale, measuring conflict in the household as the parent struggles to raise their child. This stress variable is motivated from two studies, Shea and Coyne (2011) and Barry, Dunlap, Lochman, and Wells (2009), which find that higher stress in mothers had predictive power over pre-school boys' disruptive behavior through inconsistent parenting disciplines. Neece and Baker (2008) also reveal that parental stress is linked to the child later developing poor social interaction skills. It is evident that parental distress has negative consequences for toddlers' development, as well as for the home environment.

Fourth, the discipline severity index is an ordered response recording parenting discipline in response to hypothetical conflict situations, ranging responses from 1 to 5 from the parent issuing a timeout (mild discipline) to using physical violence. From this index, the data collectors derived a binary indicator, equal to one for the parents' use of mild discipline and zero otherwise, which entails talking to the child, using a time out, or removing them from a situation of conflict without issuing violence or shouting. We believe mild discipline contributes to higher MDI and HOME scores by displaying more attentive parenting skills and avoiding violence. The use of mild discipline falls for both groups from wave 1 to 3, which is usual as the toddlers gain more mobility and get into more mischief.

Fifth, I control for social differences in the two groups, poverty and household marriage status, which represent aspects of the household composition. To proxy for level of income or poverty, we have an indicator of Aid to Families with Dependent Children (AFDC) and Temporary Assistance to Needy Families (TANF) benefits, equal to one if the family reported receiving benefits during the survey.[1] I employ this proxy because monthly household income data is only available at wave 1. I will use the AFDC/TANF indicator in the robustness check to identify if the results are sensitive to poverty in Table A.3 in the Appendix. We expect that poorer families have lower HOME and MDI scores since families of lower socioeconomic statuses generally have children with lower standardized test scores (Fomby, James-Hawkins, and Mollborn, 2015; Duncan and Magnuson, 2005) and have a higher risk of child neglect and lower quality parenting skills (Slack, Holl, McDaniel, Yoo, and Berger, 2004).

Lastly, I control for the mother's marital status, which equals one if the mother is married to the biological father. Higher rates of marriage to the biological father lead to higher involvement in parenting through a more stable nuclear family, and children with married parents on average have higher educational attainment and are healthier emotionally and psychologically (Amato, 2000; Weitoft, Hjern, Haglund, and Rosén, 2003). We posit that a married mother leads to positive MDI and HOME scores. Due to limited data from the fathers in the study, most of the parental attributes come from the mother.

In short, we see gains from EHS for the MDI and HOME scores for the treated group, evident in Table 1. Also, from Table 2, we can see an increase in both nightly reading and play frequency between parent and child for the treated EHS group, relative to the control group. These differences imply that the EHS may have positive effects on

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[1] AFDC and TANF are jointly included because AFDC as a program ended in the late 1990s during the Clinton Administration, transforming into TANF as a part of welfare reform.

the MDI and HOME scores, and I verify the positive effects using regressions.

Specification

The specification follows from the equation (1) below:

$$Y_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 X_{it} + T_t + \alpha_i + \varepsilon_{it} \tag{1}$$

where Y_{it} represents the HOME score or the MDI, β denotes parameter to be estimated, V_{it} indicates variables of central interest, including nightly reading frequency and participating in playing and activities with the child, and X_{it} indicates a vector of the control variables including the parents' use of mild discipline, mother's marital status, the parental distress scale, and family's reception of AFDC/TANF benefits. T_t represents time fixed effects at waves 2 and 3, α_i denotes individual fixed effects, and ε_{it} is an error term. Certain controls, such as race, gender, or educational status, are not utilized since the individual fixed effects absorb them.[2] For the educational status variable, indicating 1 for the mother's enrollment in an educational program and 0 for otherwise, enrollment did not vary over time. For the time fixed effects, I use waves 2 and 3 to compare to wave 1, which is the baseline and is omitted. The time fixed effects capture the effect of the latter waves.

I avoid utilizing the difference-in-difference estimation method since I cannot verify the parallel trends assumption because I lack the data of each individual before the EHS services begin. These data are required to examine pre-treatment and post-treatment trends in outcomes. Normally, the difference-in-difference estimation method is useful with a policy change, and since EHS begins at birth, there is no pre-treatment data to

[2] Breaking each regression down by race does not yield a significant impact on the dependent variables.

observe for the family that occurs before the implementation of the policy. Instead, I run equation (1) separately for the pooled, control, and treated groups in order to examine to overall effect from each regression. In doing so, I can compare the control and treated groups to determine the differential effects of EHS.

I use the fixed effects model to study variation within individuals across time. For the decision to use fixed effects, I utilized a Hausman test, in which the null hypothesis is that the random effects model is the most appropriate. Using the variables from the baseline model in Table 3, I find a p-value of 0, rejecting the null of random effects and confirming the fixed effects model. Since our two groups are very similar from the outset, this model is successful in comparing the variation within groups across time to observe the positive effects that families in EHS yield. The random assortment of families into the treatment and control groups satisfies the conditional independence assumption, which confirms that the treatment is random and does not rely on particular characteristics from the families.

Next, I will discuss omitted variables, serial correlation, and endogeneity within my model. I use individual fixed effects to control for time-invariant individual characteristics, such as race, gender, or educational status, that may affect the MDI and HOME scores. These mitigate the concern about omitted variable bias. In addition, I utilize time fixed effects to control for trends in either outcome; as shown in Table 1, the MDI trends down as time progresses, while HOME scores trend upwards during EHS. Also, I use clustered standard errors by the individual ID number to address a possible serial correlation in the error. Due to the nightly reading indicator being a self-reported binary variable, measurement error seems likely. Assuming the measurement error exists, the coefficient for nightly reading is slightly overstated due to a small attenuation bias.

CHAPTER III

RESULTS

Table 3: Pooled Fixed Effects Regressions for MDI and HOME Scores

	MDI		**HOME**	
	(1)	(2)	(3)	(4)
Reads to Child Nightly	1.74***	1.61**	0.38**	0.37**
	(0.65)	(0.62)	(0.18)	(0.18)
Parent-Child Play Scale	1.01**	1.04**	0.75***	0.74***
	(0.41)	(0.4)	(0.14)	(0.12)
Parents Used Mild Discipline		1.71***		0.31**
		(0.53)		(0.14)
Mother Married to Biological Father		0.36		0.50*
		(1.05)		(0.26)
Parental Distress Scale		0.03		-0.02
		(0.03)		(0.01)
Constant	93.53***	91.79***	22.77***	22.76***
	(1.82)	(2.21)	(0.58)	(0.67)
Observations	2488	2488	2610	2610
Within R-Squared	0.23	0.23	0.10	0.11
Overall R-Squared	0.19	0.20	0.12	0.17
RMSE	9.02	9.00	2.67	2.60

Clustered standard errors, by ID, are in parentheses. Each column uses both time and individual fixed effects. *,**, and *** are significance at 10%, 5%, and 1% levels.

Table 3 reports the pooled regression results with time and fixed effects included. For columns 1 and 2, the MDI is the dependent variable, while for columns 3 and 4 it is the HOME score. The first variable of interest, a dummy variable indicating if the parents read to the child nightly, yields a 1.74-point increase in the MDI, relative to not reading nightly, significant at the 1% level. A 1-point increase in the parent-child play scale leads to a 1.01-point increase in the MDI, also significant at the 1% level.

When adding control variables, the estimate for reading nightly falls to 1.61, significant at the 5% level. The parent-child play scale is consistent, with a 1-point increase resulting in a 1.04-point increase in the MDI, and is still significant at 1%.[3] With respect to the controls, parents that used mild discipline, as opposed to those who did not, increased their child's MDI by 1.71 points, significant at the 1% level. The mother's marital status to the biological father is positive, while the parental distress scale is unexpectedly positive, but they are not precisely estimated.

Moving to columns 3 and 4, in which the HOME score is the dependent variable, we can see that reading nightly to one's child increases the HOME score by 0.38 points, relative to not reading nightly, which is significant with 95% confidence. Increasing the parent-child play scale by one point increases the HOME score by 0.75 points, significant at the 1% level. As all controls are added to the pooled regression, the estimates of nightly reading and parent-child play fall barely to 0.37 and 0.74, respectively, implying that controls do not widely influence the estimates for the key variables of interest.[4] Using mild discipline yields a 0.31-point increase in HOME scores, relative to not using mild discipline, significant at the 10% level. When the mother is married to the biological father, relative to not being married to him, HOME scores increase by .50 points, statistically significant at the 10% level. The parental distress scale has a negative effect on the HOME score, but it is not significant.

[3] In model 2, the F-stat for the joint significance of nightly reading and parent-child play is 7.26, which is significant with 99% confidence. This allows us to reject the null hypothesis that both of the coefficients are equal to 0.

[4] For model 4, the F-stat for the key variables is 20.65, significant at the 1% level.

Table 4: Fixed Effects Regressions on MDI

	MDI			
	Control		Treated	
Variables	(1)	(2)	(3)	(4)
Reads to Child Nightly	1.31	1.08	1.96**	1.91**
	(0.90)	(0.89)	(0.87)	(0.88)
Parent-Child Play Scale	0.27	0.32	1.65***	1.63***
	(0.59)	(0.59)	(0.54)	(0.54)
Parents Used Mild Discipline		2.32***		1.14
		(0.70)		(0.79)
Mother Married to Biological Father		0.93		0.15
		(1.40)		(1.62)
Parental Distress Scale		0.07		-0.02
		(0.05)		(0.05)
Constant	97.10***	93.39***	90.63***	90.53***
	(2.66)	(3.29)	(2.50)	(2.98)
Observations	1170	1170	1318	1318
Within R-Squared	0.27	0.29	0.19	0.19
Overall R-Squared	0.19	0.20	0.22	0.23
RMSE	9.20	9.16	8.82	8.78

Clustered standard errors, by ID, are in parentheses. Each column uses both time and individual fixed effects. *,**, and *** are significance at 10%, 5%, and 1% levels.

Table 4 compares the control and treated EHS groups across two regressions: a baseline regression with the parameters of central interest and one using all of the controls. Columns 1 and 2 denote the estimates for the control group, while columns 3 and 4 denote the treated group estimates. The interpretation follows that if a variable has no significance for the control group, but has significance for the treated group, then EHS has a differential effect on the variable.

First, I will discuss the results for the control group. The parameters of interest in the model, reading nightly and the parent-child play scale, are expectedly positive but not significant, for the baseline.[5] Neither variable is significant for the control group when including all controls in column 2.

Next, for the control variables and their effect on the MDI for the control group, When the parents use mild discipline, compared to not, the MDI increases by 2.32 points, significantly different than zero with 99% confidence. The indicator for if the mother is married to the biological father yields a positive but insignificant effect on the MDI. The parental distress scale yields a positive effect, an unexpected one, but is not different than zero.

Moving to the treated group, in column 3 with no controls, reading to the child nightly yields a 1.96-point increase in the MDI, relative to not having a bedtime reading routine, significant at the 5% level. Increasing the parent-child play scale by 1 point results in a 1.65-point increase in the MDI, significant with 99% confidence. These coefficients differ dramatically from the control group coefficients in columns 1 and 2, almost doubling in size for the nightly reading coefficient and five-fold for the coefficient for parent-child play, while gaining statistical significance at the 5% and 1% levels, respectively. This implies that EHS greatly influences both of the effects on the MDI score. When controls are used, the coefficient for nightly reading decreases slightly to 1.91, with the same significance level. The parent-child play scale also decreases only slightly to 1.63, implying that both the parameters of interest are not very sensitive to controls.[6] The indicator for the parents' usage of mild discipline, mother's marriage to the

[5] For model 2, the F-stat for the key variables is 1.05, with a p value of 0.35, which means they are jointly equal to 0.

[6] In model 4, for nightly reading and parent-child play, the F test stat is 7.05, significant at the 1% level.

biological father, and the parental distress scale are all statistically insignificant, but have the expected signs.

Table 5: Fixed Effects Regressions on HOME Scores

	HOME			
	Control		Treated	
Variables	(1)	(2)	(3)	(4)
Reads to Child Nightly	0.16	0.13	0.56**	0.54**
	(0.28)	(0.28)	(0.23)	(0.23)
Parent-Child Play Scale	0.80***	0.81***	0.69***	0.68***
	(0.19)	(0.19)	(0.17)	(0.17)
Parents Used Mild Discipline		0.28		0.31*
		(0.21)		(0.19)
Mother Married to Biological Father		0.17		0.83**
		(0.39)		(0.34)
Parental Distress Scale		0.01		-0.04**
		(0.02)		(0.02)
Constant	22.58***	22.11***	22.92***	23.38***
	(0.84)	(0.99)	(0.77)	(0.91)
Observations	1232	1232	1378	1378
Within R-Squared	0.07	0.07	0.14	0.15
Overall R-Squared	0.11	0.13	0.18	0.21
RMSE	2.71	2.70	2.62	2.57

Clustered standard errors, by ID, are in parentheses. Each column uses both time and individual fixed effects. *,**, and *** are significance at 10%, 5%, and 1% levels.

Table 5 reports the estimates for the parents' HOME scores for the control and treated groups. With no controls, column 1 displays that reading nightly, while positive, has no effect for the control group on HOME scores. The parent-child play scale, however, yields a .80-point increase in the HOME score with a one-point increase for the control group, significantly different than zero at the 1% level. [7]

[7] For the key variables of interest, the F-test statistic in model 2 is 9.92, significant at the 1% level.

Neither coefficients for the key independent variables of interest change qualitatively for the control group when adding control variables. The parent-child play scale estimate rises slightly to 0.81 and the nightly reading variables slightly decreases to 0.13. Neither the indicator for mild discipline nor the mother's marriage to the biological father are significant, but both have the expected positive signs. The parental distress scale is positive (though we expect it to produce a negative effect), but insignificant.

As we look to the treated group in column 3, reading to the child nightly yields a 0.56-point increase in the HOME score, relative to not reading at night, significant with 95% confidence. When the parent-child play scale increases by one point, HOME scores increase by 0.69 points for the treated group, statistically different than zero at the 1% level. When using all controls, the coefficient for nightly reading slightly falls to 0.54 with the same significance level. The parent-child play scale estimate only slightly moves down to 0.68 when adding controls to the regression.[8]

We cannot infer a differential effect between increasing play frequency and HOME scores through EHS since the control and treated groups both have significant relationships at the 1% level and the estimate actually slightly shrinks for the treated group compared to the control. This means that EHS might not influence the positive relationship between play and HOME scores. However, we do see a differential effect of EHS on reading frequency since the coefficient for reading nightly is significant at the 5% level for the treated group and insignificant for the control group. The coefficient for nightly reading for the treated group is almost five times the estimate for the control group, which shows the strong effect of the EHS on HOME scores through nightly

[8] The F-test stat for nightly reading/parent-child play joint significance in model 4 is 11.38, significantly different than zero with 99% confidence.

parental reading.

For the treated group control variables, a family using mild discipline with their child increases their HOME score by 0.31 points compared to a family that does not utilize mild discipline, statistically significant at the 10% level. When the mother is married to the biological father, HOME scores increase by 0.83 points, statistically different than zero at the 5% level. Finally, increasing the parental distress scale for the treated group by 10 points decreases the HOME score by 0.40 points, significant with 95% confidence.

Robustness

Table 6: Robustness Check

	MDI		**HOME**	
	Control	Treated	Control	Treated
Variables	(1)	(2)	(3)	(4)
Read to Child Daily	0.88	1.63**	0.50**	0.76***
	(0.81)	(0.76)	(0.21)	(0.22)
Sustained Attention During Play	0.21	0.95*	-0.07	0.27**
	(0.37)	(0.38)	(0.12)	(0.10)
Parents Used Mild Discipline	2.42***	1.32*	0.27	0.37**
	(0.71)	(0.79)	(0.22)	(0.19)
Mother Married to Biological Father	0.92	0.14	0.11	0.76**
	(1.43)	(1.62)	(0.41)	(0.33)
Parental Distress Scale	0.06	-0.02	0.01	-0.03**
	(0.05)	(0.05)	(0.02)	(0.02)
Constant	93.50***	92.09***	26.07***	24.76***
	(2.55)	(2.52)	(0.74)	(0.69)
Observations	1170	1318	1232	1378
Within R-Squared	0.28	0.19	0.05	0.15
Overall R-Squared	0.21	0.23	0.06	0.19
RMSE	9.22	9.12	2.74	2.61

Clustered standard errors, by ID, are in parentheses. Each column uses both time and individual fixed effects. *,**, and *** are significance at 10%, 5%, and 1% levels.

Table 6 shows a robustness check for the previous results in Tables 4 and 5. To examine if my results are sensitive to the timing of reading, I employ the indicator for daily reading to the child. While the nightly reading variable establishes the positive effect of a bedtime reading routine, the daily reading indicator implies that the timing of reading to the child is not as specific. It is well-known that individuals retain information better reading material right before bedtime. The parent-child play scale is replaced by the index for sustained attention during play, which is a continuous variable that was recorded after watching videotape footage of the child's sustained attention while playing with a bag of toys with the parents. Specifically, this proxy reports the level of interest and engagement the child reveals while playing with the parents, capturing an entirely different effect than that of the parent-child play scale. It ranges from 2 to 7 for both groups and is influenced by the National Institute of Child Health and Human Development Study of Early Child Care. This score increases as the child shows more attention to the toys while playing with their parents.

I discuss and compare these results to the earlier baseline estimates in Table 4, first mentioning the MDI results in columns 1 and 2, before moving to the HOME score results in columns 3 and 4. Neither the daily reading indicator, nor the sustained attention index has a significant effect on the MDI for the control group, although both coefficients are positive. These results are consistent with the results in Table 4. All other control variables qualitatively and quantitatively little changes. For the treated group, reading daily to the child yields a 1.63-point increase in the MDI score, relative to not establishing a daily reading routine, significant and different than zero at the 5% level, which is qualitatively similar to the coefficient for reading nightly in Table 5. A 1-point increase in the sustained attention index leads to a 0.95-point increase in the MDI score, significant with 95% confidence. This effect is qualitatively the same as the parent-child play scale estimate. All other control variables are similar to those found in the baseline result in Table 4. From these, I confirm that the effect of EHS on the MDI scores is not sensitive to the proxies.

As usual, I discuss and compare control group results before moving to discussion of the treated group. Reading daily to the child produces a 0.50-point increase in the HOME score for the control group, which is significant at the 5% level. This coefficient is close to the same estimate for nightly reading in Table 5. The sustained attention during play index has a negative and insignificant effect on the HOME score, which is counter-intuitive. The earlier estimate for the parent-child play scale was positive and significant, so the estimates are different. This is likely due to the sustained attention during play index not being a perfect substitute for play frequency, but it is the best proxy for the parent-child play scale within the limitations of the data. All remaining controls are quantitatively consistent with the results from Table 5.

For the treated group, reading daily to the child yields a 0.76-point increase in the HOME score, significant at the 1% level. This effect is qualitatively similar to the earlier estimate of nightly reading from the baseline results in Table 6. Increasing the sustained attention index by 1 point increases the HOME score by 0.27 points, significant with 90% confidence. Compared to the coefficient for the parent-child play scale, our estimate here is qualitatively the same. Again, we can see the differential effects of EHS since the coefficients for sustained attention index and reading daily both have the expected sign and are significant for the treated group. Overall, for the coefficients of the control variables, little changes compared to the baseline result. It is apparent that EHS still positively influences HOME scores through reading and play between the parents and their child, despite altering the variable selection. The estimate for parental reading is still larger in size and magnitude than the estimate for play on HOME scores.

Finally, the indicator for reception of AFDC benefits is included in Tables A.3 and A.4 to control for poverty. In these tables, I matched observations for each group to confirm that my results are consistent and not sensitive to the loss of observations from the AFDC benefits. In addition to this, I confirm that my results are not sensitive to this inclusion of poverty.

Table A.3 displays the adjusted results for both groups, in which the MDI is the dependent variable. In column 1 for the control group, we can see that the nightly reading and parent-child play coefficients are statistically insignificant, but have the positive signs to match expectations from Table 4.

In column 2 when we control for poverty, nightly reading and parent-child play are quantitatively similar to Table 4. The remaining control variables for the control group are all quantitatively and qualitatively the same as Table 4. Lastly, the indicator for AFDC benefits yields the expected negative sign, but is imprecisely estimated.

For the treated group in Table A.3, reading nightly yields a 2.10-point increase in the MDI, significant with 95% confidence. A one-point increase in parent-child play produces a 1.54-point increase in the MDI, significant at the 10% level.

As we move to column 4 to control for AFDC benefits, both the nightly reading and parent-child play estimates are quantitatively congruent to the baseline in Table 4 and to the estimates in column 3. Also, the control variables all contain similar estimates to the baseline in Table 4. The indicator for AFDC benefits still has the expected negative effect for the treated group and is statistically insignificant.

Next, I will discuss the estimates from Table A.4, where the HOME score is the dependent variable. For the control group, we can see that nightly reading is positive, but not statistically different from zero, which matches the estimate in Table 6 in size and magnitude. For the parent-child play scale, a one-point increase produces a 0.79-point increase in the HOME score, significant at the 1% level. This estimate is the exact same as the coefficient for the control group in Table 5.

When poverty is accounted for, the estimates for nightly reading and parent-child play in column 2 match similarly to column 1. The rest of the controls in column 2 are quantitatively and qualitatively congruent to the estimates to Table 5. Again, the indicator for poverty is negative and imprecisely estimated.

Finally, we move to the third column of Table A.4 for the treated group results. Reading nightly yields a 0.50-point-increase in the HOME score, significant at the 5% level, which is qualitatively similar to the estimate in Table 6. A one-point increase in the parent-child play scale produces a 0.66-point increase in the HOME score, statistically different from zero with 99% confidence, matching closely in size and magnitude to the previous estimate. The remaining control variables from the treated group in Table A.4 match quantitatively with the controls in Table 5. The results in column 4 do not change quantitatively with the inclusion of the control for poverty. The AFDC benefits indicator yields the expected negative effect and is still insignificant. It is apparent that even when controlling for families on AFDC benefits, and thus public assistance, the estimates of our key independent variables are consistent.

Chapter IV

Conclusion

In this study, we examine the effects of beneficial parental strategies, derived from the EHS program, on child and parent outcomes. While the literature is clear that EHS causes positive outcomes, increasing reading, and influencing engagement in play, it was previously unclear if these parental strategies led to positive child and parenting outcomes. Using the EHS Research and Evaluation dataset from 1997 to 1999, we examine the differential effects of EHS on the MDI and HOME scores across 17 EHS centers in the US. In order to unveil the effects, I pool the sample to observe the overall estimates on MDI and HOME scores. Next, I separate the sample into control and treated groups, which reveals the differential effects by comparing the coefficients of the control to that of the treated group.

The pooled results display that both nightly reading and parent-child play yield significant and positive outcomes for both MDI and HOME scores. When separating the pooled data into the control and treated group, we find that both nightly reading and parent-child play greatly influence the MDI. Specifically, for the treated group nightly reading produces a 1.91-point increase in the MDI, while a one-point increase in the parent-child play scale increases the MDI by 1.63 points. The nightly reading indicator is more than twice as large for the treated group than the control group. For parent-child play scale, this estimate is more than four times larger for the treated rather than control group. The positive and significant coefficients for the treated group, relative to the control group, show the differential effects of EHS on MDI scores.

For the HOME scores, nightly reading produces a 0.54-point increase, which is almost five times as large as the estimate for the control group, while the parent-child play scale yields a 0.68-point increase given a one-point increase for the treated group.

Since parent-child play significantly increases HOME scores for both treated and control groups, we fail to find evidence showing that EHS has produced a differential effect on HOME scores through parent-child play.

These results have implications for federal policy to expand early child intervention programs across the US, emphasizing the need to increase nightly reading frequency between the parent and their toddler. Supportive parent-child play, such as showing sensitivity and encouraging cognitive stimulation during play, has a positive impact on child cognitive development so this should still be a major point of emphasis in the EHS program.

To confirm that my results are not sensitive to the choice of proxies for reading and parent-child play, I conduct a sensitivity analysis. I replace the nightly reading indicator with the daily reading indicator to show that, despite changing the time of day, reading still influences MDI and HOME scores. Also, I substitute the parent-child play scale with the sustained attention during play index to display the level of interest the child shows while engaging in parent-child play. This proxy controls for the endowment of sustained attention that the child displays during parent-child play interactions. Neither the coefficients for daily reading, nor the sustained attention proxy changed significantly compared to the baseline results. This confirms that, despite changing the proxies, daily reading frequency and sustained attention during play still positively influence the outcomes of interest. More specifically, reading frequency to the child maintains stronger estimates than parent-child play for both child and parent outcomes.

While my study expands upon the literature in the early child intervention field, it has three limitations. First, it is still unclear if the at-home EHS services, center-based

EHS services, or a combination of both is most effective in promoting reading frequency and parent-child play for families enrolled in EHS due to lack of data. A study uncovering this with detailed program-specific data could have strong implications for improving efficiency for EHS. Second, it is unclear if either parent is more effective at promoting learning during reading or play since data does not specify if the mother or father is more involved in reading or play. Finally, unavailable yearly income data in this sample limits the specific outlook of socioeconomic status on EHS. Previous literature is ambiguous if lower middle class households maintain the same gains as low-income families do. This is another future avenue that can be explored with more extensive data at the household level.

APPENDICES

Appendix A.1

Table A.1 Summary Statistics for MDI and HOME Scores at Waves 1 and 3

			MDI			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control	387	98.60	99	11.21	59	126
Treated	443	98.28	99	11.45	51	130
Wave 3	Obs	Mean	Median	SD	Min	Max
Control	387	90.45	91	12.63	49	125
Treated	443	91.73	92	12.77	49	134
			HOME			
Wave 1	Obs	Mean	Median	SD	Min	Max
Control	412	26.28	27	3.38	12	31
Treated	458	26.17	27	3.54	13	31
Wave 3	Obs	Mean	Median	SD	Min	Max
Control	412	27.32	27.50	4.77	10	37
Treated	458	27.90	28	4.66	10	36

Appendix A.2

Table A.2 Wave 2 Summary Statistics of Covariates

Read Nightly						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.27	0	0.45	0	1
Treated Group	443	0.31	0	0.46	0	1
Read Daily						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.55	1	0.5	0	1
Treated Group	443	0.6	1	0.49	0	1
Parent-Child Play Scale						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	4.52	4.56	0.77	2.11	6
Treated Group	443	4.54	4.56	0.77	2.22	6
Sustained Attention During Play						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	4.97	5	1.08	2	7
Treated Group	443	5.04	5	1	2	7
Parental Distress Scale						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	25.19	24	9.38	12	56
Treated Group	443	25.08	24	9.49	12	56
Parents Used Mild Discipline						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.43	0	0.5	0	1
Treated Group	443	0.48	0	0.5	0	1
Mother Married to Biological Father						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	387	0.41	0	0.49	0	1
Treated Group	443	0.38	0	0.49	0	1
Family Received AFDC/TANF During Survey						
Wave 2	Obs	Mean	Median	SD	Min	Max
Control Group	355	0.25	0	0.43	0	1
Treated Group	394	0.26	0	0.44	0	1

Appendix A.3

Table A.3 Fixed Effects Regressions with AFDC Benefits on the MDI

	MDI			
	Control		Treated	
Variables	(1)	(2)	(3)	(4)
Reads to Child Nightly	0.93	0.75	2.10**	2.02**
	(0.97)	(0.96)	(0.97)	(0.98)
Parent-Child Play Scale	0.21	0.19	1.54***	1.53***
	(0.64)	(0.63)	(0.59)	(0.59)
Parents Used Mild Discipline		2.49***		1.25
		(0.77)		(0.85)
Mother Married to Biological Father		1.96		0.45
		(1.49)		(1.76)
Parental Distress Scale		0.06		-0.04
		(0.06)		(0.05)
Received AFDC/TANF Benefits During Survey		-0.49		-0.42
		(1.35)		(1.28)
Constant	97.13***	93.46***	91.11***	91.49***
	(2.87)	(3.57)	(2.70)	(3.27)
Observations	1074	1074	1171	1171
Within R-Squared	0.26	0.27	0.20	0.20
Overall R-Squared	0.19	0.20	0.23	0.24
RMSE	9.31	9.25	8.91	8.86

Clustered standard errors, by ID, are in parentheses. Each column uses both time and individual fixed effects. *,**, and *** are significance at 10%, 5%, and 1% levels.

Appendix A.4

Table A.4 Fixed Effects Regressions with AFDC Benefits on HOME Score

	HOME			
	Control		Treated	
Variables	(1)	(2)	(3)	(4)
Reads to Child Nightly	0.08	0.06	0.50**	0.47**
	(0.30)	(0.29)	(0.25)	(0.25)
Parent-Child Play Scale	0.79***	0.80***	0.66***	0.65***
	(0.20)	(0.20)	(0.17)	(0.17)
Parents Used Mild Discipline		0.22		0.34*
		(0.23)		(0.20)
Mother Married to Biological Father		0.15		0.69*
		(0.45)		(0.37)
Parental Distress Scale		0.01		-0.03**
		(0.02)		(0.02)
Received AFDC/TANF Benefits During Survey		-0.45		-0.18
		(0.44)		(0.34)
Constant	22.58***	22.08***	23.05***	23.58***
	(0.88)	(1.06)	(0.78)	(0.97)
Observations	1136	1136	1231	1231
Within R-Squared	0.07	0.07	0.15	0.16
Overall R-Squared	0.11	0.13	0.16	0.21
RMSE	2.77	2.73	2.59	2.56

Clustered standard errors, by ID, are in parentheses. Each column uses both time and individual fixed effects. *,**, and *** are significance at 10%, 5%, and 1% levels.

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