Abstract Title Page
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Title: Understanding how participation in education changes mothers' parenting practices

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Abstract Body

Limit 4 pages single-spaced.

Background / Context:

Description of prior research and its intellectual context.

The well-established association between increases in maternal education and children's academic outcomes has led to research and policy interest in the potentially of programs to increase maternal education for improving educational outcomes for low-income children (Chase-Lansdale & Brooks-Gunn, 2014; Magnuson, 2007; Magnuson, Sexton, Davis-Kean, & Huston, 2009). However, little research has explored the processes by which increasing maternal education improves outcomes for children. Research suggests that mothers who have higher levels of education may interact with their children in ways that promote children's educational success. For instance, higher levels of maternal education are related to the quality of the home environment provided (Magnuson, 2007; Magnuson et al., 2009), more frequent involvement in children's schooling (Crosnoe & Kalil, 2010; Domina & Roksa, 2012), and to the selection of configurations of child care that are the most closely linked to children's school readiness (Augustine, Cavanagh, & Crosnoe, 2009).

These documented differences in parenting practices according to maternal education in conjunction with evidence of relationships between maternal education and children's cognitive outcomes, suggests that parenting is a central way that the benefits of maternal education are conferred to children. However, research exploring the association of maternal education with parenting practices is limited in two key ways. First, research has focused on the association of maternal education with a relatively narrow set of parenting practices, including maternal language use and the quality of the home environment. Maternal education likely shapes a wider range of parenting behaviors than is typically examined because education increases mothers' cognitive, language, and organizational skills, which can then be employed in interactions to promote their children's educational outcomes (Harding, Morris, & Hughes, in press; Mirowsky & Ross, 2003). Second, there is little causal evidence for the relationship between maternal education and parenting practices. Although correlational evidence suggests the importance of maternal education for parenting, a number of factors, including mothers' academic ability and their perceptions of the value of education, may contribute to mothers' decisions to complete additional schooling, and these could drive the observed associations between maternal education and parenting practices.

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

This research will explore whether low-income mothers' participation in education influences a constellation of different parenting practices that are related to young children's academic outcomes. Importantly, understanding whether maternal participation in education influences mothers' parenting practices can illuminate a pathway by which increases in maternal education may have long-lasting influence on children's academic outcomes.

Setting:

Description of the research location.

The data for this study came from the Head Start Impact Study (HSIS; U.S. Department of Health and Human Services, 2010), which was designed to be nationally representative of 3-

and 4-year olds attending Head Start programs in the United States. The HSIS collected data from children in 378 Head Start Centers in 22 states.

Population / Participants / Subjects:

Description of the participants in the study: who, how many, key features, or characteristics.

This analysis focuses on families in the 3-year old cohort of the HSIS. The 1953 families (80% of the 3-year old sample) who have information on the key predictor of interest - maternal participation in education in 2003 - are included in the analysis sample. Demographic characteristics of the sample are shown in Table 1.

Intervention / Program / Practice:

Description of the intervention, program, or practice, including details of administration and duration.

Children were randomly assigned to receive Head Start services or to a control group who did not have access to Head Start. Random assignment to Head Start was significantly associated with maternal participation in education in 2003 and this treatment effect is leveraged using quasi-experimental techniques to explore the associations between maternal participation in education in 2003 and parenting practices in 2004.

Research Design:

Description of the research design.

Random assignment occurred prior to the beginning of the 2002-2003 school year. Data collection began during the fall of the 2002-2003 school year and was then conducted annually in the spring until children's entry to first grade. Parent interview data from 2002, 2003, and 2004 is the primary data used for the current analyses.

Data Collection and Analysis:

Description of the methods for collecting and analyzing data.

Measures. Baseline variables in 2002 are used as controls in analyses (the full set of controls used are shown in Table 1). The primary predictor is mothers' participation in education in 2003. Self-reported parenting practices in 2004 are the primary outcomes. Preliminary outcomes include: the number of types of books in the home, the hours of TV watched per week, the number of learning materials parents use for activities, parents' beliefs about the importance of early learning, the frequency of participation in cultural activities (e.g. vising museums), and the frequency of parents' involvement in schooling.

Analytic plan. The aim of this analysis is to explore the parenting practices of mothers who engaged in education when they were assigned to Head Start, who would not have otherwise engaged in education, as this isolates the effect of experimentally induced participation in education. To identify the effects of maternal education, an appropriate comparison group needs to be identified. Comparing the parenting practices of mothers who participate in education to mothers who did not engage in education will likely inflate the effects of education on parenting practices because mothers who participate in education may be more educationally able and may value education more. Instead, we want to compare the parenting practices of mothers who were induced into education in the treatment group to those of mothers in the control group who would have participated in education if they were assigned to treatment. Importantly, because the treatment and control groups were randomized, we can assume that there are comparable mothers in the control group who would have engaged in education if they were assigned to treatment (Hill, Brooks-Gunn, & Waldfogel, 2003).

We use language from instrumental variables analysis to describe the different groups of mothers. "Compliers" are mothers who would not engage in education when assigned to control, but who would participate in education when assigned to Head Start, "always takers" are mothers who would participate in education regardless of whether or not they were randomly assigned to Head Start, "never takers" are mothers who would not engage in education regardless of whether or not they were randomly assigned to Head Start, and "defiers" are mothers who would not take up education when assigned to Head Start, but who would take up education when assigned to the control group (see Table 2 for a visual depiction of this).[1] There are compliers, always takers and never takers in both the treatment and control groups; to distinguish these groups participants are called "treatment always takers" or "control always takers".

To identify the compliers, we will use propensity scoring techniques to identify subgroups as described in the steps listed below. We build on previous applications of this approach because we try to identify multiple different subgroups, whereas prior applications typically identify a single subgroup (Kemple, Snipes, & Bloom, 2001; Peck, 2003, 2007). We attempt to identify the treatment always takers (the mothers who would have participated in education whether or not their child was assigned to Head Start) and the control compliers (mothers who did not participate in education in the control group but who would have if their child had been assigned to Head Start). Overall, the process should create matched groups that have similar values, on average, for each of the background variables included in the estimation.

Findings / Results:

Description of the main findings with specific details.

Preliminary analyses were conducted on the sample with no missing data on the covariates ($N = 1337$).

Twenty percent of mothers in the control condition versus twenty-six percent of mothers in the treatment condition participated in education in 2003 (please insert Table 3 here). The additional six percent of mothers who participate in education in the treatment condition are the treatment compliers who we aim to identify using propensity score techniques.

Step 1. A probit regression analysis was conducted to calculate the likelihood of participating in education for those in the control group using the following equation:

Probit $(Mi) = \beta_0 + \sum\beta_1 X_i + \varepsilon_i$, where X_i represents the pretreatment child, mother, and family characteristics that could influence mother i's likelihood of participating in education.

Step 2. The coefficients from this regression model and the values of participants' background characteristics were used to predict propensity scores for mothers in the Head Start treatment condition. Thus, all mothers have a score that predicts how likely they would be to participate in education if they were assigned to the control group. The mothers who had low predicted probabilities of participating in education infrequently participated in education, suggesting that the baseline characteristics used in the propensity score models have some predictive validity (please insert Figure 1 here).

Step 3. K-neighbor propensity score matching with replacement (Dehejia & Wahba, 1999) was used to identify a proportionally-sized comparison group for those who increased their education in the control group, from those who increased their education in the treatment group. Different model specifications were used to obtain the best balance in means and standard

[1] We will make the assumption that there are no defiers, which is necessary for identification. It is difficult to think of a likely situation where random assignment would cause defiance systematically, although there are plausible individual cases where this could occur.

deviations between these groups. The average standardized difference for the matched mothers improved from .05 to .04 and the average deviation in standard deviation ratios improved from .12 to .09. Treatment and control always takers were then excluded from analyses in order to isolate the compliers.

Step 4. To identify the control compliers the same process outlined in Steps 1-4 was used; however, now the likelihood of participating in education was modeled in the treatment group, rather than in the control group. That is, a probit regression analysis was conducted to calculate the probability of participating in education for those who were randomly assigned to Head Start.

Step 5. The coefficients from this regression model and the values of participants' background characteristics were used to predict propensity scores for mothers in the control condition. Thus, all mothers have a score that illustrates how likely they would be to participate in education if they were assigned to treatment. Again, mothers who had low predicted probabilities of participating in education participated in education infrequently (please insert Figure 2 here).

Step 6. Nearest neighbor matching was used to identify a sample of control group mothers similar to those who participated in education in the treatment group. The average standardized difference for the matched mothers improved from .07 to .06 and the average deviation in standard deviation ratios improved from .10 to .09. Covariate means and standard deviations for the always takers, compliers, and never takers suggest these groups are different from one another (please insert Table 4 here). The always takers were more advantaged than the never takers and compliers: they had much higher baseline education, the fathers of their children also had higher education, they were more likely to have been born in the USA, and they had higher maternal literacy scores. Interestingly, compliers were more disadvantaged than never takers in many ways: they were less likely to be married, less likely to speak English in the home, more likely to report at least one economic difficulty, had higher depression, and were younger. This suggests that access to Head Start encourages mothers who face a number of barriers to engage in education.

Step 7. Regression analyses comparing parenting practices in 2004 between the matched sample of control and treatment compliers were conducted using the following equation:

$Y_i = \beta_0 + \beta_1 Z_i + \sum \beta_2 X_i + \varepsilon_i$, where the parenting outcomes (Y_i) are a function of maternal education ($\beta_1 Z_i$), an intercept (β_0) and the confounding covariates used to estimate the propensity score ($\sum \beta_2 X_i$).

Preliminary results indicate that increases in maternal education were associated with significant increases in the number of books and learning materials in the home (please insert Table 5 here). There were also trend level associations between participation in maternal education and fewer hours of TV watched per week as well as with more strongly endorsing the importance of early learning. In the presentation the assumptions, strengths, and limitations of this method will be discussed and sensitivity analyses will be presented.

Conclusions:

Description of conclusions, recommendations, and limitations based on findings.

This research provides preliminary evidence that participation in maternal education is related to parenting practices, particularly the quality of children's learning environments. Results will be discussed with reference to how changing parenting practices can create and sustain gains for children's cognitive outcomes. Finally, the implications for promoting two-generation strategies as a means to improve outcomes for low-income children and families will also be discussed.

Appendices

Not included in page count.

Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures

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Table 1. Means, standard deviations, Ns, and Cronbach alpha coefficients for baseline covariates

	M	*SD*	*N*	*a*
Mother Characteristics				
Age (20-64)	31.51	6.06	1750	
Less than high school diploma (0,1)	0.34	0.47	1756	
High school diploma/ GED/ vocational training (0,1)	0.41	0.49	1756	
Some college or higher (0,1)	0.25	0.43	1756	
Married (0,1)	0.45	0.50	1757	
Works full time (0,1)	0.34	0.47	1740	
Works part time (0,1)	0.17	0.38	1740	
Does not work (0,1)	0.49	0.50	1740	
Teen mother (0,1)	0.15	0.36	1761	
Born in USA (0,1)	0.72	0.45	1758	
Sense of control (1-4)	3.16	0.49	1755	0.75
CES-D Depression (0-3)	0.49	0.52	1754	0.87
KFASTS literacy score (55-130)	85.17	15.68	1663	
Self-reported health (1-4)	2.74	1.01	1760	
Household Characteristics				
Father has less than a high school diploma (0,1)	0.38	0.49	1636	
Father has high school diploma/ GED (0,1)	0.42	0.49	1636	
Father has some college or more (0,1)	0.20	0.40	1636	
Father lives in household and works (0,1)	0.41	0.49	1720	
Father lives in household and does not work (0,1)	0.09	0.29	1720	
Father does not live in household (0,1)	0.50	0.50	1720	
Primary home language is English (0,1)	0.72	0.45	1935	
Number of children in household (1-6)	2.62	1.23	1756	
Number of adults in household (1-5)	2.04	0.92	1755	
Income to needs ratio (0-4.74)	0.84	0.54	1572	
Family receives TANF (0,1)	0.10	0.29	1746	
Family experienced economic difficulty (0,1)	0.36	0.48	1753	
Family reports inadequate housing (0,1)	0.11	0.31	1759	
Urban locality (0,1)	0.83	0.38	1953	
State 1 (0,1)	0.08	0.27	1953	

State 2 (0,1)	0.04	0.20	1953	
State 3 (0,1)	0.04	0.19	1953	
State 4 (0,1)	0.01	0.09	1953	
State 5 (0,1)	0.02	0.12	1953	
State 6 (0,1)	0.04	0.20	1953	
State 7 (0,1)	0.02	0.15	1953	
State 8 (0,1)	0.05	0.22	1953	
State 9 (0,1)	0.03	0.16	1953	
State 10 (0,1)	0.08	0.27	1953	
State 11 (0,1)	0.03	0.16	1953	
State 12 (0,1)	0.02	0.14	1953	
State 13 (0,1)	0.05	0.22	1953	
State 14 (0,1)	0.02	0.15	1953	
State 15 (0,1)	0.11	0.31	1953	
State 16 (0,1)	0.03	0.16	1953	
State 17 (0,1)	0.09	0.29	1953	
State 18 (0,1)	0.13	0.34	1953	
State 19 (0,1)	0.01	0.12	1953	
State 20 (0,1)	0.02	0.13	1953	
State 21 (0,1)	0.05	0.21	1953	
Child Characteristics				
Male (0,1)	0.49	0.50	1953	
Hispanic (0,1)	0.35	0.48	1943	
Black (0,1)	0.36	0.48	1943	
White (0,1)	0.29	0.46	1943	
Age in weeks (75-101)	84.24	3.96	1756	
Maternal reported health (1-4)	3.24	0.88	1760	
Baseline total behavioral problems (0-1.67)	0.51	0.30	1760	0.72
Baseline PPVT score (128.54-360.99)	231.67	36.57	1660	
Baseline WJ-III letter-word identification score (264-374)	293.88	22.35	1639	

Table 2. Visual representation of labels used to refer to groups.

		Would they have participated in education if they were assigned to control?		Would they have participated in education if they were assigned to treatment?	
		Yes	No	Yes	No
Did they participate in education when assigned to control?	Yes			(Control) always taker*	(Control) defier[+]
	No			(Control) complier	(Control) never taker
Did they participate in education when assigned to treatment?	Yes	(Treatment) always taker	(Treatment) complier		
	No	(Treatment) never taker*	(Treatment) defier[+]		

* these groups can be observed

[+] these groups are assumed to not exist

Table 3. Distribution of mothers' participation in education by treatment and control

	Control	Treatment	Total
Did not participate in education	392 (80.16%)	631 (74.41%)	1023 (76.51%)
Participated in education	97 (19.84%)	217 (25.59%)	314 (23.49%)
Total N	489 (100%)	848 (100%)	1337 (100%)

Table 4. Means and standard deviations for predicted subgroups from feasibility analyses

	Never takers		Always takers		Induced		Total	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Mother Characteristics								
Age (20-64)	31.89	6.21	30.28	5.61	30.60	5.08	31.51	6.06
Less than high school diploma (0,1)	0.37	0.48	0.18	0.39	0.36	0.48	0.34	0.47
High school diploma/ GED/ vocational training (0,1)	0.45	0.50	0.32	0.47	0.32	0.47	0.41	0.49
Some college or higher (0,1)	0.19	0.39	0.50	0.50	0.32	0.47	0.25	0.43
Married (0,1)	0.46	0.50	0.43	0.50	0.38	0.49	0.45	0.50
Works full time (0,1)	0.36	0.48	0.30	0.46	0.25	0.44	0.34	0.47
Works part time (0,1)	0.16	0.37	0.18	0.39	0.22	0.41	0.17	0.38
Does not work (0,1)	0.48	0.50	0.52	0.50	0.53	0.50	0.49	0.50
Teen mother (0,1)	0.14	0.34	0.22	0.41	0.18	0.38	0.15	0.36
Born in USA (0,1)	0.72	0.45	0.78	0.42	0.68	0.47	0.72	0.45
CES-D Depression (0-3)	5.83	6.23	5.59	6.10	6.39	6.95	5.84	6.28
KFASTS literacy score (55-130)	84.40	15.59	89.17	15.60	84.12	15.51	85.17	15.68
Self-reported health (1-4)	2.71	1.02	2.92	0.97	2.64	0.99	2.74	1.01
Household Characteristics								
Father has less than a high school diploma (0,1)	0.40	0.49	0.27	0.44	0.44	0.50	0.38	0.49
Father has high school diploma/ GED (0,1)	0.43	0.50	0.42	0.49	0.35	0.48	0.42	0.49
Father has some college or more (0,1)	0.18	0.38	0.31	0.46	0.21	0.41	0.20	0.40
Father lives in household and works (0,1)	0.43	0.49	0.36	0.48	0.39	0.49	0.41	0.49
Father lives in household and does not work (0,1)	0.09	0.29	0.11	0.31	0.06	0.24	0.09	0.29
Father does not live in household (0,1)	0.48	0.50	0.53	0.50	0.56	0.50	0.50	0.50
Primary home language is English (0,1)	0.72	0.45	0.79	0.41	0.69	0.46	0.72	0.45
Number of children in household (1-6)	2.69	1.24	2.38	1.20	2.48	1.10	2.62	1.23
Number of adults in household (1-5)	2.07	0.94	1.90	0.86	2.03	0.91	2.04	0.92
Income to needs ratio (0-4.74)	0.84	0.55	0.86	0.56	0.81	0.49	0.84	0.54
Family receives TANF (0,1)	0.08	0.28	0.13	0.34	0.14	0.35	0.10	0.29
Family experienced economic difficulty (0,1)	0.36	0.48	0.34	0.48	0.42	0.49	0.36	0.48

Urban locality (0,1)	0.82	0.39	0.87	0.34	0.85	0.36	0.83	0.38
State 1 (0,1)	0.08	0.27	0.10	0.30	0.06	0.23	0.08	0.27
State 2 (0,1)	0.04	0.21	0.03	0.18	0.04	0.19	0.04	0.20
State 3 (0,1)	0.04	0.19	0.04	0.19	0.02	0.15	0.04	0.19
State 4 (0,1)	0.01	0.09	0.00	0.06	0.03	0.16	0.01	0.09
State 5 (0,1)	0.01	0.12	0.01	0.08	0.04	0.19	0.02	0.12
State 6 (0,1)	0.04	0.20	0.06	0.24	0.02	0.15	0.04	0.20
State 7 (0,1)	0.02	0.15	0.04	0.19	0.03	0.16	0.02	0.15
State 8 (0,1)	0.05	0.22	0.04	0.19	0.07	0.25	0.05	0.22
State 9 (0,1)	0.03	0.16	0.03	0.18	0.02	0.15	0.03	0.16
State 10 (0,1)	0.08	0.27	0.07	0.26	0.07	0.25	0.08	0.27
State 11 (0,1)	0.03	0.16	0.04	0.19	0.02	0.13	0.03	0.16
State 12 (0,1)	0.02	0.13	0.02	0.15	0.03	0.16	0.02	0.14
State 13 (0,1)	0.05	0.22	0.04	0.20	0.09	0.28	0.05	0.22
State 14 (0,1)	0.02	0.13	0.04	0.20	0.02	0.15	0.02	0.15
State 15 (0,1)	0.11	0.31	0.10	0.30	0.12	0.33	0.11	0.31
State 16 (0,1)	0.02	0.15	0.04	0.19	0.04	0.19	0.03	0.16
State 17 (0,1)	0.10	0.30	0.05	0.23	0.09	0.28	0.09	0.29
State 18 (0,1)	0.14	0.34	0.13	0.34	0.13	0.33	0.13	0.34
State 19 (0,1)	0.01	0.11	0.03	0.16	0.01	0.07	0.01	0.12
State 20 (0,1)	0.02	0.12	0.02	0.14	0.01	0.10	0.02	0.13
State 21 (0,1)	0.05	0.23	0.03	0.17	0.03	0.16	0.05	0.21
Child Characteristics								
Male (0,1)	0.49	0.50	0.49	0.50	0.45	0.50	0.49	0.50
Hispanic (0,1)	0.35	0.48	0.32	0.47	0.38	0.49	0.35	0.48
Black (0,1)	0.35	0.48	0.41	0.49	0.37	0.48	0.36	0.48
White (0,1)	0.31	0.46	0.27	0.44	0.25	0.43	0.29	0.46
Age in weeks (75-101)	84.23	4.01	84.19	3.88	84.39	3.78	84.24	3.96
Maternal reported health (1-4)	3.24	0.88	3.28	0.88	3.13	0.90	3.24	0.88
Cognitive stimulating activities	1.01	0.44	1.04	0.43	1.03	0.43	1.02	0.44
Positive parenting style	2.32	0.32	2.33	0.28	2.33	0.32	2.32	0.31

Routines	0.57	0.50	0.63	0.48	0.64	0.48	0.59	0.49
Cultural activity participation	1.96	1.14	2.13	1.17	1.94	1.16	1.99	1.14
Exposure to print	0.64	0.22	0.72	0.19	0.66	0.22	0.66	0.22
Safety practices	0.31	0.46	0.32	0.47	0.28	0.45	0.31	0.46

N = 1337

Table 5. Preliminary regression coefficients of associations between participation in maternal education and parenting practices

Outcome	***b***	***se***	
Number of types of books in the home	0.12	0.04	*
Hours of TV watched per week	-0.66	0.35	+
Number of learning materials parents use for activities	0.69	0.21	**
Parents' beliefs about the importance of early learning	0.23	0.12	+
Frequency of participation in cultural activities	0.36	0.29	
Frequency of parents' involvement in schooling	-0.11	0.17	

$N = 109$

$^{+}p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 1. Percentage of control and treatment participants who participated in education, within propensity score deciles of the likelihood of participating in education.

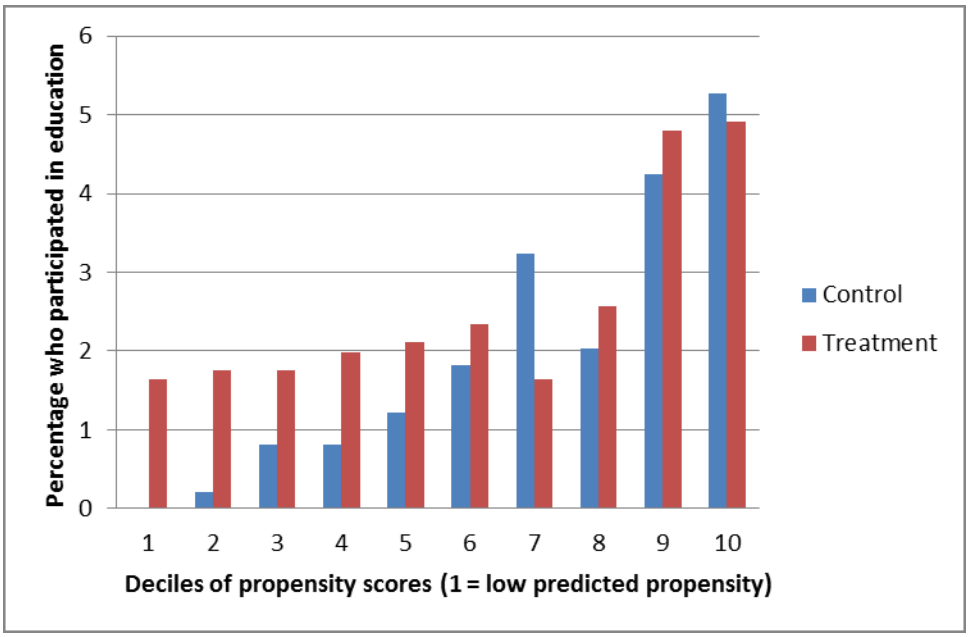

Figure 2. Percentage of treatment participants who participated in education, within propensity score deciles of the likelihood of participating in education.