When Should Low-Income Mothers with Young Children Return to School? Associations Between Mothers' Educational Attainment and Children's Early Academic, Socio-Emotional, and Health Outcomes

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There is no doubt that maternal education influences child development. Voluminous research links higher maternal education levels to enhanced child cognitive and achievement-related outcomes, most commonly on samples of children in elementary through high school (e.g., Augustine & Crosone, 2010; Choi et al., 2008; Davis-Kean, 2005; Dubow et al., 2009; Duncan & Brooks-Gunn, 1997; Harding, Morris, & Hughes; Pettit et al., 2009; Sirin, 2005). Mothers with higher education levels also tend to have children with more positive social-emotional functioning and behaviors (e.g., Briggs-Gowan et al., 2001; Dearing McCartney & Taylor, 2002; Duncan, Brooks-Gunn, & Klebanov; Nagin & Tremblay, 2001) and better overall health (Currie and Moretti, 2003; Chen, Martin, & Matthews, 2006; Spencer, 2005).

The well-documented positive links between maternal education and child developmental outcomes operate both directly and indirectly. Directly, mothers with higher levels of education tend to know more about how to stimulate and support child development with age appropriate materials and activities (e.g., Davis-Kean, 2005; Hoff et al., 2002; 2006; Rodrigues et al., 2009); more educated mothers also report less stress (e.g., Leadbeater, 1996; Way & Leadbeater, 1999; Chevalier and Feinstein, 2006), which supports more sensitive and responsive parent-child interactions (Guryan et al., 2008; Hoff-Ginsberg & Tardiff, 1995; Klebanov et al., 2004; Magnuson et al., 2009). At the same time, there are indirect benefits of increased maternal education for child development: mothers with higher levels of education tend to have better jobs, job satisfaction and earn higher wages (Felmlee, 1988; Jencks et al., 1979; Ma, Pender, & Welch, 2016; Murnane et al., 1995; Oreopoulous & Salvanes, 2009; Sewell et al., 1980; Yoshikawa, Aber, & Beardslee, 2012), which can channel money back into the household to purchase developmentally supportive goods and services (Yeung, Linver, & Brooks-Gunn, 2002) and relieve the financial stress associated with inadequate resources that can negatively impact parenting and family wellbeing (e.g., Johnson & Markowitz, 2018).

Yet while the positive impacts of mothers' education on children's developmental and health outcomes have been firmly established and the pathways through which they operate have been investigated with rigor, until now, most studies have focused on *levels* rather than *change* in maternal education: that is, the majority of studies examine associations between maternal education level at one single time-point, and children's outcomes. In fact, only four studies have explored associations between *changes* in maternal education from one time-point to another, and children's outcomes (Augustine & Prickett, 2018; Harding, 2016; Magnuson, 2007; Magnuson et al. 2009). Consistent with literature on static education level, these studies have also found that increases in maternal education over time predict better child cognitive outcomes. What remains unknown is whether changes in maternal education predict better child outcomes in other domains of development, specifically with regard to child health and social-emotional wellbeing alongside cognitive skills. Moreover, researchers increasingly agree that a child's first 5 years of life are among the most important developmental years, yet no studies have

investigated the associations between *when* mothers increase their education over this span and this full range of early childhood outcomes.

To fill these gaps in the literature, we draw on data from the nationally representative Early Childhood Longitudinal Study – Birth Cohort (ECLS-B); across multiple waves, the ECLS-B collected rich information on maternal education level, household demographic and economic characteristics, and direct and teacher-reported assessments of child cognitive, social, and health outcomes. To estimate unbiased associations between the timing of mothers' education increases on children's kindergarten outcomes, we rely on residualized change models that control for lagged versions of each outcome and a comprehensive vector of covariates corresponding to the start of three distinct education change periods: child age 9 months to 2 years, child age 2 years to 4 years, and child age 4 years to 5 years. All analyses are conducted on a low-income sample of mothers and children with non-missing mother education and child outcome data ($N \approx 3{,}150$).

Consistent with prior literature documenting positive associations between increased maternal education and children's cognitive and academic outcomes, we find that increases in mothers' education promote children's kindergarten language/literacy, and, at a trend level, math scores, but only when those increases occur in infancy and early toddlerhood. Ranging from .13 to .2 standard deviations, the magnitudes of these effects appear consistent with but on the upper bound of those estimated by others but over broader developmental spans (Harding, 2016; Magnuson et al., 2009). We also find that increases in mothers' educational attainment are positively associated with children's hyperactivity and conduct problems in kindergarten, mostly corroborating the only existing research to date (Harding, 2016); however, we also contribute the novel finding that these associations may be primarily driven by mothers' education change from child age 2 years to preschool (effect sizes range from .20 to .22 standard deviations). Lastly, results suggest that mothers' education increases are more generally associated with a decreased likelihood of kindergarten obesity and increased mother-rated overall health status, but developmental patterns of change by timing of educational attainment remain somewhat less clear.

We discuss all results in the context of empirical and theoretical literature across disciplines exploring how the timing of mothers' human capital investment might differentially affect children's outcomes both by outcome domain and the developmental period(s) during which the investment occurs. Future research should track longer-term relationships between increased maternal schooling in early childhood and children's lifecycle cognitive, social-emotional, and health outcomes to consider whether the observed associations persist, fade, or change over time.

Table 1
Descriptive Statistics by Timing of Education Change at 9 Months, 2 Years, and Preschool

	Full sample		No education increase		Increase from wave 1 → 2		Increase from wave 2 → 3		Increase from wave 3 → 4	
	M/%	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*
Mothers' education										
Highest attainment, 9 mos										
Less than HS	34.32		31.32		53.76		44.62		37.03	
HS/GED	37.74		38.62		33.04		30.65		37.34	
Some college/AA	23.69		25.47		12.96		20.16		20.64	
BA or above	4.26		4.58		0.24		4.57		4.99	
Highest attainment, 2 yrs										
Less than HS	31.70		31.88		7.48		43.01		32.99	
HS/GED	40.09		39.99		40.03		38.47		42.24	
Some college/AA	23.78		23.64		43.71		14.72		22.13	
BA or above	4.44		4.49		8.77		3.80		2.64	
Highest attainment, Preschool										
Less than HS	28.98		32.06		6.75		5.39		38.45	
HS/GED	37.32		37.82		30.51		30.08		39.30	
Some college/AA	27.78		25.25		52.81		49.32		17.21	
BA or above	5.92		4.88		9.93		15.20		5.03	
Enrolled in school, 9 mos	13.67		10.16		39.38		22.07		19.78	
Enrolled in school, 2 yrs	14.90		11.29		33.05		30.91		19.31	
Enrolled in school, Preschool	13.22		9.65		23.89		23.82		26.72	
Family characteristics, 9 mos										
Family size	4.13	0.03	4.16	0.04	3.91	0.13	4.15	0.08	3.98	0.10
No. children under 6	0.80	0.02	0.82	0.03	0.66	0.07	0.80	0.06	0.69	0.05
No. children over 6	0.68	0.03	0.68	0.03	0.67	0.07	0.66	0.07	0.64	0.07
Average household income[a]	24,849.74	380.64	24,982.70	429.74	26,516.64	1,484.16	24,975.88	980.30	22,733.87	644.48

	Full sample		No education increase		Increase from wave 1 → 2		Increase from wave 2 → 3		Increase from wave 3 → 4	
	M/%	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*
Received public benefits	90.12		88.48		95.83		95.65		94.75	
Food insecure	40.95		41.10		35.46		44.09		40.68	
Income-to-needs ratio	1.11	0.02	1.11	0.02	1.12	0.05	1.11	0.04	1.09	0.04
Maternal characteristics, 9 mos										
Depression indicator	17.08		16.83		16.54		20.42		15.15	
Race/Ethnicity										
White	39.08		40.12		33.00		43.00		33.94	
Black	20.85		19.96		24.29		21.08		22.16	
Hispanic	33.58		33.85		32.88		28.35		36.48	
Asian	6.49		6.07		9.83		7.56		7.42	
Single mother	31.09		29.13		39.41		36.01		36.94	
Immigrant born	28.32		28.45		29.96		19.92		32.69	
Mother over age 20 at birth	82.18		85.10		63.99		74.74		78.75	
Fluent in English	80.76		79.82		82.95		87.64		80.06	
Mother is employed	42.28		42.03		43.50		44.33		41.75	
Works irregular hours	64.52		64.92		53.77		67.53		70.20	
Mother has multiple jobs	6.65		7.44		2.78		4.05		4.93	
In vocational training	3.76		3.43		5.53		4.45		4.25	
Child-care use										
Parental care only, 9 mos	55.99		58.57		42.95		47.37		49.00	
Home-based care, 9 mos	37.73		35.54		48.85		44.58		45.28	
Center-based care, 9 mos	6.27		5.89		8.20		8.05		5.73	
Parental care only, 2 yrs	56.57		59.21		43.97		49.56		49.24	
Home-based care, 2 yrs	30.61		29.20		33.29		34.92		37.02	
Center-based care, 2 yrs	12.82		11.59		22.74		15.52		13.74	
Parental care only, Preschool	27.78		29.79		16.52		20.99		22.37	
Home-based care, Preschool	20.90		20.72		28.10		23.91		19.14	

	Full sample		No education increase		Increase from wave 1 → 2		Increase from wave 2 → 3		Increase from wave 3 → 4	
	M/%	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*
Center-based care, Preschool	51.32		49.48		55.38		55.10		58.49	
Child characteristics										
Child is male	50.90		49.79		54.02		54.72		53.44	
Child kindergarten age (mos.)	68.08	0.12	68.00	0.14	67.53	0.34	68.25	0.31	68.55	0.30
Child has special needs, 9 mos	10.17		10.40		11.28		10.50		8.34	
On-time kindergarten entry	74.20		74.64		84.49		73.58		67.80	
Kindergarten outcomes										
Math	40.37	0.34	40.32	0.40	40.41	0.86	40.35	0.81	40.62	0.68
Language/literacy	39.14	0.50	38.83	0.59	40.29	1.28	40.08	1.01	39.19	0.95
Approaches to learning	3.74	0.03	3.76	0.03	3.57	0.09	3.68	0.06	3.70	0.07
Conduct problems	7.30	0.08	7.16	0.11	8.20	0.32	8.12	0.32	7.29	0.25
Hyperactivity	11.16	0.14	10.98	0.16	12.24	0.38	12.03	0.42	11.43	0.37
Body Mass Index	17.12	0.08	17.19	0.11	16.87	0.25	17.13	0.21	16.94	0.18
Parent-reported child health	81.17		80.23		83.70		82.01		85.59	
Lagged outcomes										
9 months										
Bayley cognitive score	76.38	0.37	76.40	0.42	76.09	0.79	77.02	0.81	76.16	0.61
Bayley behavior score	3.66	0.03	3.66	0.03	3.62	0.07	3.78	0.05	3.65	0.05
BMI	18.00	0.10	17.92	0.09	18.28	0.27	18.17	0.27	18.18	0.26
Parent-reported health (very good or above)	85.57		86.15		87.06		82.40		84.52	
2 years										
Bayley cognitive score	124.79	0.30	124.86	0.29	125.26	0.86	124.92	0.73	123.87	0.90
Bayley behavior score	3.40	0.03	3.41	0.03	3.35	0.06	3.43	0.06	3.39	0.06
BMI	17.72	0.08	17.74	0.09	17.71	0.21	17.57	0.17	17.79	0.18
Parent-reported health (very good or above)	84.43		83.72		85.81		87.16		88.05	

	Full sample		No education increase		Increase from wave 1 → 2		Increase from wave 2 → 3		Increase from wave 3 → 4	
	M/%	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*	*M/%*	*SE*
Preschool										
Math	25.78	0.31	25.81	0.35	26.51	0.89	26.10	0.81	24.82	0.78
Language/Literacy	21.52	0.23	21.48	0.26	22.30	0.88	22.15	0.81	20.97	0.64
Approaches to learning	3.75	0.03	3.77	0.03	3.76	0.09	3.67	0.08	3.69	0.08
Hyperactivity	2.41	0.03	2.37	0.03	2.46	0.08	2.54	0.09	2.46	0.09
Conduct problems	2.05	0.03	1.99	0.03	2.10	0.07	2.34	0.08	2.13	0.10
BMI	16.95	0.09	16.99	0.11	16.83	0.29	16.88	0.19	16.86	0.16
Parent-reported health (very good or above)	81.68		81.92		78.04		83.02		77.91	

Note: Data are drawn from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) 9-month kindergarten restricted use data file. $N \approx 3{,}700$. Sample is limited to low-income families defined as families with income at or below 185% of the Federal Poverty Line (FPL) at the 9-month interview wave. Means are weighted using jackknife replicate weights WK1C1-90 for cognitive and health outcomes and WK45T1-90 for social-emotional outcomes. Dependent variables are standardized to ease interpretation. *Ns* are rounded to the nearest 50 per NCES data security requirements.

Table 2

Regression Models Predicting Standardized Math, Reading, Socio-Emotional, and Health Outcomes in Kindergarten from Timing of Education Change Across Early Childhood

	Math			Language/ Literacy			Approaches to learning			Hyperactivity			Conduct problems			Child BMI Overweight			Mother-rated child health		
	b	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*
Wave 1 --> 2	.13	.07	.07	.20	.08	.02	-.11	.12	.34	.16	.09	.07	.16	.10	.10	-.17	.09	.04	.08	.09	.37
N	3,050			3,050			2,300			2,250			2,300			3,000			3,150		
Wave 2 --> 3	.01	.09	.86	.12	.08	.12	-.09	.08	.24	.20	.08	.02	.22	.09	.02	-.01	.07	.95	-.03	.07	.64
N	2,850			2,850			2,350			2,250			2,300			2,700			3,100		
Wave 3 --> 4	.07	.07	.32	.03	.06	.64	-.06	.10	.59	.03	.10	.75	-.08	.09	.41	-.03	.05	.65	.20	.07	.00
N	2,800			2,800			1,450			1,400			1,450			3,000			3,100		

Note: Data are drawn from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) 9-month kindergarten restricted use data file. Sample is limited to low-income families defined as families with income at or below 185% of the Federal Poverty Line (FPL) at the 9-month interview wave. Means are weighted using jackknife replicate weights WK1C1-90 for cognitive and health outcomes and WK45T1-90 for social-emotional outcomes. Dependent variables are standardized to ease interpretation. *Ns* are rounded to the nearest 50 per NCES data security requirements.

Table 3

Regression Models Predicting Standardized Math, Reading, Socio-Emotional, and Health Outcomes in Kindergarten from Timing of Education Change, Controlling for All Other Periods of Education Change Across Early Childhood

	Math			Language/ Literacy			Approaches to learning			Hyperactivity			Conduct problems			Child BMI Overweight			Mother-rated child health		
	b	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*
Wave 1 --> 2	.13	.07	.08	.21	.09	.02	-.11	.12	.35	.18	.09	.06	.17	.10	.09	-.16	.08	.06	.07	.09	.46
Wave 2 --> 3	0	.08	.99	.09	.07	.24	-.06	.08	.45	.20	.08	.02	.26	.09	.01	-.01	.08	.87	.02	.07	.81
Wave 3 --> 4	.02	.08	.78	-.02	.08	.79	-.09	.09	.33	.06	.08	.02	-.04	.08	.64	-.05	.09	.56	.17	.07	.02
N	3,000			3,000			2,250			2,200			2,250			3,000			3,100		

Note: Data are drawn from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) 9-month kindergarten restricted use data file. Sample is limited to low-income families defined as families with income at or below 185% of the Federal Poverty Line (FPL) at the 9-month interview wave. Means are weighted using jackknife replicate weights WK1C1-90 for cognitive and health outcomes and WK45T1-90 for social-emotional outcomes. Dependent variables are standardized to ease interpretation. *Ns* are rounded to the nearest 50 per NCES data security requirements.