Introduction

Child health can dramatically influence life chances. Compared to normal-birth-weight (NBW) children, children who are born low birth weight (LBW) are more likely to drop out of school (Conley and Bennett 2000), have lower lifetime earnings (Case, Fertig, and Paxson 2005), have worse adult health (Blackwell, Hayward, and Crimmins 2001), and generally experience a lower quality of life across a variety of social, health, and economic measures (Palloni 2006). Although the long-term negative outcomes of poor child health are well documented, explanations for *how* poor child health is linked with social disadvantage remain elusive. In an effort to clarify the role child health disparities play in shaping social inequality this study investigates two mechanisms that may link infant health with later-life socioeconomic outcomes: cognitive development and parenting.

How does birth weight influence achievement? To the extent that child development has important consequences for adult achievement, one pathway through which birth weight affects long-term outcomes is through the development of skills, abilities, and health early in the life course. Indeed, scholars examining the relationship between birth weight and school readiness have identified birth weight disparities across a variety of developmental measures. For example, in a meta-analysis of case-control studies medical studies, (Bhutta et al. 2002) found a strong and persistent positive correlation between birth weight and cognitive skill and emotional stability by age 6. One provocative explanation for birth weight disparities in achievement is that parents tend to reinforce health disparities by investing more resources in healthier children than unhealthy children (Datar, Kilburn, and Loughran 2010). In other words, parents favor their healthiest children—reinforcing health disparities as a result. Following the Human Capital perspective which views children as economic investments (Becker and Tomes 1976), in order to maximize the aggregate well-being of their family parents may choose to reinforce the advantages of good child health by investing more resources and attention in their healthy children than their health-disadvantaged children. If parents are favoring healthier children, parenting could be an important mechanism linking LBW with short- and long-term achievement.

As cognitive development early in the life course has important implications for later achievement (Duncan et al. 2007), including adult educational and occupational success (Case, Lubotsky, and Paxson 2002; Entwisle, Alexander, and Olson 2005), a focus on the earliest mechanisms of birth weight disparities in cognitive development is needed. This study contributes to the literature on health disparities and social inequality by using a sample of 8,405 children from the *Early Childhood Longitudinal Study–Birth Cohort* (ECLS-B) to ask three questions. First, does parenting behavior vary across birth weight status? Second, to what extent does parenting explain birth weight disparities in math and reading skills? And third, are these effects consistent across the full distribution of math and reading ability?

Analytic Strategy

Our analysis takes place in four stages. First, we examine whether there is evidence of parenting differences across children's birth weight status. Next, we predict parenting behaviors by birth weight statuses at both bivariate and multivariate levels. Then, we model birth weight with and without covariates to establish whether any parenting factors mediate the relationship between birth weight and early cognitive skills. Finally, we use quantile regression to explore the relationship between birth weight status and early math across the distribution of math scores.

Data & Measures

To examine these research questions, we use data from the *Early Childhood Longitudinal Study – Birth Cohort* (ECLS-B). The ECLS-B is a nationally representative sample of children born in 2001. The ECLS-B gathers extensive data on parent, child, and home characteristics that enable researchers to examine factors influencing cognitive and non-cognitive differences at kindergarten entry. The ECLS-B data are ideal for this research primarily because they include a broad range of parenting assessments and have extensive child health measures. For the analyses, we use data from birth certificates as well as waves 1, 2, and 3. Wave 1 was collected between 2001 and 2002 when the children were approximately 9 months old, Wave 2 was collected between 2003 and 2004 when the children were approximately 24 months of age, and Wave 3 was collected in between 2005 and 2006 when the children were approximately 48 months of age or 4 years old.

We use math scale scores as measure of cognitive development at Wave 3. We examine six broad measures of parenting behaviors: *Parental Interaction.* Parents' may spend time intentionally interacting with and stimulating their children in order to help them develop cognitive skills. *Parental Investments.* Parental investments are a tangible measure of parental investment in child rearing. *Maternal Warmth.* We utilize three measures of a parent's emotional connection to their child. *Parenting Quality*. We use the composite "Parent Scale Score" compiled by NCES. It includes 50 "yes" "no" assessments of parenting in the home. *Cognitive Stimulation*. The measure for cognitive stimulation was not based on a test of the parent or child but a *task* that required parent and child interaction. *Breastfed 6 Months or More.* Breast-feeding has value as a measure of parental investment to the extent that compared to formula feeding, breastfeeding may be associated with improved cognitive development (Anderson, Johnstone, and Remley 1999). We examine three categories of birth weight status. NBW children are those who weigh 2,500 grams or more at birth, LBW children are those who weigh between 1,500 and 2,499 grams at birth, and VLBW children are those who weigh less than 1,500 grams at birth. We also include a number of sociodemographic control variables.

Preliminary results

Table 1 presents the math scores for LBW and VLBW children at four years of age. In the baseline model 1, the LBW gap in math is -2.62 ($p<.001$) and the VLBW gaps is nearly twice as large at -4.82. Models 2 and 3 show that about a third of the LBW and VLBW gaps in math are explained by family SES, race/ethnic status as well as observable background factors. The birth weight gaps remain, however, large and significant. As a point of comparison, the size of these gaps are comparable to a half and whole standard deviation decrease in socioeconomic status (not shown). Remarkably, introducing parenting measures individually or together has virtually no effect on birth weight gaps in early math skill. This, despite evidence that parenting seems to favor normal and low birth weight babies compared with very low birth weight babies (not shown), although cognitive stimulation is the only parenting measure that favors more normal birth weight children *and* is still a significant predictor of early math skill.

Discussion

Compared to normal-birth-weight children, children with LBW are developmentally delayed at the earliest stage of the life course. By age four, there are already large and persistent birth weight disparities in math ability. More than 30% of the baseline birth weight gap in cognitive development travels indirectly through observed family characteristics and unobserved heterogeneity between families. However, birth weight disparities remain suggesting that although much of the birth weight effect on learning is a product of the correlation between sociodemographic characteristics and birth weight, birth weight has a substantive causal effect on math ability prior to formal schooling that is independent of sociodemographic characteristics typically associated with cognitive development.

To be sure, the ways in which parents' parent has important consequences for child development, but parenting has at best a marginal effect on birth weight disparities in learning. For example, our results suggest that if VLBW children were, on average, to receive double the amount of parental investment that NBW children receive, this would do little to mediate birth weight disparities in math ability. Moreover, a standard deviation shift in parental socioeconomic status across birth weight status would reduce disparities in math scores substantially more than a standard deviation shift in parental investment. Counter to findings by Datar, Kilburn, and Loughran (2010), these results emphasize that variation in the level of parenting experienced across birth weight is not a primary mechanism connecting poor child health with the formation of disparities in educational ability.

Overall, this study finds that birth weight differences in parental investment are a product of between-family differences and are not a product of parents discriminately favoring healthier children over unhealthy children. In short, that the negative effect of low birth weight on cognitive development remains when controlling for parental investment suggests that there is more to the birth weight effect on learning than low-birth-weight children simply being born to families who favor healthier children.

References

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Table 1: OLS Modeling the Mediating Effect of Parental Investment on the Relationship between Low Birth Weight and Early Math Scores (N = 7,400). ECLS-B 2001.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Low Birth Weight	-2.62***	-1.85***	-1.35***	-1.40***	-1.33***	-1.35***	-1.34***	-1.34***	-1.33***	-1.37***
(ref=Normal Weight)	(0.32)	(0.26)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)
Very Low Birth Weight	-4.82***	-3.59***	-3.18***	-3.23***	-3.15***	-3.18***	-3.14***	-3.05***	-3.15***	-3.07***
(ref= Normal Weight)	(0.39)	(0.33)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Socioeconomic Status		4.00***	3.87***	3.64***	3.80***	3.86***	3.76***	3.52***	3.82***	3.30***
		(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)
Age of Assessment		0.82***	0.83***	0.83***	0.83***	0.83***	0.83***	0.82***	0.83***	0.82***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Parental Interaction				0.90***						0.75***
				(0.10)						(0.10)
Parental Investment					0.32**					0.05
					(0.10)					(0.10)
Maternal Warmth						0.06				-0.07
						(0.09)				(0.09)
Parenting Quality							0.39***			0.19 t
							(0.10)			(0.10)
Cognitive Stimulation								1.03***		0.88***
								(0.11)		(0.12)
Breastfeeding for 6 mths									0.60*	0.35
									(0.26)	(0.26)
Constant	30.47***	-12.96***	-15.11***	-15.45***	-15.30***	-15.12***	-15.22***	-14.78***	-15.17***	-15.22***
Background controls	no	no	yes	yes	yes	yes	yes	yes	yes	yes

$^{t}p < .10$ $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$ two-tailed tests.

Note: SEs are in parentheses. Background controls include child's gestation age, health, gender, twin status, number of siblings and their parent's marital status.