The Impact of Special Health Care Needs on Academic Achievement in Children Born Prematurely

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ABSTRACT

BACKGROUND: Preterm, low-birth-weight (LBW) children are at increased risk for poor academic achievement and special health care needs (SHCN) compared to term-born peers. It is not known how having SHCN during childhood modifies the relationship between LBW and achievement over time.

METHODS: We used data from the Infant Health and Development Program, a multisite randomized trial of an intervention for preterm, LBW infants with longitudinal follow-up. Primary outcome measures were Woodcock-Johnson Tests of Academic Achievement math and reading scores at age 8 and 18 years. Primary predictor was having a SHCN, defined by prescription medication and medical services use, receipt of special therapies, or any functional limitation. We used repeated measures multivariate analysis of covariance to test the effect of SHCN on achievement at 8 and 18 years and effect modification by IQ.

RESULTS: The 576 participants had a mean body weight of 1798.1 ± 455.0 g and a median gestational age of 33 weeks (range, 26–37 weeks). Mean achievement scores were as follows: math (age 8) 97.5 ± 21.6, math (age 18) 90.1 ± 18.3, reading (age 8) 99.0 ± 20.1, and reading (age 18) 96.8 ± 23.5. Mean full scale IQ at age 8 was 92.3 ± 18.2. Eighty percent had a SHCN. Mean achievement scores were significantly different between those with and without SHCN in both math and reading. There was no evidence of effect modification by IQ.

CONCLUSIONS: SHCNs are associated with poor academic achievement. Targeted interventions for improving performance outcomes by reducing the burden of chronic health problems may be accomplished through prevention strategies or efforts to limit the frequency and severity of symptoms.

KEYWORDS: academic achievement; children with special health care needs; chronic illness; low birth weight infant; prematurity

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WHAT'S NEW

Children born preterm are at risk for poor academic achievement compared to term peers. Having special health care needs increases this risk. Targeted interventions for symptom prevention or management may lead to improved neurocognitive outcomes in this vulnerable population.

INCREASED SURVIVAL HAS led to larger numbers of preterm (PT) infants reaching school age, adolescence, and beyond. Salient among these survivors are problems related to cognition, learning, and achievement. Assessments of global intelligence among adolescents with low birth weight (LBW) have yielded varying results, with some investigators finding a decrement in IQ from childhood to adolescence[1–3] and one author finding an increase in IQ over time.[4] However, most studies have in fact shown stability of IQ from early to late school age to adolescence.[5–7] These studies have revealed IQ to be associated with neonatal illness severity, brain injury, neurosensory impairment, and social risk. Learning disabilities and poor academic achievement have also been studied in this population. Although some studies demonstrated a plateau in disabilities in reading and math,[8,9] 2 groups have reported an increase in math-related disabilities in adolescence.[6,10] A recent study found that extremely LBW adolescents had significantly lower scores on tests of IQ, achievement, and executive function compared to term-born controls. They also had higher rates of math disability.[11]

In addition to these problems, children born PT with LBW have higher rates of chronic illness compared to term-born peers, particularly with respect to asthmalike respiratory diseases.[12] One study demonstrated persistence

of these higher rates of chronic illness into adolescence.[13] There is a robust literature outlining the increased risks for poor growth, hypertension, and impaired pulmonary function posed by LBW.[14,15]

The relationship between SHCN and school achievement has been explored in the past and has focused primarily on specific chronic conditions such as asthma, diabetes, and epilepsy. A meta-analysis revealed that children with diabetes suffer a disadvantage at school and have been shown to have cognitive and executive function problems.[16] Another meta-analysis of studies evaluating the relationship between asthma and achievement concluded that children with severe asthma diagnoses did have poorer academic achievement than healthier peers.[17] A study of school-age children in urban St Louis, Missouri, revealed significant differences on academic achievement testing in those with severe asthma compared to milder forms. However, there were no differences in standardized test scores between those with and without asthma. High rates of school absenteeism were associated with poor achievement regardless of health status.[18]

There is a high degree of variability in both physical health status and achievement outcomes among PT, LBW children, even among those with normal-average intelligence. The existing literature shows a clear link between LBW, PT birth, and risk for poor neurocognitive outcomes. Yet not all extremely PT and LBW infants have developmental delays. Factors such as parental education and income have been associated with better neurodevelopmental outcomes.[19,20] Intensive early educational intervention has been shown to improve cognitive and behavioral outcomes among LBW, PT children from more disadvantaged environments.[21]

We posit a potential explanatory mechanism for poor neurocognitive outcomes beyond what is explained by significant global cognitive and neurosensory impairment and social environment. Though the mechanism by which chronic health problems impart risk is currently not known, potential explanations include missed school days due to acute symptom flare-ups, comorbid learning and behavior problems, or altered cognitive processing abilities due to inflammation, hypoxemia, or other physiologic stressors. Global intelligence is correlated with, but is not perfectly predictive of, achievement. It has been proposed that having higher IQ provides greater cognitive flexibility in the face of stress and allows for higher achievement and academic performance. We therefore expected differential impact of special health care needs (SHCN) on achievement by those with high versus low full-scale IQ.[22]

We hypothesized that having a SHCN at school age modifies the relationship between LBW and poor academic achievement in school-age children and adolescence (Fig. 1). We further hypothesized that the impact of SHCN on achievement would be greater among those with below-average intelligence, for boys, and for children born at earlier gestation and lighter birth weight.

METHODS

POPULATION

Infants were eligible for the Infant Health and Development Program (IHDP) if they were born with a birth weight less than 2500 g and a gestational age of <36 completed weeks between January and October 1985 in 1 of 8 geographically diverse medical centers in the United States. There were 2 preplanned strata for the sample: one third of the sample was in a 2001 to 2499 g "heavier" group, and two thirds were in a 2000 g "lighter" group. One third of the total sample was randomized to an intensive 3-year educational intervention program, while two thirds were randomized to the comparison group. Details of the protocol have been published previously.[23]

ASSESSMENT AND OUTCOME

The assessment schedule has previously been described.[24] The outcomes of relevance to this study are as follows.

The primary outcome was Woodcock-Johnson—Revised broad reading and broad math subscales scores measured at ages 8 and 18 years. This test assesses specific academic skill domains and has a mean score of 100 and standard deviation of 15.[25] The primary predictor was having a SHCN at age 8. Items were selected from the parental interview to correspond to the Children With Special Health Care Needs (CSHCN) screener[26] domains with the following questions: 1) Does your child currently

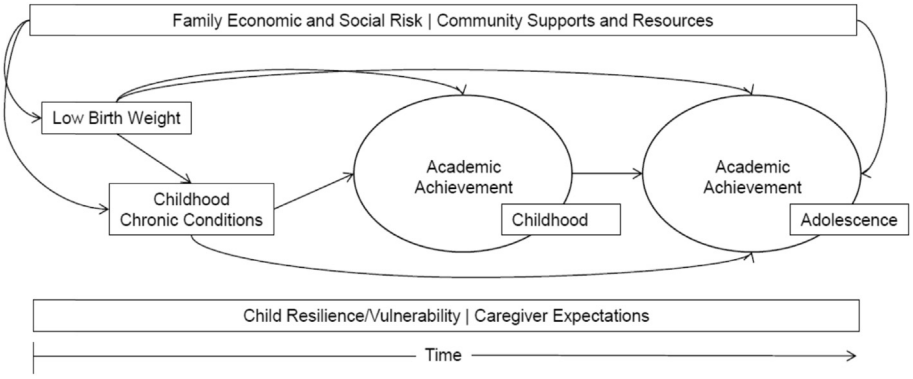

Figure 1. *Bioecological model of SHCNs and achievement for PT children with LBW.*