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Low Birth Weight Status Combined with Socioeconomic Factors Influences Future Diagnosis of Learning Disability

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Abstract

Objective: To determine if there is correlation between low birth weight and the development of learning disabilities in later stages of life.
Methods: Data from the National Child Health Survey from 2018-2020 was used with data from 59,963 U.S. households looking at children aged six to eleven years. A multiple linear regression model was used to assess the relationship between low birth weight (<2500g) and learning disabilities and developmental delays when controlling for ethnicity, family structure, and household income.
Results: The results indicate 7.2% of those surveyed reported a child with a diagnosed learning disability. In response to the low birth weight category, 8.2% of the children involved were in the category below 2500g.
Conclusion: Pediatric health practitioners should be aware of this relationship and use low birth weight status as a screening criterion for potential to develop learning disabilities.
Policy Implications: More screening programs should be implemented to ensure that children with low birth weight status are assessed for signs of learning disabilities.

Introduction

Low birth weight status and diagnosis of learning disability are critical issues impacting child health in the United States. As of 2020, approximately 300,000 (8%) of babies born in the United States annually are classified as having low birth weight[1]. Low birth weight (LBW) is a clinical determination of weight less than 2500g at birth[4]. This distinction has subcategories of very low birth weight (VLBW) and extremely low birth weight (ELBW), less than 150g and less than 1000g, respectively.

Attention Deficit Hyperactivity Disorder (ADHD) and associated learning disabilities affect almost 14% of American children between the ages of 3 and 17 years[2]. For this study, the definition of "learning disabilities" includes intellectual disability, developmental delay, learning disability, speech/language disorder, and diagnosed Attention Deficit Disorder (ADD), ADHD, Autism, Autism Spectrum Disorder (ASD), Asperger's Disorder, and Pervasive Development Disorder (PDD). These diagnoses are grouped together as learning disabilities based on the National Institute of Neurological Disorders and Stroke (NINDS) definition that includes disorders affecting language, mathematical, and movement skills[3].

Previous research has demonstrated that LBW infants face challenges including below-average intelligence, problems of inattention, and need for more school-based support[5,6,7,]. Studies have determined that low birth weight is neither a necessary nor a sufficient condition for learning disabilities, but that it may contribute to these outcomes, particularly when combined with preterm status[8, 9]. Studies show that poor post-natal growth played a role in predicting poor developmental outcomes, regardless of birth weight and small for gestational age (SGA) status[10]. Assessing the relationship between birth weight and later cognitive and behavioral outcomes has demonstrated that the severity, not only the presence or absence, of outcomes may be influenced[11].

A gap that remains is the social, cultural, and political factors that contribute to the later onset of these learning disabilities. Genetic and environmental factors should be studied more closely to determine which factors contribute most strongly. There may be factors that are discernible at a younger age (such as ASD symptoms) or later in life (e.g., learning difficulties), so long-term study follow-up is required for preschool children[11].

This research will determine if there is a greater prevalence of learning disabilities in LBW children, aged 6-11, when compared to normal birth weight children. Our research will investigate which socioeconomic and cultural factors contribute most strongly to this future diagnosis when paired with a history of LBW. In this regard, we will focus on family structure, poverty status, and race and ethnicity. Identifying early developmental markers linked to LBW and learning disabilities are crucial to ensure prompt therapeutic

attention. This research will aid in the timely detection of early risk factors critical to successful transition to the school environment and beyond.

Methods

Data were gathered from the National Child Health Survey (NCHS) from 2018-2019 and 2019-2020, via 360,000 mailed survey questionnaires to parents of children aged 6-11 years. Follow-up interviews were conducted with 59,963 households. In this cross-sectional study, we compare the responses in children weighing less than 2500g at birth, to children 6-11 years of age with normal birth weights (between 2500g and 4000g), nationally. The survey was conducted with one child from each household. Interviews were conducted in English or Spanish. Parents were asked whether their child had any of the following specific learning disabilities: intellectual disability, developmental delay, learning disability, speech/language disorder, and diagnosed ADD, ADHD, Autism, ASD, Asperger's Disorder, and PDD. If parents replied "yes" to any of the learning disabilities, children were assigned the "any developmental disability" outcome. A multiple linear regression analysis was performed using SPSS Version 26 to establish the relationship between low birth weight and presence of a learning disability while controlling for ethnicity (Hispanic, White non-Hispanic, Black non-Hispanic, Asian non-Hispanic, American Indian or Alaska Native non-Hispanic), household income (0-99% Federal Poverty Line, 100-199% Federal Poverty Line, 200-399% Federal Poverty Line, 400% Federal Poverty Line or greater), and family structure (two parents currently married, two parents not currently married, single parent, grandparent, other). Results were deemed statistically significant at the 0.05 alpha level. This study meets exemption criteria by the University of Vermont Committees on Human Subjects Research.

Results

A total of 72,210 responses included responses to the questions relevant to this analysis. Of this sample size, 7.2% of participants reported a child diagnosed with a learning disability (n=5,226; Table 1). The remaining 92.4% reported not having a child with a learning disability. Due to incomplete responses, 237 (0.3%) cases were excluded. Approximately 8.2% of children were classified as low birth weight status (n=5,897; Table 1). Another 87.9% of participants reported a child being born at 2500 grams or more and these children were classified as having normal birth weight (n=63,500). The remaining 3.9% of the sample population did not give a valid response (n=2,813). Most respondents identified racially as only white (77.4%; n=55,895). The remainder of respondents identified as Black or African American, Native American, Asian, Native Hawaiian or Pacific Islander, or two or more races.

Variables Frequencies

		Frequency	Percent
Learning Disability			
	Yes	5226	7.2
	No	66747	92.4
	No Valid Response	237	0.3
Low Birth Weight <2500g			
	Yes	5897	8.2
	No	63500	87.9
	No Valid Response	2813	3.9
Race			
	White alone	55895	77.4
	Black or African America alone	5268	7.3

	American Indian or Alaska Native alone	686	1.0
	Asian alone	3920	5.4
	Native Hawaiian and Other Pacific Islander alone	504	0.7
	Two or More Races	5937	8.2
Family Structure			
	Two parents, currently married	20423	69.4
	Two parents, not cur. married	1948	6.6
	Single parent	5213	17.7
	Grandparent household	937	3.2
	Other family type	285	1.0
Family Income			
	0-99% Federal poverty level	8644	12.0
	100-199% Federal poverty level	12087	16.7
	200-399% Federal poverty level	22336	30.9
	400% Federal poverty level	29143	40.4

Table 1. Frequencies of Learning Disability, Low Birth Weight, Race, Family Structure, and Family Income variables.

For every 1-gram increase in infant birth weight, development of a learning disability decreased by 1.3% 0.013, controlling for ADD/ADHD, autism/ASD, family structure, race/ethnicity, and poverty. This association was statistically significant with a p-value of 0.039 (95% CI [88.10, 88.65]). There is also a strong association between family poverty ratio and children with a learning disability diagnosis when controlling for birth weight, ADD/ADHD, Autism, family structure, and race (p= <0.001).

Multiple Linear Regression

	Unstandardized B	Coefficients Std. Error	Standardizes Coefficients Beta	t	sig.
1 (Constant)	27.885	0.882		31.606	<0.001
Birth Weight is Low	-0.013	0.006	-0.011	-2.065	0.039
ADD/ADHD Currently	0.263	0.005	0.311	57.991	0.000
Autism ASD Currently	0.380	0.008	0.251	46.941	0.000
Family Structure	0.015	0.009	0.009	1.648	0.099
Race/Ethnicity Categories	0.043	0.157	0.001	0.271	0.786
Family Poverty Ratio	0.010	0.001	0.051	9.687	<0.001

a. Dependent Variable: Learning Disability Currently

Table 2. Multiple linear regression comparing the relationship between learning disabilities and birth weight when controlling for ADD/ADHD, autism/ASD, family structure, race/ethnicity, and poverty.

Discussion

Our study found that LBW children who are aged six to eleven in the U.S. were significantly more likely ($p=0.039$) to develop learning disabilities.

This study collected data from a nationally representative sample of children aged six to eleven, so the results are generalizable to children throughout the United States. Secondly, the study includes a large sample with a high response rate. The study does, however, have limitations. Firstly, since parental reporting is the basis for both exposure and outcome, the data might not accurately reflect diagnoses. In addition, around 4% of the sample population did not have a valid response which could lead to more potential bias.

This study is consistent with the literature as most studies have shown that LBW increases the likelihood of developing learning disabilities. It has been shown, for instance, that children born with extremely low birth weight are more likely to develop learning disabilities caused by attention problems and emotional distress when they reach school age[9]. In another population-based study, LBW infants were more likely to have ADD, ADHD as well as a learning disability[12]. The sample population in this study consisted of children from the 2002 National Health survey categorized by family income and structure.

Currently, there are limited population-level strategies for preventing LBW making anticipatory planning for neurodevelopmental services essential. This study can assist with developing new preventative and monitoring measures as well as promote collaboration among the various caregivers.

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