Early Human Development 115 (2017) 82–87

Contents lists available at ScienceDirect

Early Human Development

journal homepage: www.elsevier.com/locate/earlhumdev

Special health care needs explains the effect of extremely low birth weight on math but not language achievement

Jonathan S. Litt[a,b,*], Nori Minich[c], H. Gerry Taylor[c,d], Maureen Hack[c,d]

[a] Department of Neonatology, Beth Israel Deaconess Medical Center, Boston, MA, United States
[b] Department of Pediatrics, Harvard Medical School, Boston, MA, United States
[c] Department of Pediatrics, Case Western Reserve University School of Medicine, Cleveland, OH, United States
[d] Rainbow Babies & Children's Hospital, University Hospitals Cleveland Medical Center, Cleveland, OH, United States

ARTICLE INFO

Keywords:
Extremely low birth weight infant
Special health care need
Academic achievement

ABSTRACT

Objectives: Extremely low birth weight (ELBW; < 1 kg) adolescents are at risk for special health care needs (SHCN) and poor math achievement compared to normal birth weight (NBW) peers. SHCN are associated with poor academic achievement among NBW children. We hypothesize that SHCN explain the effect of ELBW on math achievement.

Methods: We compared age 14 Woodcock-Johnson Calculation standard scores between 181 ELBW infants and 115 NBW controls. Persistent SHCN included: 1) prescription medication or equipment use, 2) subspecialty or therapeutic service use, or 3) hospitalization. We used nonlinear marginal effects models to decompose the total effect of ELBW on math into the following 4 components: the effect of ELBW controlling for SHCN, the effect of SHCN controlling for ELBW, effect modification by SHCN, and mediated interaction where SHCN is both causal mediator and effect modifier. Models were adjusted for sociodemographic factors.

Results: ELBW adolescents had lower mean math scores than NBW peers (81.3 vs. 96.4). SHCN were more common among ELBW adolescents (54.1% vs. 27%). The total effect of ELBW on math scores was − 15.7 points (95% CI − 21.0, − 10.5). The effect of birth weight alone was − 7.6 points (95% CI − 13.7, − 1.4); the effect of SHCN alone was negligible. SHCN interaction and mediated interaction effects each accounted for 25% of the total effect.

Conclusions: Birth weight alone explains only half of the effect of ELBW on math achievement. We found evidence of effect modification and mediation by SHCN. Understanding these explanatory pathways may lead to targeted interventions for improved outcomes.

1. Introduction

Adolescents born at extremely low birth weight (ELBW, < 1000 g) have poor academic achievement compared to term born normal birth weight (NBW) children [1–6]. Data also indicate significantly worse functional outcomes for ELBW survivors related to higher rates of chronic respiratory disease and neurosensory impairment [4,7]. Our group recently reported the persistence of high rates of special health care needs (SHCN) into adolescence, with 74% having an identified chronic condition at 14 years [8]. In fact, the odds of having a SHCN at age 14 was 2.8 (95% CI = 1.7, 4.6) among ELBW adolescents compared to NBW peers.

The relationship between SHCN and school achievement has focused primarily on asthma, diabetes, and epilepsy and found a negative impact of chronic illness on achievement [9]. A meta-analysis revealed that children with diabetes suffer a disadvantage at school and have cognitive and executive function problems [10]. Another meta-analysis revealed that children with severe asthma diagnoses had poorer academic achievement than healthier peers [11]. One recent study of school-age children in urban St. Louis revealed significant differences on academic achievement testing in those with severe asthma compared to milder forms [12].

Noting that ELBW adolescents are at increased risk for both poor academic achievement and SHCN related to chronic illnesses, one might hypothesize that SHCN play a causal role in poor achievement in this population. A recent study tested this relationship in a cohort of infants born < 2500 g. Those with SHCN at 8 years of age had significantly lower scores on academic achievement at age 18 compared to those without a SHCN [13]. As all study participants had low birth weight, it was not possible to examine interactional effects of birth

* Corresponding author at: Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Rose 318, Boston, MA 02115, United States.
E-mail address: jonathan.litt@bidmc.harvard.edu (J.S. Litt).

http://dx.doi.org/10.1016/j.earlhumdev.2017.09.019
Received 31 May 2017; Received in revised form 2 August 2017; Accepted 26 September 2017
0378-3782/ © 2017 Published by Elsevier Ireland Ltd.

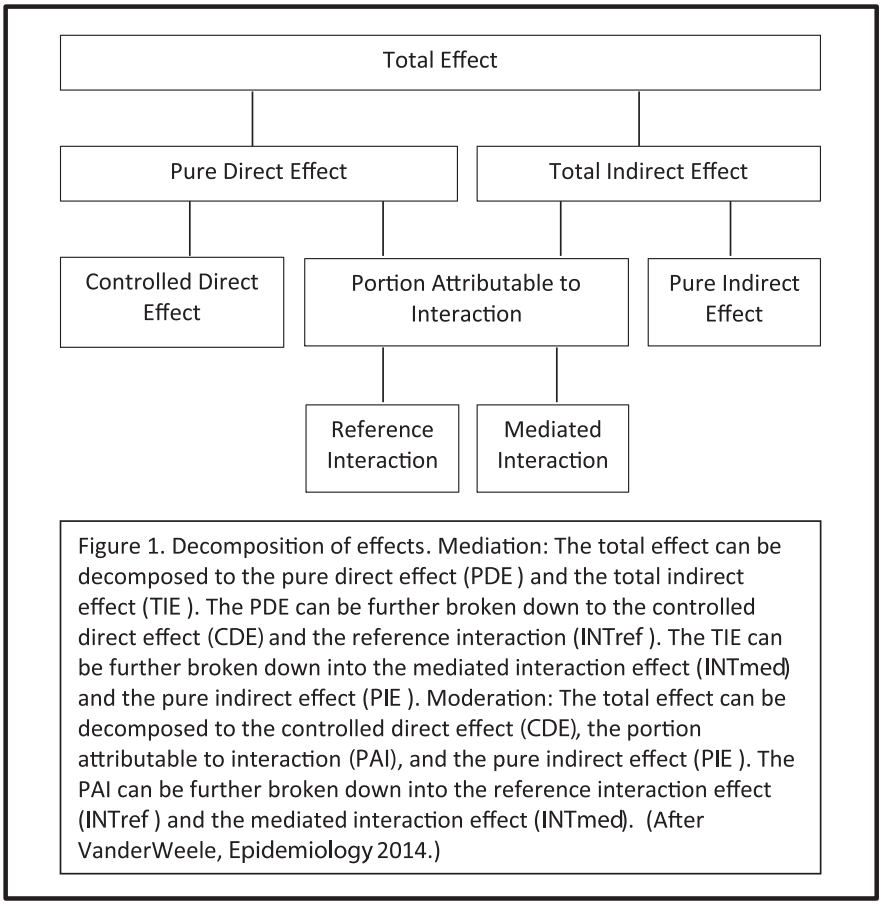

Figure 1. Decomposition of effects. Mediation: The total effect can be decomposed to the pure direct effect (PDE) and the total indirect effect (TIE). The PDE can be further broken down to the controlled direct effect (CDE) and the reference interaction (INTref). The TIE can be further broken down into the mediated interaction effect (INTmed) and the pure indirect effect (PIE). Moderation: The total effect can be decomposed to the controlled direct effect (CDE), the portion attributable to interaction (PAI), and the pure indirect effect (PIE). The PAI can be further broken down into the reference interaction effect (INTref) and the mediated interaction effect (INTmed). (After VanderWeele, Epidemiology 2014.)

Fig. 1. Decomposition of effects. Mediation: the total effect can be decomposed to the pure direct effect (PDE) and the total indirect effect (TIE). The PDE can be further broken down to the controlled direct effect (CDE) and the reference interaction (INTref). The TIE can be further broken down into the mediated interaction effect (INTmed) and the pure indirect effect (PIE). Moderation: The total effect can be decomposed to the controlled direct effect (CDE), the portion attributable to interaction (PAI), and the pure indirect effect (PIE). The PAI can be further broken down into the reference interaction effect (INTref) and the mediated interaction effect (INTmed). (After VanderWeele, Epidemiology, 2014)

weight and SHCN on achievement.

We aim to further understand the role of SHCN in explaining higher rates of academic underachievement among adolescents with ELBW. We hypothesize that having a SHCN modifies the relationship between low birth weight and poor achievement. Being agnostic as to the causal relationships under study, we tested the possibility that SHCN acts as a mediator, an effect modifier, or a mediated modifier of achievement among adolescents with ELBW.

2. Methods

2.1. Sample

Participants included the 238 survivors of 344 children born < 1 kg admitted to the Neonatal Intensive Care Unit (NICU) at Rainbow Babies and Children's Hospital, Cleveland, Ohio from 1992 through 1995. A NBW comparison group of 176 children born at term gestation (> 36 weeks by parent report) was recruited at 8 years from the same school as the ELBW child and of the same sex, race, and age within 3 months.

Two hundred and nineteen children (92%) were followed to age 8 years, 181 (83%) were followed to 14 years (overall retention rate 76%). Children participating in 14-year follow up did not differ significantly from those who did not participate in maternal socio-demographic factors, sex, or IQ. One hundred fifteen (63.5%) of the original 176 normal birth weight children recruited at age 8 were seen at age 14 years. They did not differ from the 61 children not followed in maternal socio-demographic factors, sex, or IQ.

2.2. Data sources

Birth and demographic data were collected at NICU discharge. Data collected at 8 and 14 years included information on health status, mood and behavior, intelligence and achievement, school performance, and family stress. Psychometric testing included the Woodcock-Johnson Tests of Achievement – Revised (WJ – R) [14] and the Wechsler Abbreviated Scales of Intelligence (WASI) [15,16]. Parents completed the Questionnaire for Identifying Children with Chronic Conditions – Revised (QuICCC-R) [17,18].

2.3. Variables

The primary outcome variables were Woodcock-Johnson Tests of Achievement – Revised standard scores for Letter/Word and Calculation subtests (mean 100, standard deviation 15) [16]. The Letter/Word subtest is an oral test of reading skills in which the respondent reads words aloud from an increasingly difficult vocabulary list. The Calculation subtest requires the respondent to perform increasingly difficult mathematical calculations. The primary predictor was birth weight group. The intermediary variable was the presence of a SHCN, defined by an affirmative answer to any of the following 6 items on the QuICCC: Does your child: take prescription medication, go to a medical specialist regularly, go to a counselor, psychiatrist, psychologist, or social worker regularly, receive services such as physical, occupational, speech or language, or orientation therapy regularly, use special medical or adaptive equipment, or has you child been hospitalized? We created two indicators of SHCN, one for those with a SHCN at 8 years of age and another for “persistent” SHCN at both 8 and 14 years of age. Covariates included child sex and markers of socioeconomic status, including maternal age, race, education, employment and

Download English Version:

https://daneshyari.com/en/article/5694459

Download Persian Version:

https://daneshyari.com/article/5694459

Daneshyari.com