Journal of Affective Disorders 190 (2016) 294–299

Contents lists available at ScienceDirect

Journal of Affective Disorders

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

Research report

Childhood motor coordination and adult psychopathology in extremely low birth weight survivors

Kristie L. Poole [a,*], Louis A. Schmidt [b], Cheryl Missiuna [c], Saroj Saigal [d], Michael H. Boyle [e], Ryan J. Van Lieshout [e]

[a] Department of Clinical Epidemiology and Biostatistics, McMaster University, Canada
[b] Department of Psychology, Neuroscience, & Behaviour, McMaster University, Canada
[c] School of Rehabilitation Sciences, McMaster University, Canada
[d] Department of Pediatrics, McMaster University, Canada
[e] Department of Psychiatry and Behavioural Neurosciences, McMaster University, Canada

ARTICLE INFO

Article history:
Received 15 September 2015
Received in revised form
15 October 2015
Accepted 16 October 2015
Available online 28 October 2015

Keywords:
Depression
Anxiety
Epidemiology
Motor coordination
Risk factors
Low birth weight

ABSTRACT

Objective: To determine if childhood motor coordination is associated with lifetime major depressive disorder (MDD), current generalized anxiety disorder (GAD), and attention-deficit/hyperactivity disorder (ADHD) in adulthood, and to examine if extremely low birth weight (ELBW; <1000 g) status moderates the strength of these associations.

Method: Prospective study of a cohort of normal birth weight (NBW) controls and ELBW survivors. Participants completed the short form Bruininks-Oseretsky Test of Motor Proficiency (BOTMP-SF) at age 8. At age 29–36, participants completed the Mini International Neuropsychiatric Interview to diagnose the psychiatric disorders of interest.

Results: Birth weight status significantly influenced the strength and direction of associations between childhood motor coordination and adult psychiatric outcomes such that the odds of MDD ($P_{interaction}=.02$) and GAD ($P_{interaction}=.01$) increased with worsening motor scores in NBW adults but not ELBW survivors. Stratified analyses indicated that in NBW adults, for each one-point decrease in BOTMP-SF score, the odds of lifetime MDD increased by 10% (OR=1.10, 95% CI: 1.01–1.20).

Limitations: Participant attrition reduced sample size and that may have limited our ability to detect statistically significant results for some of our analyses.

Conclusion: Poorer motor coordination in early life has a negative long-term impact on the development of MDD and GAD of individuals born at NBW. The long-term mental health risks of childhood motor coordination problems are significant and highlight the importance of recognizing motor deficits in all children, so that associated psychological difficulties can be identified and treated at an early age.

1. Introduction

Poor motor coordination affects up to 6% of children (American Psychiatric Association, 2000) and is marked by challenges with the functioning of body parts that involve fine and/or gross motor movements, balance and motor planning. These children have difficulty learning new motor tasks and completing them accurately within a specified time frame. Motor difficulties interfere with a child's ability to perform daily tasks both at home and in school environments, including the completion of self-care regimens, participating in playground activities and developing friendships with peers (Kirby et al., 2010). While the etiology of poor motor coordination is not completely understood, individuals born prematurely are at 6–8 times the risk of motor difficulties relative to their normal birth weight (NBW; >2500 g) counterparts (Edwards et al., 2011).

In addition to the functional limitations manifested by children with poor motor coordination, they are also at increased risk for experiencing mental health problems. Children with poor motor coordination often display comorbid attention-deficit/hyperactivity disorder (ADHD), as well as elevated rates of depression

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; BOTMP-SF, short-form Bruininks-Oseretsky Test of Motor Proficiency; CI, confidence interval; DCD, developmental coordination disorder; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; ELBW, extremely low birth weight; GAD, generalized anxiety disorder; IQ, intellectual quotient; MDD, major depressive disorder; MINI, Mini International Neuropsychiatric Interview; NBW, normal birth weight; NSI, neurosensory impairment; OR, odds ratio; SD, standard deviation; SES, socioeconomic status

* Correspondence to: Department of Clinical Epidemiology and Biostatistics, McMaster University, 1280 Main Street West, Hamilton, Ontario, L8S 4K1, CANADA.
E-mail address: poolekl@mcmaster.ca (K.L. Poole).

http://dx.doi.org/10.1016/j.jad.2015.10.031
0165-0327/

and anxiety (Cairney et al., 2010; Missiuna et al., 2014; Pratt and Hill, 2011). The mechanisms by which motor coordination problems are linked to mental illness is not fully understood; however, poorly coordinated children tend to have low frustration tolerance and experience feelings of inadequacy during their failed attempts to complete basic motor tasks (Campbell et al., 2012). Further, given the visible nature of motor coordination, children with motor problems tend to experience more rejection and victimization from their peers, and have a tendency to be more socially withdrawn and manifest poorer social skills than their typically developing age mates (Cairney et al., 2010; Campbell et al., 2012; Skinner and Piek, 2001). Poorly coordinated children experience feelings of failure and are subjected to criticism, which may ultimately result in lowered self-esteem and an increased risk of mental health difficulties by late childhood and adolescence (Piek et al., 2000). However, our understanding of the association between early motor coordination and mental health is limited by a number of shortcomings.

Most studies have utilized cross-sectional designs and so the long-term mental health of these children is not clear. The relatively few longitudinal studies that do exist suggest that youth identified with motor coordination difficulties are at increased risk for symptoms of depression and anxiety in late childhood (Lingam et al., 2012; Piek et al., 2010; Shaffer et al., 1985) and adolescence (Hellgren et al., 1994; Losse et al., 1991). However, prospective studies are scarce, of short duration, and primarily utilize self-report questionnaires. Therefore, it remains unclear whether these mental health problems persist into adulthood, and if they manifest as clinically significant psychiatric disorders. Finally, existing studies have exclusively utilized samples of individuals born at NBW, and therefore it is unclear if being exposed to additional, significant early life adversities amplifies the risk of mental health problems in those with poorer motor coordination. Since those born at extremely low birth weight (ELBW; <1000 g) are exposed to significant perinatal adversity and are more susceptible to both mental disorders (Boyle et al., 2011; Van Lieshout et al., 2015) and poorer motor coordination (Dewey et al., 2011; Poole et al., 2015; Williams et al., 2010), ELBW survivors with poor motor coordination may be at even greater risk for mental illness than comparable NBW controls.

We wished to extend prior research by utilizing one of the oldest known, prospectively followed cohorts of ELBW survivors and NBW controls in the world, objective assessments of motor coordination at age 8, and structured psychiatric interviews in the early to mid-thirties to: (1) determine if childhood motor coordination is associated with psychopathology in ELBW survivors and NBW controls in adulthood, and (2) examine if birth weight status moderates the strength of the association between childhood motor coordination and adult psychopathology. Based on previous research (Cairney et al., 2010; Missiuna et al., 2014; Pratt and Hill, 2011), we predicted that poorer motor coordination would be associated with increased levels of major depressive disorder (MDD), generalized anxiety disorder (GAD) and ADHD in adulthood, and that the risk of these problems would be amplified by ELBW status.

2. Method

2.1. Population

2.1.1. ELBW Cohort

ELBW participants were recruited at birth and comprised 397 infants born <1000 g between 1977 and 1982 to residents of central-west Ontario. Of these, 179/397 (45%) survived to hospital discharge and 10 children subsequently died, leaving 169 survivors at age 8. Of these, 139/169 (82%) completed motor assessments at the 8-year-old visit. Assessments have also been conducted at age 14, 22–26, and 29–36 years. At age 29–36, 84 of the original ELBW survivors participated in our structured psychiatric assessment, the Mini International Neuropsychiatric Interview (MINI).

2.1.2. NBW controls

Participants in our NBW group were recruited when they and the ELBW survivors were 8 years old. These 145 children were selected from a random sample of students in the Hamilton Public School System who were born at term and matched with the ELBW participants on age, race, gender, and family socioeconomic status (SES) at age 8 (Saigal et al., 1991). They have been assessed at the same ages as the ELBW cohort. At age 29–36, 90 NBW controls completed the MINI.

2.2. Procedures

Study visits took place at McMaster Children's Hospital at age 8 and at the Child Emotion Laboratory at age 29–36. After a description of the study was provided, written informed consent was obtained from the parents of participants at age 8, and by the participants themselves at the adult visit. The McMaster University Health Sciences Research Ethics Board approved all study procedures.

2.3. Measures

2.3.1. Bruininks-Oseretsky Test of Motor Proficiency

The short-form Bruininks-Oseretsky Test of Motor Proficiency (BOTMP-SF) was used to assess motor proficiency when participants were 8 years old. It contains eight subscales that test running speed and agility, balance, bilateral coordination, strength, upper-limb coordination, response speed, visual-motor control and upper-limb speed and dexterity. The total scale score can range from 0 to 98, with lower scores reflecting poorer motor coordination. The BOTMP-SF has been validated against the full battery BOTMP, with correlations of .90–.91 for children aged 8–14 (Bruininks, 1978). The BOTMP-SF was administered to participants individually by a trained research assistant who was blind to participant birth weight status.

2.3.2. Mini International Neuropsychiatric Interview

The MINI is a structured diagnostic interview used to assess psychiatric disorders consistent with the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). It has demonstrated similar reliability and validity to the Structured Clinical Interview for DSM-IV disorders, and can be administered in a shorter period of time. Strong inter-rater and test-retest reliability have been demonstrated (Sheehan et al., 1998). The MINI was administered to participants by trained graduate students who were naïve to birth weight status in the Child Emotion Laboratory.

A priori, we chose to examine MDD, GAD and ADHD, given their associations with poor motor coordination in past studies (Cairney et al., 2010; Hellgren et al., 1994; Hill and Brown, 2013; Lingam et al., 2012; Losse et al., 1991; Missiuna et al., 2014; Pratt and Hill, 2011; Rasmussen and Gillberg, 2000). Lifetime diagnosis of MDD was chosen because it captures cumulative risk of disorder, and current GAD and current ADHD were selected because there were no modules assessing lifetime diagnoses of these disorders in the MINI. Since the peak age of onset of these disorders occurs prior age 29 (Kessler et al., 2005) and given the chronic nature of both of these conditions, it was felt that current diagnoses of GAD and ADHD adequately captured risk. As a minimum prevalence threshold (≥ 5 cases total) was set for analyzing psychiatric disorders in this work the inattentive subtype of ADHD was