

Correspondence: Blake Gimbel, PhD;
University of Minnesota; gimbe013@umn.edu

3 Relationships between Motor Skills and Executive Functions in Preterm-Born Preschoolers

Christina Dandar¹, Allyssa Mattes¹, Jamie Piercy², Andrew Heitzer³, Brittany Paul¹, Emma Gimenez DeGeorge¹, Christina Lee¹, Judith Klarr⁴, Sarah Raz¹

¹Wayne State University, Detroit, MI, USA.

²University of British Columbia, Okanagan, Canada. ³St. Jude Children's Research Hospital, Memphis, TN, USA. ⁴William Beaumont Hospital, Royal Oak, MI, USA

Objective: Motor skills have been linked to executive functions (EFs) in typically developing school-, and preschool-age children. Yet fine motor skills have been more consistently correlated with EFs than gross motor skills, perhaps because they are more frequently investigated. Preterm born children are vulnerable to deficits in both gross and fine motor skills, even after exclusion of neurological cases. In addition to motor skills, EFs may also be compromised in preterm born preschoolers. Because premature birth increases the odds for atypical brain development, and since adverse effects on brain functioning tend to yield increased dispersion of performance scores, we wished to determine whether fine and gross motor skills are differentially linked to performance on tasks measuring EF skills in nonhandicapped preschoolers born preterm.

Participants and Methods: We studied 99 preterm (born < 34 weeks) singleton preschoolers (3-4 years of age; 50 females), all graduates of the Neonatal Intensive Care Unit at William Beaumont Hospital, Royal Oak, MI. Motor skills were assessed with the Peabody Developmental Motor Scales – (Second Edition) which provide Fine and Gross Motor Quotients (FMQ, and GMQ, respectively). Three core EFs were measured: working memory, motor inhibition, and verbal fluency. Working memory skills were assessed with two Clinical Evaluation of Language Fundamentals – Preschool – Second Edition subtests: Recalling Sentences (RS) and Concepts and Following Directions (CFD). Motor inhibition and verbal fluency were assessed with the NEPSY-II Statue and Word

Generation (WG) subtests, respectively. Children with a history of moderate to severe intracranial pathology or cerebral palsy were excluded.

Results: We conducted linear regression analyses using scaled scores from the Statue, WG, RS, and CFD subtests as the predicted variables. Predictors of interest were the FMQ and GMQ. We adjusted for sociodemographic factors (SES and sex) and perinatal risk (gestational age, sum of antenatal complications and birth weight SD). The GMQ was significantly associated with all four EF measures (Statue, $t(84) = 4.13, p < .001$; CFD, $t(92) = 3.83, p < .001$; WG, $t(84) = 3.38, p = .001$; RS, $t(90) = 3.37, p = .001$). The FMQ was significantly associated with three of four EF measures (Statue, $t(84) = 3.41, p = .001$; CFD, $t(92) = 3.97, p < .001$; WG, $t(84) = 1.96, p = .054$; RS, $t(90) = 2.91, p = .005$).

Conclusions: Both fine and gross motor skills were associated with EF in nonhandicapped preterm-born singletons. Lower motor functioning in either motor domain was linked to reduction in performance on diverse EF measures. It should be emphasized that motor performance contributed to explaining variance in EFs even after statistical adjustment for early medical risk. In addition to the obvious conclusion that motor skills may underpin EF skills, it is likely that early risk factors not captured by the medical risk variables used in our analyses were nonetheless tapped by variability in motor performance. As preschool EFs are essential for subsequent academic performance, the significance of age-appropriate motor development in the preschool age should not be underestimated in our at-risk population.

Categories: Prenatal/Perinatal Factors/Prematurity

Keyword 1: executive functions

Keyword 2: motor function

Keyword 3: child development disorders

Correspondence: Christina Dandar Department of Psychology, Wayne State University cdandar@wayne.edu

4 Severity of Retinopathy of Prematurity and Motor Skills Development in Preschoolers

Emma Giménez DeGeorge¹, Christina Dandar¹, Allyssa Mattes¹, Andrew Heitzer², Jamie Piercy³, Brittany Paul¹, Christina Lee¹, Judith Klarr⁴, Sarah Raz¹

¹Wayne State University, Detroit, MI, USA. ²St. Jude Children's Research Hospital, Memphis, TN, USA. ³University of British Columbia, Okanagan, Canada. ⁴William Beaumont Hospital, Royal Oak, MI, USA

Objective: Children born preterm are at increased risk of deviation from the typical developmental trajectory. The probability of adverse developmental sequelae is increased in those with history of major perinatal complications. Retinopathy of prematurity (ROP) is a pathological disordered growth of retinal blood vessels occurring in very preterm neonates who require supplemental oxygen. ROP has been linked to intermittent hypoxic events and blood gas derangements occurring in the Neonatal Intensive Care Unit (NICU), particularly in ventilated infants. Though presence and severity of ROP have been linked to neurodevelopmental impairment, little is known about the relationship between ROP severity and motor development in the preschool age. Because the same hypoxic events and blood gas changes that lead to severe ROP may also lead to greater developmental deficits in motor control, we hypothesized that ROP severity will be inversely linked to the quality of motor functioning even in NICU graduates without neurological impairments.

Participants and Methods: We included 95 preterm (23.6 – 33.6 weeks gestation) preschoolers (49 females, 44 members of twin pairs or triplets). The participants' age ranged from 3.3 – 4.1 years (adjusted for prematurity). ROP screening was conducted during NICU stay and rated from immature retina (0) to grade 4. Motor abilities were assessed with the Peabody Developmental Motor Scales (PDMS-2). Cases with diagnosed perinatal brain pathology (moderate to severe) or cerebral palsy were excluded from analyses.

Results: We used linear mixed regression analyses with multiple gestation as a random factor. Severity of ROP was our predictor of interest, whereas socioeconomic status, sex, gestational age, and birth-weight SD served as covariates. Separate analyses were conducted using the PDMS-2 Total Motor, Fine Motor, and Gross Motor Quotients as dependent variables. ROP severity explained a unique portion of the

variance in the Total Motor Quotient ($F[1, 89] = 5.59, p = .02$). Examination of the relationship between ROP severity and motor skill domains yielded a significant association for the Fine Motor Quotient ($F[1, 89] = 6.19, p = .015$) and a trend for the Gross Motor Quotient ($F[1, 89] = 3.64, p = .06$).

Conclusions: The results of this study reveal that increase in ROP severity is linked to poorer motor skills in preterm-born preschoolers without major disabilities or perinatal diagnosis of moderate to severe brain pathology. This association was evident for both fine and gross motor skills, though only the relationship between ROP severity and the former motor index reached conventional statistical significance. Importantly, ROP severity accounted for a unique portion of the variance in motor performance, over and above the variance explained by other perinatal risk factors. This result is consistent with previous research findings indicating that ROP is linked to the occurrence of multiple, subtle hypoxic events and 'exposure' to blood gas derangements during NICU stay in very preterm neonates who require respiratory support.

Categories: Prenatal/Perinatal Factors/Prematurity

Keyword 1: motor function

Keyword 2: perinatal factors

Keyword 3: pediatric neuropsychology

Correspondence: Emma Giménez DeGeorge
Department of Psychology, Wayne State
University egdegeorge@wayne.edu

5 PediaTrac™: A Novel Measure for Screening Early Motor Development in Infants Born Preterm and Other At-Risk Populations

H. Gerry Taylor^{1,2}, Jennifer C. Gidley Larson³, Renee Lajiness-O'Neill⁴, Alissa C. Huth-Bocks⁵, Seth Warschausky⁶

¹Abigail Wexner Research Institute at Nationwide Children's Hospital, Columbus, OH, USA. ²Pediatrics, The Ohio State University, Columbus, OH, USA. ³Physical Medicine and Rehabilitation, University of Michigan, Ann Arbor, MI, USA. ⁴Psychology, Eastern Michigan University, Ypsilanti, MI, USA. ⁵Pediatrics, Case Western Reserve University, Cleveland, OH,