Executive Function and Attention in Children Born Prematurely

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Abstract

Aim - The aim of this study is to measure the abilities of premature school-aged children in tasks of attention, working memory and executive functioning in order to determine if premature newborns are more at risk to develop delays compared to children born at term.

Method - The sampling will be based on a previous study where five school-age premature children from Northern Ontario will be assessed using standardized tests. Each parent will be given a standardized questionnaire designed to measure the executive functioning of his or her child. The results will be then compared to those of a control group born at term without any neonatal complications. Participants will be matched according to gender, age, language status and socio-economic status. Preliminary analysis has shown that premature infants have reduced performance in tasks such as attention and executive functioning (inhibitory control, working memory, and cognitive flexibility). The influence of gestational age, birth weight and socio-economic status will be explained.

Importance of the Study - Premature children are more vulnerable to developmental and behavioural delays (Taheri, Goudarzi, Shariat, Nariman, & Martin, 2017). Several studies have shown that delays in executive functions are associated with lower academic achievement (Hüning et al., 2017). This study will help us determine the nature of the impact on non-language skills in premature infants. Preliminary results will allow us to better understand the impact of prematurity on the development of attention and executive functioning (inhibitory control, working memory, and cognitive flexibility), as it relates to language.

Key words: Executive function, Attention, Memory, Prematurity
Résumé

Objectif – Cette recherche a pour but de mesurer la capacité des enfants d’âge scolaire nés prématurément à accomplir des tâches mesurant l’attention, la mémoire de travail et le fonctionnement exécutif afin de déterminer s’ils sont plus susceptibles de développer des retards que les enfants nés à terme.

Méthode – L’échantillonnage comprend cinq enfants prématurés d’âge scolaire et provenant du nord de l’Ontario qui ont été soumis à une batterie de tests normalisés. Chaque parent a rempli un questionnaire normalisé cherchant à mesurer le fonctionnement exécutif de leur enfant. Les résultats ont ensuite été comparés à ceux d’un groupe contrôle, nés à terme et sans complication néonatale. Les participants ont été appariés selon le sexe, l’âge, le statut linguistique et le statut socio-économique. Les analyses préliminaires ont permis de montrer que les enfants prématurés ont une performance réduite aux tâches mesurant l’attention, la mémoire et le fonctionnement exécutif. L’influence de l’âge gestationnel, du poids à la naissance et du statut socio-économique sera examinée.

Introduction

Preterm birth defined by the World Health Organization [WHO] (2012) is a birth occurring prior to 37 completed gestational weeks. Prematurity occurs at a rate of 7.5%-12.5% births worldwide (Taheri, Goudarzi, Shariat, Nariman, & Martin, 2017). Considering that the last several weeks of normal gestation are responsible for more than one third (35%) of brain growth (Canadian Institute for Health Information, 2009), birth at an early gestational age may disrupt the development of the foetus (Kallankari, Kaukola, Olsén, Ojaniemi, & Hallman, 2015). Consequently, it is not uncommon for premature children to be more vulnerable to neurodevelopmental and cognitive delays, socio-behavioural problems, sensory disabilities and hearing impairment (Fuchs et al., 2016; Taheri et al., 2017). These delays interfere with typical learning abilities at school and increase the need for special education (Marret et al., 2015). The aim of this study is to measure the abilities of premature school-aged children in Northern Ontario, Canada, in tasks of executive functioning (inhibitory control, working memory & cognitive flexibility) and attention in order to determine if premature newborns are more at risk to develop delays compared to children born at term.

Method

In a previous study, 26 children born prematurely were assessed using a battery of tests measuring executive functioning and attention (David, 2017). The results demonstrated that 65% of premature infants obtained a score indicating executive dysfunction; also, on tasks measuring attention, preterm participants had weak or below average scores.

In the current study, children born at term and without neonatal complications will be assessed. The results of these participants will be compared to those of the David (2017) study. Participants will be matched according to gender, age, linguistic status and socio-economic status. A detailed questionnaire will be sent to each participant’s caregiver in order to determine linguistic status, as well as the presence of sociodemographic risk factors. Participants will be divided into four groups, depending on the level of exposure to French and English, as well as the language of communication with peers and family members: French-English bilinguals (dominant language is French), English-French bilinguals (dominant language is English), equal competencies in both languages and monolingual Anglophones. This project received ethics approval from the Laurentian University Research Ethics Board (LUREB).

Procedure

A speech-language pathologist or trained research assistant will complete a formal assessment using a battery of tests measuring attention and executive functioning; for bilingual children, testing will be completed in each language. The tasks will be divided according to the skill measured: memory, attention, and executive functioning. The Brief IQ substests of the Leiter International Performance Scale-Revised (Leiter-3) (Roid, Miller, Pomplun, & Koch, 2013) will
be used to measure non-verbal intelligence. According to test standards, the mean is 100 with a standard deviation of 15; children with scores between 85 and 115 will therefore be included in the study. Statistical analyses will allow us to determine if children born prematurely are at increased risk of delays, as well as determine the influence of gestational age, birth weight and socio-economic status on performance.

**Importance of the Study**

Premature children are more vulnerable to developmental and behavioural delays (Taheri, et al., 2017). These delays can have lasting negative effects that extend into adolescence and adulthood (Ross-Sheehy, Perone, Macek, & Eschman, 2017). Previous studies have show that premature infants have reduced performance in tasks such as attention and executive functioning (Head et al., 2015; Hüning et al., 2017; Ross-Sheehy et al., 2017). Several studies have shown that delays in executive functions are associated with lower academic achievement (Hüning et al., 2017). Due to the impact of these skills in a child’s everyday academic and social life, it is essential to understand the development of executive functioning, as well as differences in outcomes (Vandenbroucke, Verschueren, & Baeyens, 2017).

This study will help us better understand the impact of prematurity on the development of attention and executive functioning (inhibitory control, working memory & cognitive flexibility), as it relates to language. The findings of this study will help improve early detection of delays in order to provide early intervention. This information will be relevant for family physicians, pediatricians and speech-language pathologists working with this population.
References


