| Project Details | |
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| Project Code | MRCNMH26Br Holmboe |
| Title | The impact of parental mental health on the brain bases of early executive function development |
| Research Theme | NMH |
| Project Type | The project is lab based and involves cognitive testing and neuroimaging of young children. |
| Summary | In recent years we have made new discoveries in how young children develop executive functions – important skills that allow children to adapt flexibly in their daily lives. At the same time, we have started to uncover the brain bases of these key skills – including the finding that brain development sometimes precedes changes in behaviour. It is well established that poor parental mental health has a negative impact on early child development. In this project we will investigate the impact of maternal and paternal mental health on the brain mechanisms underlying the earliest development of executive function skills. |
| Description | Executive functions (EFs) are a group of key cognitive skills that help monitor, control and regulate behaviour in order to set and achieve goals in everyday life [1]. Childhood EF skills have been shown to be predictive of important outcomes, such as academic achievement [2]. A difficulty in assessing the earliest development of EFs has been the lack of age-appropriate tasks for infants and toddlers. However, recent advances in EF assessment from Bristol University Baby Lab (BUBL) now allow us to assess these important skills even in infancy [3]. We have also recently gained new insight into the brain bases of early EF development [4].<br>Parental mental health difficulties have been associated with negative outcomes in children, including poorer EF skills [5]. However, most studies have focused on EFs in children older than 3 years, and few studies have investigated the potential impact of parental mental health on the brain areas involved in early EF skills. The latter is important because research from Prof Holmboe's lab demonstrates that brain changes take place in early toddlerhood to support the development of EFs even before changes in behaviour become evident [4]; as such, the substantial brain development that occurs in infancy and toddlerhood may be an important marker of the developmental status of these key cognitive skills and may help guide early intervention efforts.<br>We propose to investigate the potential impact of parental mental health difficulties (including symptoms of depression, stress and anxiety) on both behavioural EF performance and the brain development underlying these important skills during the first 3½ years of life. To do this, we will use data from three infant cohorts, nested within very different cultural contexts. The first cohort (completed in 2022), the Oxford Early Executive Functions (OEEF) cohort, includes 144 children assessed at 10, 16 and 42 months. The second cohort includes 226 children assessed at BUBL at 10, 16, 24 and 30 months. All children in this cohort have been assessed at 10 and 16 months and are currently being assessed at 24 and 30 months. The final cohort, the Khula cohort [6], includes 394 children from Gugulethu in Cape Town, South Africa. Infants in this cohort were assessed at 3, 6, 12, 18 and 24 months and will be assessed again at 36-42 months. These three cohorts include |

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| | extensive longitudinal assessment of early EF skills, measures of parental mental health, rich sociodemographic and other contextual measures, and brain data using several different imaging techniques (electroencephalography (EEG), functional near-infrared spectroscopy (fNIRS) and Magnetic Resonance Imaging (MRI)). This provides us with an outstanding opportunity to investigate the impact of parental mental health on the early brain development underlying the emergence of EF skills across very diverse contexts.<br>Although the proposed project is defined broadly as focusing on the impact of parental mental health on early EF-related brain development, we want the student to have the freedom to shape the project into their own. For example, they may choose to focus on a specific dimension of parental mental health, a particular analytical strategy (e.g., structural equation modelling of brain and behavioural data), or the impact of specific contextual factors that have been measured across cohorts (e.g., cultural differences, socioeconomic status, social support). We will encourage them to explore factors related to the diverse contexts that these cohorts were assessed in (i.e., a high-income minority world country vs. a low-to-middle income majority world country). However, again the student will have the freedom to focus on specific aspects of these diverse backgrounds that they find particularly interesting. The supervisory team will support the student in narrowing down the project to one the student is passionate about, and which allows them to develop the best possible skill set for their future career.<br>References:<br>1. Morgan, B. et al. Early Executive Function Development: The First Three Years. In J. H. Grafman (Ed.), Encyclopedia of the Human Brain, Second Edition, Vol. 3, pp. 12–25, (2025). Elsevier. https://doi.org/10.1016/B978-0-12-820480-1.00078-4<br>2. Willoughby, M. et al. Contributions of hot and cool self-regulation to preschool disruptive behavior and academic achievement. Dev. Neuropsychol. 36, 162-180 (2011). https://doi.org/10.1080/87565641.2010.549980<br>3. Hendry, A. et al. Development of directed global inhibition, competitive inhibition and behavioural inhibition during the transition between infancy and toddlerhood. Dev. Sci. 25, e13193 (2022). https://doi.org/10.1111/desc.13193<br>4. Fiske, A. et al. The Neural Correlates of Response Inhibition across the Transition from Infancy to Toddlerhood: An fNIRS study. Imaging Neuroscience (2024). https://doi.org/10.1162/imag_a_00206<br>5. Power, J. et al. Maternal perinatal depression and child executive function: A systematic review and meta-analysis. J. Affect. Disord. 291, 218-234 (2021). https://doi.org/10.1016/j.jad.2021.05.003<br>6. Zieff, M. R. et al. Characterizing developing executive functions in the first 1000 days in South Africa and Malawi: The Khula Study. Wellcome Open Research 9, 157 (2024). https://doi.org/10.12688/wellcomeopenres.19638.1 |

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