Project Details	
Project Code	MRCNMH24Br Holmboe
Title	Early executive function development in moderate-to-late preterm infants
Research Theme	Neuroscience & Mental Health
Summary	We will investigate how moderate-to-late preterm (MLP) infants (32-37 weeks gestation) develop early executive function skills (cognitive skills that allow children to adapt and learn) compared to term born infants. In 2021, about 44,000 MLP babies were born in the UK. These children often experience EF difficulties at school age, but it is unknown when these difficulties first emerge. This is important to know in order to plan appropriate support and intervention.
Description	Approximately 1 in 13 babies are born prematurely (before 37 weeks of gestation) in the UK (https://www.bliss.org.uk/research-campaigns/neonatal-care-statistics/prematurity-statistics-in-the-uk). The majority of these infants are born moderate-to-late preterm (MLP). This group used to be considered at relatively low risk, however, recent research indicates that many MLP children experience cognitive and behavioural difficulties [1], with particular problems in attention and executive functions (EFs) [2]. EF deficits are in turn associated with many adult mental health, cognitive and social difficulties [3]. As MLP affects a sizeable proportion of children, the impact of EF difficulties at the population level is considerable. Therefore, it is important to understand when and how EF difficulties start to emerge as well the neural substrate underlying these emerging difficulties. EFs encompass a set of key regulatory skills which include inhibitory control, working memory and cognitive flexibility [4]. A difficulty in assessing the earliest development of EFs has been the lack of age-appropriate assessments for infants and toddlers. However, recent advances in EF assessment from the Bristol University Baby Lab (BUBL) now allow us to assess these important skills even during the first two years of life [4]. We have also recently gained new insight into the neural substrate of EF development in infancy [5], potentially providing a vital early marker of later difficulties. The proposed project involves investigating the longitudinal development and neural substrate of executive functions in a sample of 50 MLP infants. At BUBL we are currently assessing a cohort of 200 term born infants on a battery of early EF tasks at 10, 16, 24 and 30 months of age (funded by an MRC grant). We also measure the neural substrate of this early development using EEG and fNIRS at all ages. As such, we will have a large and well-characterised comparison group for our MLP infants, who will be recruited from two maternity and neonatal units in Bristol with a combined birth rate of over 10,000 infants per year. This will allow us to investigate when, and by how much, MLP infants start to deviate from the typical trajectory of early EF development and the concomitant neural development. We will also be able to explore which specific EF domains are most affected in MLP infants' early development, providing clues as to where intervention efforts may be most effective. The student will have substantial freedom in terms of focusing on the development of specific EFs, neural markers and mental health outcomes. Working closely with both basic and clinical researchers, they will have the opportunity to develop a wide range of skills, including

rigorous protocol design, recruiting families from the neonatal unit, collection of behavioural and neuroimaging data, data cleaning and advanced data analysis, and write-up for publication. The student will be encouraged to take ownership of the project and pursue areas of particular interest to them within the broader scope of investigating early cognitive difficulties in MLP infants.   References: 1. Odd, D., Evans, D. & Emond, A. Preterm birth, age at school entry and long term educational achievement. PLoS One 11, e0155157 (2016). 2. Martínez-Nadal, S. & Bosch, L. Cognitive and learning outcomes in late preterm infants at school age: A systematic review. International Journal of Environmental Research and Public Health 18, 74 (2021). 3. Moffitt, T. E. et al. A gradient of childhood self-control predicts health, wealth, and public safety. PNAS 108, 2693-2698 (2011). 4. Holmboe, K. et al. The Early Childhood Inhibitory Touchscreen Task: A new measure of response inhibition in toddlerhood and across the lifespan. PLoS One 16 (2021). 5. Fiske, A. et al. The neural correlates of inhibitory control in 10-month-old infants: a functional near-infrared spectroscopy study. NeuroImage (2022).

Supervisory Team

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