Project Details	
Project Code	NMH27Br Chakkarapani
Title	Decoding Early Brain and Movement Signals to Predict Outcomes after Birth Asphyxia
Research Theme	Neuroscience & Mental Health
Project Type	Dry lab
Summary	Birth asphyxia occurs when a baby is deprived of oxygen around birth, causing brain injury, disability or death. This project will study two early signs of brain health in affected babies. First, it will record early brain activity in moderate-to-late preterm babies to understand what normal and abnormal patterns look like. Second, it will test whether a simple video-based assessment of babies' spontaneous movements at 3 months can predict later thinking and learning difficulties in babies who underwent cooling treatment for birth asphyxia. The findings could improve early diagnosis, guide follow-up, and refine brain monitoring.
Description	Background Each year in the UK, more than 2400 babies are affected by birth asphyxia, where a baby receives too little oxygen around birth. (1) This is usually recognised by poor condition at birth and abnormal acid levels in the blood soon after delivery. Birth asphyxia can lead to death, brain injury and lifelong disability. (1, 2) The societal and economic burden is substantial, with NHS litigation costs exceeding £4.56 billion (3) and estimated lifetime care costs of around £900,000 per affected child.(4) Approximately 2000 affected infants are born at or after 36 weeks' gestation, referred to as term or near-term infants. Around 400 are born between 33 and 35+6 weeks' gestation, classified as moderate-to-late preterm (MLP) infants.(1) After birth asphyxia, babies are assessed within the first 6 hours of life for signs of brain dysfunction, known as neonatal encephalopathy (NE). This assessment includes a clinical neurological examination and brain activity monitoring using amplitude-integrated electroencephalography (aEEG).(2, 5) In term or near-term infants with moderate or severe NE, whole-body cooling is now the standard of care and reduces the risk of death and disability.(6) However, there are two important unresolved problems. First, diagnosing encephalopathy in MLP infants is difficult. Their neurological examination may appear abnormal because of expected developmental immaturity, rather than brain injury.(7) Similarly, their early aEEG may differ from those of term infants simply because their brains are less mature (5, 8). Cooling therapy, which benefits term infants, increases the risk of death or disability in MLP infants(9) and is therefore not recommended.(10) This could be due to challenges in ascertaining encephalopathy, highlighting an urgent need to define what a normal early aEEG pattern looks like in MLP infants, so that brain dysfunction after birth asphyxia can be identified more accurately. Further early aEEG pattern data within 6 hours after birth are sparse in near-term and term infants. Second, although cooling therapy has improved outcomes for term and near-term infants with neonatal encephalopathy (11), approximately 1 in 5 children still develop intellectual difficulties.(12, 13) Current neonatal assessments, including neurological examination, aEEG and brain MRI,

	do not reliably identify which infants will later develop intellectual impairment.(2) General Movements Assessment (GMA), a structured assessment of babies' spontaneous movement patterns at around 3 months of age(14) predicts later motor outcomes, especially cerebral palsy (15) and is associated with later cognitive development in children born prematurely.(16) However, it is not known whether GMA predict later intellectual development in term or near-term infants who received cooling treatment for NE. Therefore, the key research question is whether aEEG can be used to reliably characterise brain dysfunction in MLP infants, and, along with brain MRI & GMA, to indicate later intellectual development in term or near-term infants cooled for NE. Objectives: 1. To establish gestation-specific aEEG patterns within 6 hours after birth in MLP, near-term and term infants. 2. To compare the prediction of encephalopathy using early aEEG patterns in MLP, near-term and term infants. 3. To determine the association between neonatal aEEG, brain MRI lesions, GMA and cognitive development at 2 years and 6-7 years in infants cooled for NE. Methodology The student will work with the supervisors to obtain ethics approval for objectives 1 and 2. Infants will be recruited antenatally or shortly after birth. Inclusion: with or without birth asphyxia. Birth asphyxia: poor condition at birth (Apgar < 7 at 5 minutes) and/or Acidosis (pH □7.0 or base excess □ 12 mmol/L in cord blood) Exclusion: congenital anomalies, severe maternal sepsis Setting: Bristol NHS Foundation Trust aEEG will be acquired using either clinically used devices or ClicEEG. ClicEEG is a novel, compact wireless EEG device. The supervisor team have optimised ClicEEG for use in newborn babies to acquire EEG through an NIHR i4i grant, in partnership with industry (Huru), and has developed the algorithm to acquire aEEG. aEEG recordings (40 minutes to 2 hours) will be obtained within 6 hours after birth, from 120 infants (□25 infants per gestational subgroup). Previous studies used 24-40 infants in other populations. Parent and staff feedback on acquiring aEEG will be obtained. We have ethics approval, aEEG, brain MRI, GMA and cognitive scores for Objective 3 from 100 infants for 2 years and 45 infants for 6-7 year outcomes. Areas for Student Ownership: • Developing objectives 1 and 2, and could extend the population to very preterm infants • They will be able to take ownership of the movement and EEG analysis and develop their own research direction. References 1.10.1136/archdischild-2020-320902 2. 10.1038/s41390-025-03986-2. 3. https://resolution.nhs.uk/wp-content/uploads/2022/12/FOI_5418_Cerebral-Palsy_Brain-Damage.pdf

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Can be completed part time?	Yes
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