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The Effect of Early Adversity on Neurodevelopment: Defining a Biological Poverty Line through Social Brain Fingerprinting



The team is also composed of Dr Sarah Lloyd-Fox (University of Cambridge), Professor Mark H. Johnson (University of Cambridge), Maria Rozhko (University of Cambridge) and Anathi Kwinana (University of Cambridge). The project advisors are Professor Topun Austin (Cambridge University Hospitals NHS Foundation Trust), Dr Nicholas Everdell and Dr Samuel Powell (Gowerlabs Ltd, University College London).

Summary of the study:

The first two years of life are a critical period for neurodevelopment, during which early adversity, such as poverty, can profoundly impact cognitive and social-emotional development as well as brain function. While technological advances have improved neuroimaging tools for neurodevelopmental research, most studies remain confined to passive lab-based paradigms that fail to capture the complexity of real-world social interactions. Understanding the neural mechanisms underlying emerging social behaviours requires approaches that reflect infants' dynamic, interactive environments. This project aims to optimize a neurodevelopmental assessment toolkit leveraging wearable and portable neurotechnologies to study infants' brain activity during social interactions in naturalistic settings, such as their homes.

Specifically, our research seeks to identify brain networks supporting infants' social interactions and examine how contextual factors, such as socioeconomic status, shape developmental trajectories. To achieve this, the project combines the Neonatal Behavioural Assessment Scale (NBAS), a comprehensive tool for evaluating neonatal behaviour and state regulation, with the simultaneous monitoring of brain activity using high-density diffuse optical tomography (HD-DOT). Combining the NBAS and HD-DOT in this way builds on their respective advantages, creating a potentially groundbreaking synergy of methods.

Family feedback and focus groups will guide protocol refinements to enhance child- and family-friendliness, and address barriers to participation, preferences for

communication, and privacy concerns. These efforts aim to reduce dropout rates, improve engagement, and ensure inclusivity for families from diverse socioeconomic backgrounds. The project's objectives include demonstrating the feasibility of integrating NBAS and HD-DOT, identifying neuromarkers of social interaction, and advancing accessibility in neurodevelopmental research. By addressing critical gaps in current methodologies, this research aims to provide new insights into early brain development and its modulation by environmental factors, with significant implications for global health and developmental neuroscience.

