Infant EEG markers of novelty detection show longitudinal associations with preschool executive function outcomes in rural Gambia.

Laura Katus1, Bosiljka Milosavlevic1,2, Ebrima Mbye3, Ebou Touray3, Tijan Fadera3, Mariama Saidykhan3, Muhammed Cesay3, Ousman Kambi4, Giulia Ghillaia5, Samantha McCann3,4, Lena Acolatse5, Luke Mason6, Sophie Moore4,5, Clare Elwell6,7, Michelle de Haan8, Sarah Lloyd-Fox1,2

1University of Cambridge, 2Birkbeck, University of London, 3Medical Research Council Unit, The Gambia, 4London School of Hygiene and Tropical Medicine, 5King’s College, 6University of Utah, 7University College London

Background
- Neuroimaging is a useful method to study at-risk infant populations around the world [1,2], however predictive associations between infant neural markers and developmental outcomes have yet to be established.
- EEG markers have been shown to be associated with concurrent developmental outcomes [3].
- Here, we examine the link between event related potential (ERP) responses measured during infancy with executive function (EF) at preschool age.

Method
- We assessed longitudinal associations between infant ERP markers of habituation and novelty detection (1, 5, and 18 months) and preschool EF (3-5 years) in a cohort of N = 181 in rural Gambia, West Africa.

Infant ERP markers
- We presented an auditory oddball event related potential (ERP) paradigm consisting of Frequent, Infrequent and Novel sounds (Figure 1).
- We examined ERP mean amplitudes and extracted markers of habituation (Frequent trials 1-15 ~ trials 30-45) and novelty detection (Trial Unique ~ Frequent), both normalized by amplitudes to Frequent sounds.

Preschool executive functions
- Children completed the EF tasks of the Early Years Toolbox [4], including tasks on working memory, inhibitory control and cognitive flexibility (Figure 2).
- Scores on each task were combined into a single latent EF factor via confirmatory factor analysis.

Results
- Our prior analyses [3] show a gradual emergence of a robust novelty response (evidenced by a high P3 to Trial Unique sounds) across infancy (Figure 3).

Associations between infant ERP and preschool EF
- Controlling for age, preschool EF performance was associated with ERP markers of novelty detection measured at 1 and 5 months, and at trend level at 18 months.
- No such associations were found for ERP habituation markers.

Discussion
- Our results show an association between infant ERP markers of novelty detection, but not habituation, and preschool EF, perhaps due to the greater reliance of novelty detection on early working memory.
- Given our previous findings from this cohort [3] showing a gradual emergence of a novelty response over the first 18 months of life, the current findings indicate that individual variance in our neural markers of novelty detection holds potential as a meaningful early biomarker for later development even before the emergence of a group-level response.
- These preliminary analyses highlight the potential of infant neuroimaging to inform identification of individuals at-risk for compromised long-term neurodevelopmental outcomes.
- Next, we will expand our analyses to include population-specific risk factors to fully interrogate these individual differences in developmental trajectories.

References