

# Assessing cognitive skills from infancy to preschool age among children from rural Gambia

Bosiljka Milosavljevic<sup>1,2</sup>, Ebrima Mbye<sup>3</sup>, Ebou Touray<sup>3</sup>, Tijan Fadera<sup>3</sup>, Mariama Saidykhan<sup>3</sup>, Fabakary Njai<sup>3</sup>, Ousman Kambi<sup>3</sup>, Giulia Ghillia<sup>2</sup>, Samantha McCann<sup>4</sup>, Lena Acolatse<sup>3,5</sup>, Clare Elwell<sup>6</sup>, Sophie E. Moore<sup>4</sup>, Sarah-Lloyd-Fox<sup>1,2</sup> & The BRIGHT Project Team

<sup>1</sup>Department of Psychology, University of Cambridge; <sup>2</sup>Centre for Brain and Cognitive Development, Birkbeck, University of London; <sup>3</sup>Medical Research Council Unit The Gambia at the London School of Hygiene and Tropical Medicine; <sup>4</sup>Department of Women and Children's Health, King's College London; <sup>5</sup>School of Biomedical Sciences, Ulster University; <sup>6</sup>Department of Medical Physics and Biomedical Engineering, University College London



BILL & MELINDA GATES foundation



## Introduction

The prevalence of adverse environmental factors, such as undernutrition and poverty, in low- and middle-income countries (LMICs) places some children at risk of not reaching their full cognitive potential<sup>1</sup>

There is a pressing need to evaluate the validity of tools used to assess cognitive development in LMICs and to expand on the age appropriate outcomes measured<sup>2</sup>

The purpose of this study is to examine the use of tools to measure cognitive development, executive functions and adaptive skills among pre-school aged children in a rural area of The Gambia. Specifically the aims are:

- (1) To evaluate the use of various methodologies to assess cognitive development
- (2) To examine longitudinal trajectories of cognitive development from infancy to preschool age

## Methods

The Brain Imaging for Global Health (BRIGHT) project examines neurocognitive development of children from The Gambia from the antenatal period to preschool age.

**Participants:** 204 (51% F) families from the rural West Kiang region of The Gambia were recruited when mothers were 34-36 weeks pregnant. Families were followed up at 7-14d, 1m, 5m, 8m, 12m, 18m, 24m and 3-5y of age.

**Cognitive measures:**

**Global cognitive development** was assessed using The Mullen Scales of Early Learning (MSEL) at 5m, 8m, 12m, 18m, 24m and 3-5y.

**Executive functioning (EF)** was assessed using tablet based assessments from the Early Years Toolbox (eytoolbox.com.au) that measure inhibitory control (IC), working memory (WM) and cognitive flexibility (CF) at 3-5y.

**Adaptive functioning** was assessed using the Early Childhood Development Index (ECDI2030) parent-report questionnaire at 3-5y.



## Results

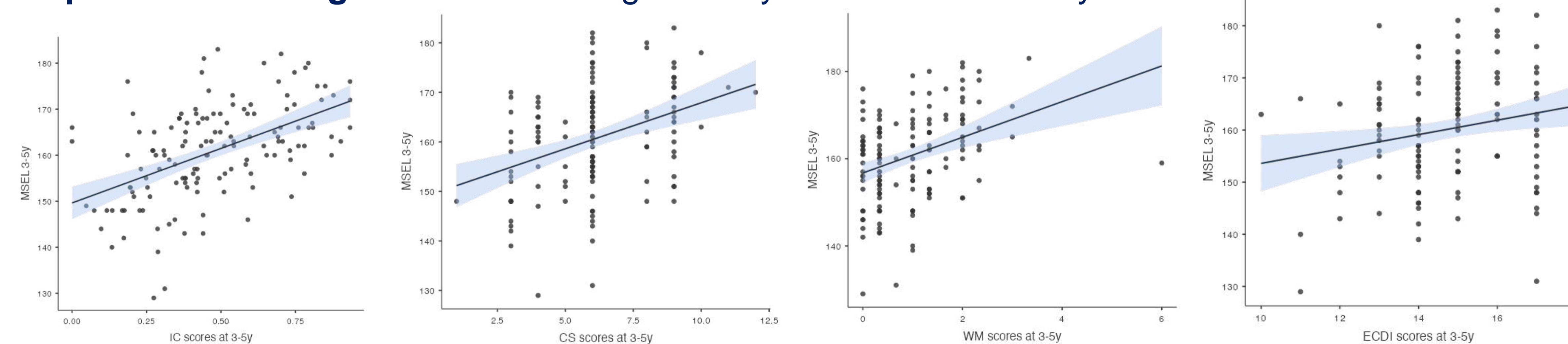
**Sample Characteristics:** OF 204 participants originally recruited, 181 were retained at the 3-5y visit and 171 completed all assessments. Age 45-63m ( $M=52.8m$ ,  $SD=5.06$ ), 86F, 85M.

**Concurrent associations:**

**Global cognitive development:** MSEL was significantly associated with ECDI ( $r=.25$ ,  $p=.005$ ), CS ( $r=.29$ ,  $p<.001$ ), IC ( $r=.44$ ,  $p<.001$ ) and WM ( $r=.29$ ,  $p<.001$ ) scores.

**Executive functioning (EF):** CS was significantly associated with IC ( $r=.33$ ,  $p<.001$ ) and WM ( $r=.24$ ,  $p=.002$ ). There were no significant associations between IC and WM.

**Adaptive functioning:** ECDI was not significantly associated with any measure other than the MSEL



**Figures 1-4:** Associations between MSEL scores and EF/adaptive functioning tasks at 3-5y

**Longitudinal associations:**

**Global cognitive development:** MSEL scores at 3-5y were significantly predicted by children's MSEL scores in toddlerhood and infancy. In particular, there were sig. associated with MSEL at 24m ( $r=.34$ ,  $p<.001$ ), 12m ( $r=.25$ ,  $p=.001$ ) and 8m ( $r=.28$ ,  $p=.002$ ).

**Executive functioning (EF):** CF was significantly predicted by MSEL scores at 24m ( $r=.24$ ,  $p=.006$ ), 18m ( $r=.26$ ,  $p=.003$ ), 8m ( $r=.25$ ,  $p=.002$ ) and 5m ( $r=.25$ ,  $p=.004$ ). Similarly, IC was predicted by MSEL scores at 18m ( $r=.22$ ,  $p=.009$ ), 12m ( $r=.23$ ,  $p=.006$ ) and 5m ( $r=.25$ ,  $p=.005$ ). WM was significantly predicted by MSEL scores at only 24m ( $r=.24$ ,  $p=.007$ ).

**Adaptive functioning:** ECDI scores at the 3-5y visit were not significantly predicted by MSEL scores at earlier visits.

## Discussion

At preschool age, we assessed diverse, but related, cognitive skills (global cognitive ability, EFs and adaptive skills).

There was evidence of construct validity. In particular global cognitive skills were predictors of both EFs and adaptive functioning.

Global cognitive skills measured from 5-24-months were also significantly associated with cognitive outcomes as preschool age.

These measures show promise in reliably measuring cognitive function among young children in global contexts.

[bm618@cam.ac.uk](mailto:bm618@cam.ac.uk)

[globalfnirs.org](http://globalfnirs.org)

[@bright\\_project](https://twitter.com/bright_project)