



Infant predictors of preschool age outcomes: Evidence from the Brain Imaging for Global Health (BRIGHT) project

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The Importance of Early Childhood Development

- Conception to 2-years is a critical window of both vulnerability to environmental challenges and opportunity to make lasting, positive cognitive impacts
- Behavioural manifestations of outcomes associated with risk are not readily observable until 2-3 years
- Measures of neural activity and attention offer a window into development early in infancy



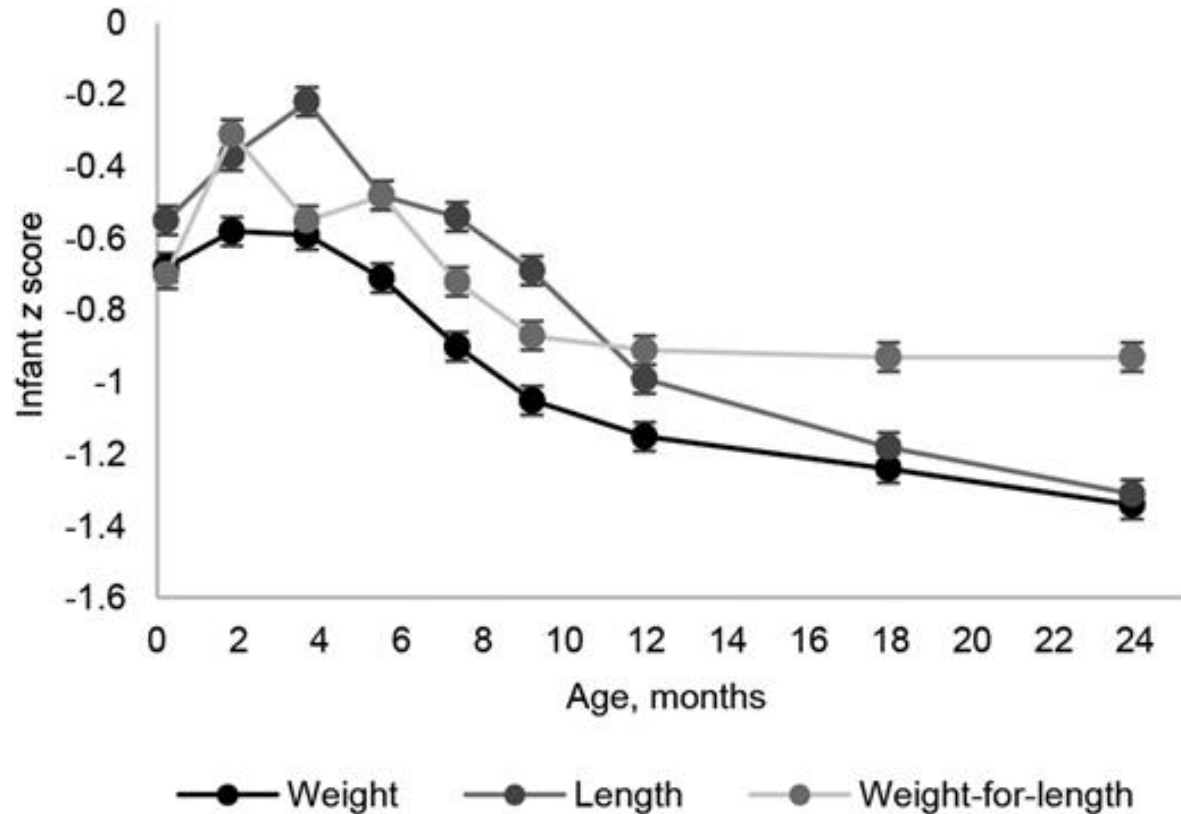
Study context in The Gambia



- West Kiang region has a population of approx. 14,000
- Majority of population live below poverty line (earn <\$2/day)
- Rely primarily on subsistence farming
- Ability to farm varies between rainy and dry seasons



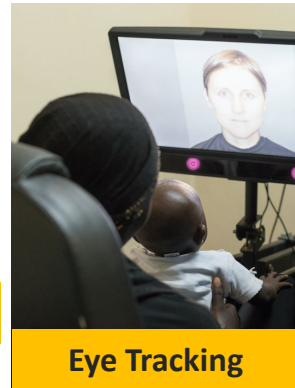
Undernutrition and Cognitive Development



- Infants in this region start to show growth faltering from 6-months of age¹
- Poorer physical growth has been associated with cognitive outcomes²
- Pressing need to investigate ***underlying mechanisms***

Figure 1. Rural Gambian infants' anthropometric measures by age (values are means \pm SE)¹

The BRIGHT Protocol



A man in a blue and white patterned shirt is holding a large, colorful geometric structure made of sticks and connectors. He is looking down at it. A young child in a blue and black patterned shirt is sitting at a table in front of him, looking up at the structure. The background shows a white wall with a calendar and some papers.

Patterns of cognitive development

Cognitive and Motor Development

- **Developmental milestones:** motor, language, and perceptual skills - Mullen Scales of Early Learning (MSEL)
- **Executive Functions:** Higher order cognitive functions that relate to memory, self-regulation, and ability to flexibly shift attention.
- **Adaptive skills:** Parent-report of child's daily living skills, socio-emotional wellbeing, and learning abilities



Cognitive and Motor Development

- Poorer physical growth related to less advanced developmental milestones, particularly among boys^{1,2}
- Executive functions are within the expected range. Children outperform peers on measure of cognitive flexibility but do slightly worse on test of working memory³
- Parent-report suggests that most children are developmentally on track, but substantial differences and some delays exhibited in domains related to school readiness.



Nutrition and development



Measures of nutrition and growth



Blood samples are collected at every visit and tested for **anaemia**

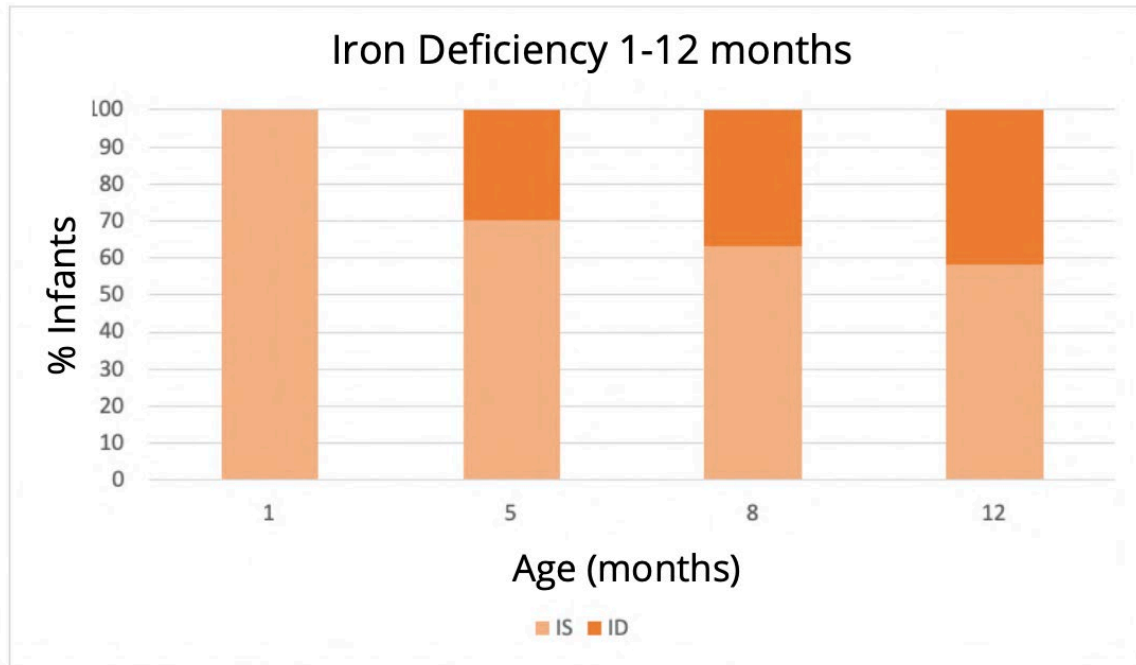


Height (length), weight, and head circumferences measures at every visit

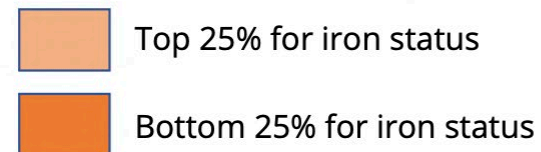
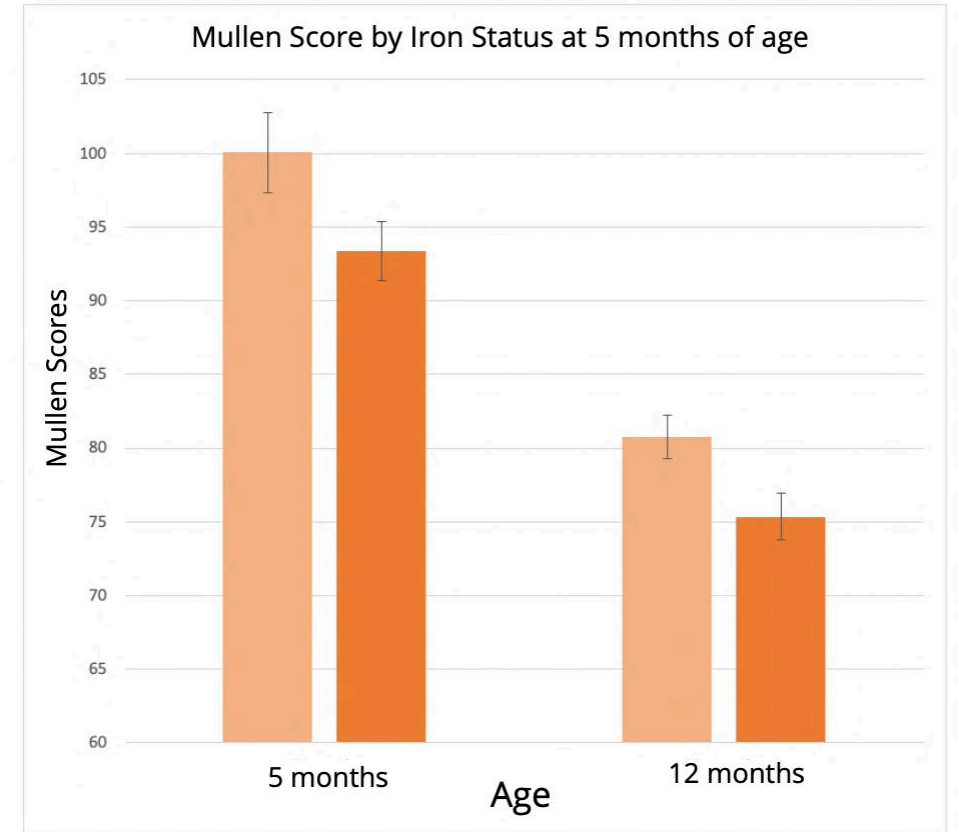
Converted to WHO norms to identify **stunting** and **wasting**

Prevalence and impact of anaemia

- Iron Deficiency Anaemia (IDA) becomes increasingly prevalent during the first year of life
- IDA at 5-months is associated with less advanced developmental milestones at both 5- and 12-months¹



IS= iron sufficient, ID= iron deficient.



¹McCann et al (2023), *PLOS Global Public Health*

Physical growth and brain development



- Functional brain network organisation, or functional connectivity (FC), is linked to processes related to healthy development
- Physical growth in the first 5-months of life predicted more mature FC developmental trajectories
- Growth after 5-months was not related to FC development¹

Summary and key messages

- Brain development, and thereby learning, begins during pregnancy.
- The skills that a child needs for successful educational outcomes begin to develop during infancy - long before they enter a classroom.
- The impacts of early environmental risk manifest in physical health, behaviour, and underlying neural development.
- We must invest in supporting infants and their families very early in life.





Next Steps



Translating findings into practice – INDiGO Trial



- Randomised, placebo-controlled efficacy trial
- Population: 600 pregnant women and their infants in The Gambia
- Intervention: Iron supplementation in pregnancy and 0-6 months of infant age
- Outcome: **Neurodevelopment**, nutritional status, growth



African Brain and Cognitive Development network - AfriBCD



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