**INTRODUCTION**

Children living in poverty grow up facing numerous obstacles to literacy, including limited time and/or resources dedicated to learning, impoverished learning environments, and inadequate education resources.

**Child Labor in Côte d’Ivoire:** Estimated 1.3 million children between the ages of 5-17 are working in cocoa production, 14.6% of children working in cocoa production are not attending school (Coope, January 2016).

**Specific Aim:** To examine the impact of poor educational access, cocoa labor, and impoverished environments on the behavioral and neural substrates of:

- bilingual language development in French and Attié/Baoule/Abidji/Bété
- executive functions, and in turn,
- reading ability

**METHODS**

**Participants.** 625 children ages 6-14 in grades 1, 2, 3, 4 (French: CP1, CE1, CM1)

**Language Assessment and Literacy Assessment** (Rhap et al. 1995, Woodcock et al. 2001)

**Phonological Awareness**
- Identification, elision, segmentation

**Tonic Awareness**
- Identify words that “share tone” to target

**Vocabulary**
- Synonym and antonym generation

**Rapid Automated Naming**
- Timed digit naming

**Oral Comprehension**
- Listen to story + comprehension questions

**Reading**
- Letter, word, pseudoword reading

**Cognitive Assessment** (with Cognitive Assessment Task)

**Task**

- Working Memory
- List Sorting Task
- Attention: Indicate the arrow direction in congruent and incongruent trials
- Flanker Task

**Survey of Home/School Environment and Child Labor**

- Measured school attendance and school habits, access to literacy materials, language background, family structure, socioeconomic status, child involvement in cocoa agriculture and other domestic and economic activities

**Field nNIRS neuroimaging** (Jasinska & Gué, 2016)

**Reading:** Print/Speech Task

- Word > False Fonts
- False Fonts > Word

**Executive Functions:** Rule Switch Task

**NEUROIMAGING RESULTS**

**BEHAVIORAL RESULTS**

**Cocoa Labor**

- **Agricultural Labor**
  - % of Children
  - Cocoa Labor
    - 55%
  - Hazardous Cocoa Labor
    - Of children working in cocoa
    - 40%
  - Other Plantation
    - 14%

**Boys more exposed to hazardous working conditions (spraying pesticide, cutting trees, burning trees, and/or carrying heavy loads)**

**DISCUSSION**

**Cocoa Labor**

- 50% of children are working on cocoa plantations, >70% of these children are engaged in hazardous labor on cocoa plantations – this has negative associations with literacy

**Literacy**

- Literacy outcomes are overall extremely poor. 5th graders (CM1) average scores indicate little to no reading competency

**Bilingualism**

- French and local language phonological awareness independently predict literacy—local language matters!

**Brain Bases of Reading**

- Stronger readers show patterns of neural activation much like what has previously been reported for Western children. Poorer readers (mean age = 10.6) do not show the same pattern of neural sensitivity to lexicality. These poorer readers do not resemble pretetrate children nor children with reading disorder.

- SES has a strong impact on functional brain activation in the prefrontal cortex, which in turn, predicts reading outcomes.

**Understanding the complex relationships between impoverished environment, brain development, children’s linguistics and cognitive development, and reading outcomes yields new information about reading development in environments with a high risk of illiteracy.**

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**SCIENTIFIC CAPACITY BUILDING**

Robust collaboration with local researchers and long-term mentorship for Ivorian students to provide opportunities to conduct child development research and advance skills in transition to independent global scientists.

**How the Brain Learns to Read in Environments with High-Risk of Illiteracy:**

**an fNIRS Study of Reading Development in Rural Côte d’Ivoire**

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