BOLD Lab Website

Relations between multiple dimensions of poverty and infant and toddler resting state brain networks using fNIRS

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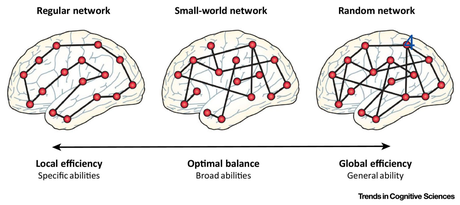
INTRODUCTION

RQ: How do poverty indicators relate to developing brain networks in infants and toddlers?

In rural Côte d'Ivoire, poverty rates are nearly 60%[1]; poverty, and its co-occurring risks (e.g. food insecurity and parental stress) adversely affect childhood outcomes periods of peak brain plasticity such as infancy[2]

Graph theoretical properties like cluster coefficients, global efficiency, and degree centrality offer insights into the brain's organization and function[3]



We use graph theory and inter/intra hemispheric correlations to investigate how poverty is related to brain development in the context of rural Côte d'Ivoire

METHODS

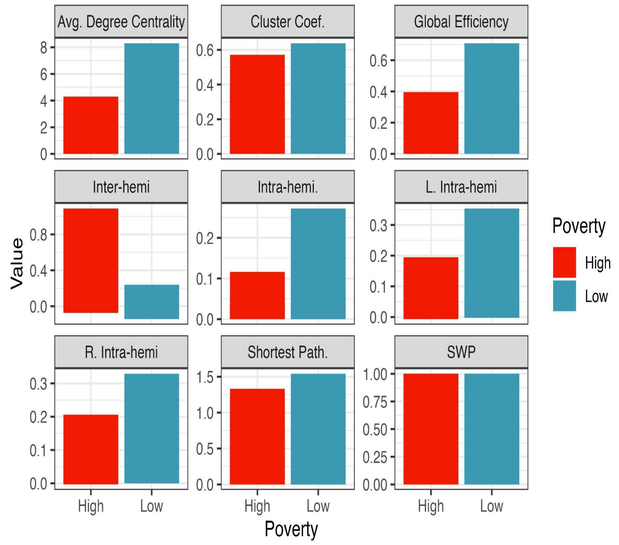
Participants

Infants and toddlers (n=33)
Ages 6-24 mo.,
M_{age}=12.8, SD_{age}=4.86

Measures

T1: Pre-conception or early pregnancy
Multidimesional Poverty Index (MDPI)[5]
Household Food Insecurity Access Scale[6]
T2: Infancy/Toddlerhood
Caregiver Reported Early Development Instruments (CREDI)[7]
fNIRS 4 min resting state scan using Inscapes[8]

POVERTY LINKED TO BRAIN NETWORK



Higher poverty was significantly associated with lower clustering coefficient, global efficiency, degree centrality, left intra-hemispheric correlation, and inter-hemispheric correlation
Food insecurity was marginally associated with small-world propensity

Predictor	Cluster Coefficient	Global Efficiency	Degree Centrality	Shortest Pathlength	Smallworld Propensity	Intra-hemi. Corr.	L. Intra-hemi. Corr.	R. Intra-hemi. Corr.	Inter-hemi. Corr.
Age	.045	.01	.006	.023	.01	.001	.0	.003	-.001
Gender (ref=F)	.042	.017	.341	-.153	.032	.002	-.009	.013	.011
CREDI	.027	.022	.155	.119	.025	.011	.02	.001	.002
Maternal Mental Health	.077	.02	1.381	-.564	.33	.007	.067	-.052	.007
Food Insecurity	-.011	.089	.792	**.546.**	**-.185.**	.031	.034	.027	.006
MDPI	**-.062.**	**-.09***	**-6.566***	-.161	.346	**-.243***	**-.264***	**-.221.**	**-.466***
R^2	.438	.438	.419	.364	.389	.369	.396	.365	.451

POVERTY INDICATORS

	Indicator	% of families
Electricity	National electricity network	39%
	Generator	27%
	Flashlight/Other	33%
Sanitation	No toilet installed / in bush or field	49%
	Pit toilet/latrine	42%
	Open pit	6%
	Neighbor's toilet	3%
Flooring	Cement	67%
	Clay	27%
	Hardened Dung	6%
Assets	Households that do not own at least one: iron, mobile phone, fan, bed, radio, tv, or motorbike	42%
Food Insecurity	None	9%
	Mild	3%
	Moderate	22%
	Severe	66%

IMPLICATIONS AND CONCLUSIONS

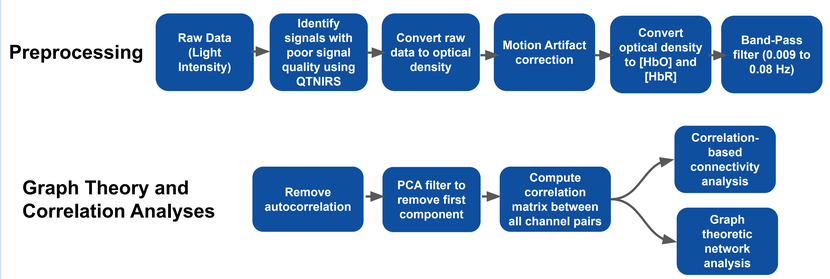
Income-disparities in brain development are evident between ages of 6-26 months

Higher levels of poverty are associated with decreased brain network efficiency, and may negatively relate to cognitive development

Future Directions

Our randomized control-trial investigating the impacts of a cash-transfer intervention in Cote d'Ivoire will provide insights into causal impact of poverty on neurocognition across development

fNIRS PROCESSING PIPELINE



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