EEG Theta/Beta Ratios as an Index of how Early Institutionalization Impacts Externalizing Problems and Callous-Unemotional Traits in Early Adolescence

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Bucharest Early Intervention Project (BEIP)
- First two years of life include sensitive and critical periods important for developmental
- Severe psychosocial deprivation as an extreme form of early adversity
- BEIP = longitudinal randomized controlled trial of infants assigned (at avg 22 mo) to foster care as intervention for institutionalized care; ongoing follow-ups every ~4 years

Methodology — 12 Year Follow-Up
Health and Behavior Questionnaire (HBQ)
- Conduct Disorder (CD): externalizing disorder (EXT), “aggression to people and animals, destruction of property, deceitfulness or theft, serious violations of the rules”
- Oppositional Defiant Disorder (ODD): EXT, angry & irritable mood, argumentative behavior, vindictiveness

Inventory of Callous-Unemotional Traits (ICU)
- Callous-Unemotional (CU) Traits: uncaring, antisocial, and aggressive behaviors, fearless temperament, fundamental disregard for wellbeing of others.

Electroencephalography (EEG)
- Precisely measure timing of electrical activity (postsynaptic dendritic currents) of pyramidal neurons; relative power
- Frontal (F), frontal temporal (FT), and whole brain (W)
- Theta/Beta Ratio (TBR): ratio of subcortical activity (theta, 4-6 Hz) to cortical regulation (beta, 13-20 Hz), elevated in ADHD populations

Research Question
Is TBR a mechanism through which early psychosocial deprivation manifests as these behavioral outcomes?

Preliminary Analysis
TBR is not related to early psychosocial deprivation.

Validity Check — Is TBR linked to ADHD?
TBR is moderately related to ADHD in our sample.
- CD cutoff (t-test): FT, p=0.065; W, p=0.077
- ODD cutoff (t-test): F, p=0.05; FT, p=0.04; W, p=0.032
- CD total score (bi. corr): F, p=0.019; FT, p=0.002; W, p=0.001
- ODD total score (bi. corr): F, p=0.023; FT, p=0.012; W, p=0.003

Post Hoc Analysis — Theta & Beta Independently
Increased theta power is related to CD and ODD.
- CD cutoff (t-test): FT, p=0.065; W, p=0.077
- ODD cutoff (t-test): F, p=0.05; FT, p=0.04; W, p=0.032
- CD total score (bi. corr): F, p=0.019; FT, p=0.002; W, p=0.001
- ODD total score (bi. corr): F, p=0.023; FT, p=0.012; W, p=0.003

Increased theta power is not related to CU traits.

Beta power is not related to CD, ODD, or CU traits.

Conclusions
- There is a significant relationship between early psychosocial deprivation and EXT/CU traits.
- TBR is not an indicator of CD, ODD, CU traits, or ADHD in our sample.
- Theta power is a potentially important mechanism for evaluating EXT.
- CD/ODD and CU traits have different underlying neural mechanisms.