Neurodevelopmental Sensitivity to Context: Socioeconomic Status, Frontolimbic Structure, & Affect Recognition in Preschool Children

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LABORATORY OF EARLY EXPERIENCES & DEVELOPMENT

Introduction

- Affect Recognition (AR) is a foundational socioemotional skill that develops rapidly during the preschool years and supports later functioning (Sun et al., 2025; Wolf et al., 2021).
- AR development is supported by frontolimbic brain development involved in emotion processing (Leisman et al., 2025)
- Socioeconomic status (SES) has been consistently associated with children's socioemotional development (Bradley & Corwyn 2002).
- However, children vary widely in how strongly SES relates to socioemotional outcomes, and little is known about how neurodevelopmental variation contributes to heterogeneity in SES-AR association during early childhood.

Present Study

- This study examines whether (1) age, SES, and frontolimbic brain structure predict AR in preschool-aged children when modeled together, and (2) whether frontolimbic structure moderates the association between SES and AR.

Hypotheses

1. Age and SES will be positively associated with AR in multivariate models
2. Variation in frontolimbic architecture will moderate SES-AR associations

Methods

Table 1. Sample Characteristics

Variable	Value
N	66
Age (yrs)	M: 5.11 (SD: 0.97), Range: 3 - 6
Sex	32 (48%) female
INR	M: 1.46 (SD: 1.12), Range: 0.23 - 3.81
AR (% correct)	M: 0.62 (SD: 0.16), Range: 0.31 - 1.0
Race	48.5% White; 18.2% Other; 13.6% Black; 10.6% Biracial; 9.1% Asian
Ethnicity	44 (67%) Hispanic

Measures

Affect Recognition NEPSY-II Affect Recognition subtest (Korkman, et al., 2007)

- Scored as % correct of administered items

Socioeconomic Status Continuous income-to-needs ratio (INR; McLoyd, 1998)

Neuroimaging Metrics

- MRI – T1 weighted images, averaged across right and left hemispheres, processed with iBEAT V2.0 (Wang et al., 2023)
- Metrics: Volume, surface area, cortical thickness, curvature, convexity
- ROIs: mOFC, lOFC, rACC, cACC, amygdala, hippocampus

Analytic Plan

- Multivariate linear regression & moderation models:
  - AR ~ Age + INR + ROI metric + Sex + ICV
  - AR ~ INR * ROI metric + Age + Sex + ICV
- FDR correction within cortical (2 ROIs) and subcortical (6 ROIs) families.

Results

Aim 1: Predictors of AR in Combined Models

- INR significantly positively predicted AR across all combined models.
- Age did not reach significant in combined models (trend level in select models)
- No ROI metric showed a main effect when controlling for INR and age

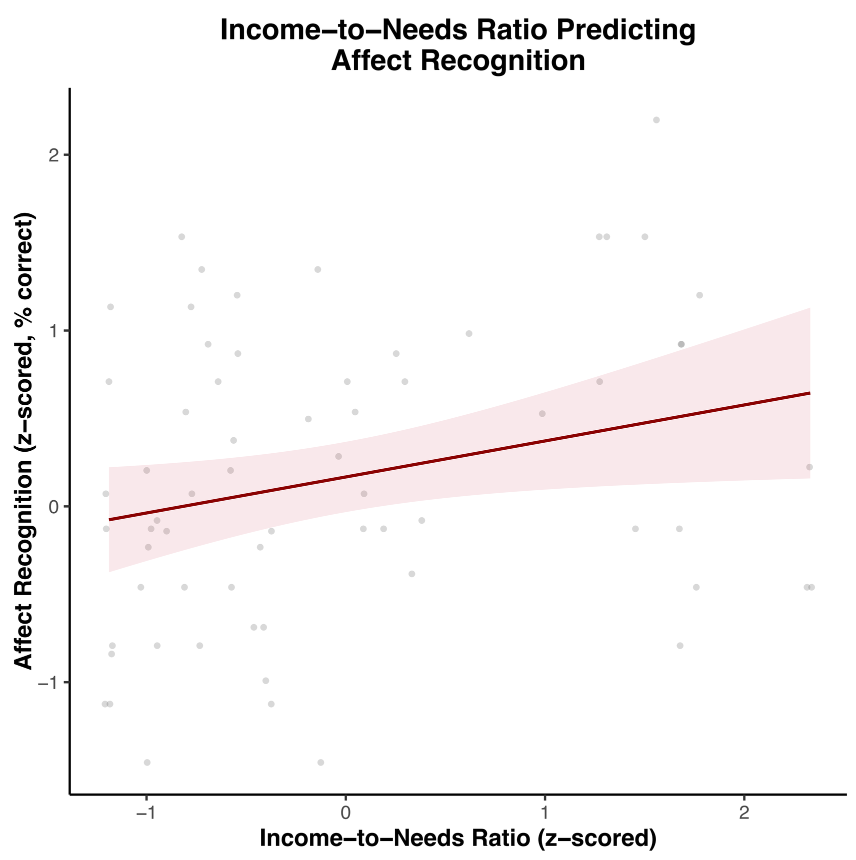
Aim 2: Frontolimbic Moderation of SES Effects on AR

- OFC thickness and hippocampal structure showed moderation trends
- Thinner OFC / smaller hippocampi ➡ stronger positive INR-AR association
- Moderation effects did not survive FDR corrections.

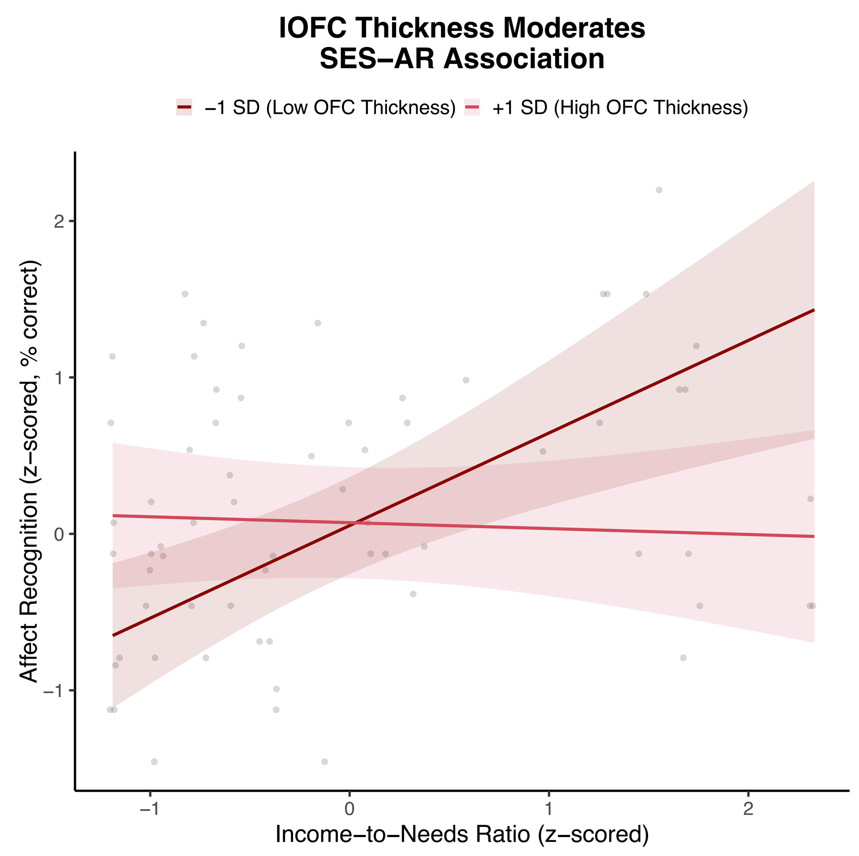
Table 2. *Frontolimbic Moderation of INR - AR Effect*

Predictor	b	p	FDR Adj. p
OFC Thickness			
INR x lOFC Thickness	-0.29	0.003**	0.07
INR x mOFC Thickness	-0.20	0.03*	0.42
Hippocampus			
INR x Hippocampus Vol.	-0.2	0.04*	0.09
INR x Hippocampus SA	-0.23	0.02*	0.08

Note: b = unstandardized regression coefficient. Covariates: age, sex, intracranial volume. FDR corrections were applied within cortical (24 interactions) and subcortical (4 interactions) families.



Note. *Shaded band reflects 95% confidence interval*



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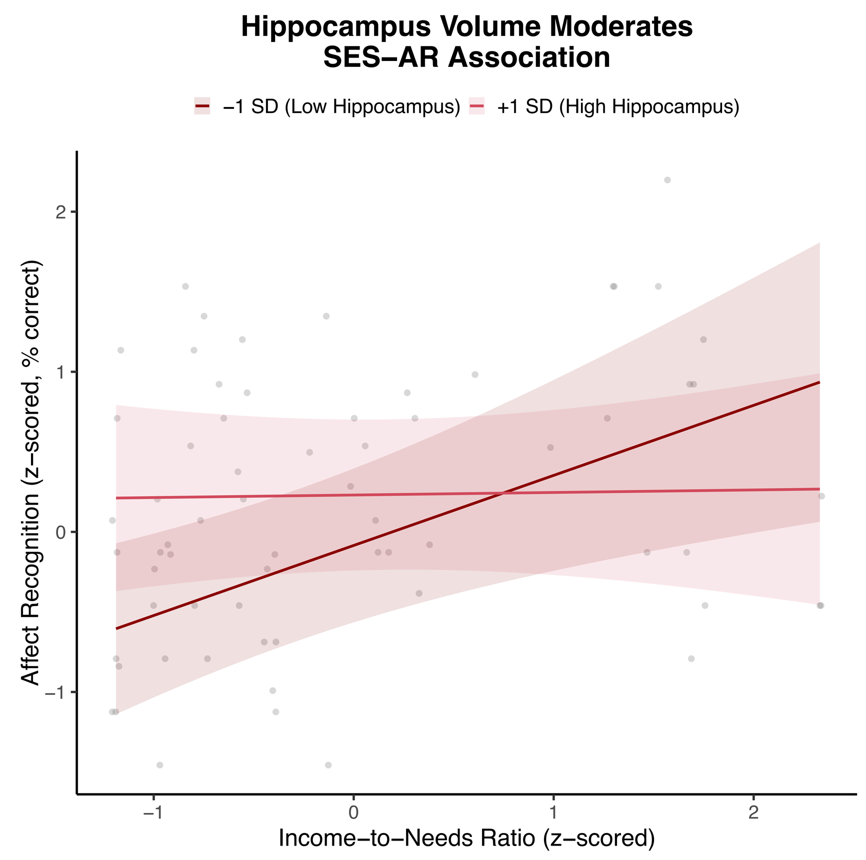

Note. *Shaded band reflects 95% confidence interval*

Discussion

- These findings suggest that individual differences in early AR are closely linked with SES and may reflect differences in environmental exposure and learning opportunities rather than solely fixed child-level ability.
- These findings highlight the importance of integrating social determinants of health into pediatric neuropsychology, particularly when interpreting AR performance within the context of children's socioeconomic environments.
- Preliminary moderation effects involving OFC thickness and hippocampus structure suggest that frontolimbic neurodevelopment may be associated with differences in children's sensitivity to socioeconomic context during early socioemotional development.

Limitations & Future Directions

- Moderation results did not survive FDR corrections and should be interpreted cautiously.
- The NEPSY AR task assesses decontextualized facial emotion matching, which may not fully capture all aspects of socioemotional functioning.
- Future studies should test whether SES-related differences in AR are associated with real-world socioemotional functioning such as peer relationships.
- Longitudinal research is also needed to examine whether changes in access to resources are linked to changes in socioemotional developmental trajectories, and whether frontolimbic development predicts changes in children's sensitivity to SES in the development of AR over time.

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Legend: *AR = Affect Recognition; SES = Socioeconomic Status; INR = Income-to-Needs Ratio; ROI = Region of Interest; mOFC = Medial Orbitofrontal Cortex; lOFC = Lateral Orbitofrontal Cortex; rACC = Rostral Anterior Cingulate Cortex; cACC = Caudal Anterior Cingulate Cortex; ICV = Intracranial Volume*