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General and Specific Factors of Environmental Stress and their Associations with Brain Structure and Psychopathology

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Introduction

- Background:** Early life stress can adversely affect the developing brain. While hierarchical modeling has established the existence of a general factor of psychopathology, no studies have modeled a general factor of environmental stress and related this to brain development
- Objective:** Identify general and specific factors of environmental stress and test their associations with brain structures and psychopathology symptoms in children
- Hypotheses:** General factor of environmental stress will be related to globally smaller brain volumes and thinner cortices as well as greater psychopathology

Materials and Methods

- Participants:** 9-10 year old children from Wave 1 (release 3.0) of the Adolescent Brain and Cognitive DevelopmentSM Study (ABCD Study[®]; $N = 11,878$, 51% male, 53% White).
- Environment Measures:** 117 items reflecting early life stress (e.g., family/community characteristics, physical environment, and interpersonal relationship)
- Psychopathology Measures:** 66 Child Behavior Checklist items
- Brain Structures:** Regional cortical and subcortical gray matter volume (GMV) and cortical thickness were examined
- Statistical Analyses**
 - Exploratory Structural Equation Modeling* followed by *Bifactor Modeling* identified general and specific factors of environmental stress and psychopathology
 - Structural Equation Modeling* was performed with 1) environmental factors predicting regional cortical thickness and GMV, controlling for demographic factors and scanner models and 2) environmental factors predicting psychopathology symptoms

Results

Figure 1. A bifactor analysis identified general and specific factors of environmental stressors and psychopathology

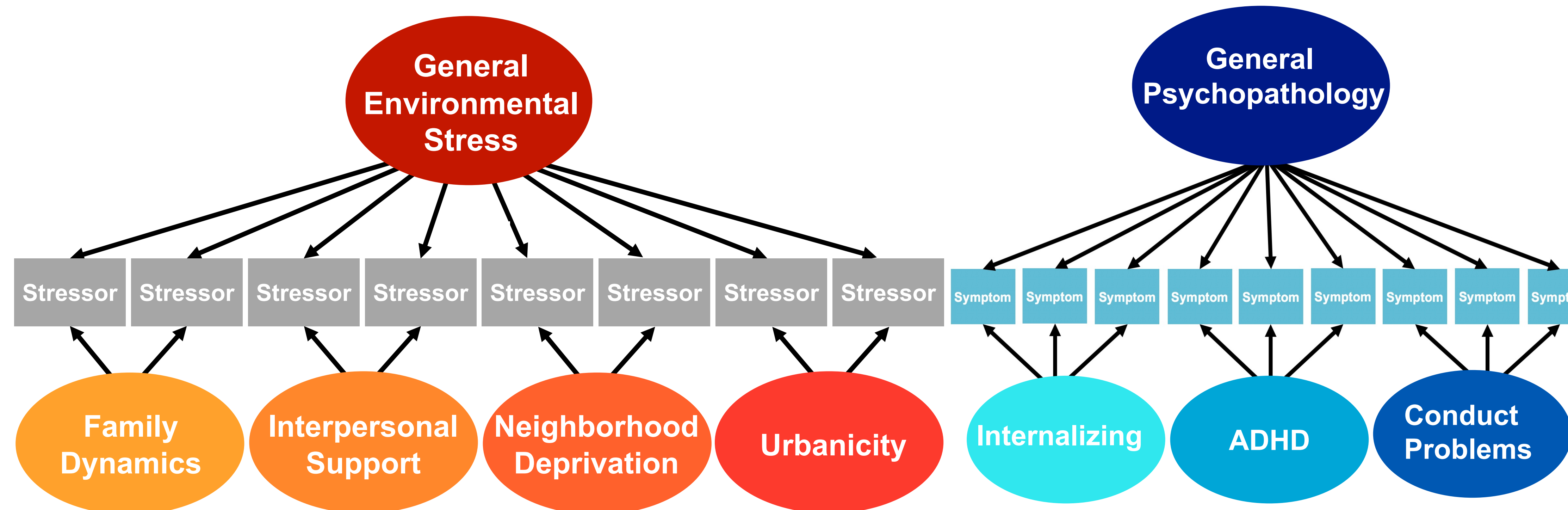


Figure 2. Regions with significant associations between regional GMV and environmental stress factors (FDR; $q < .05$)

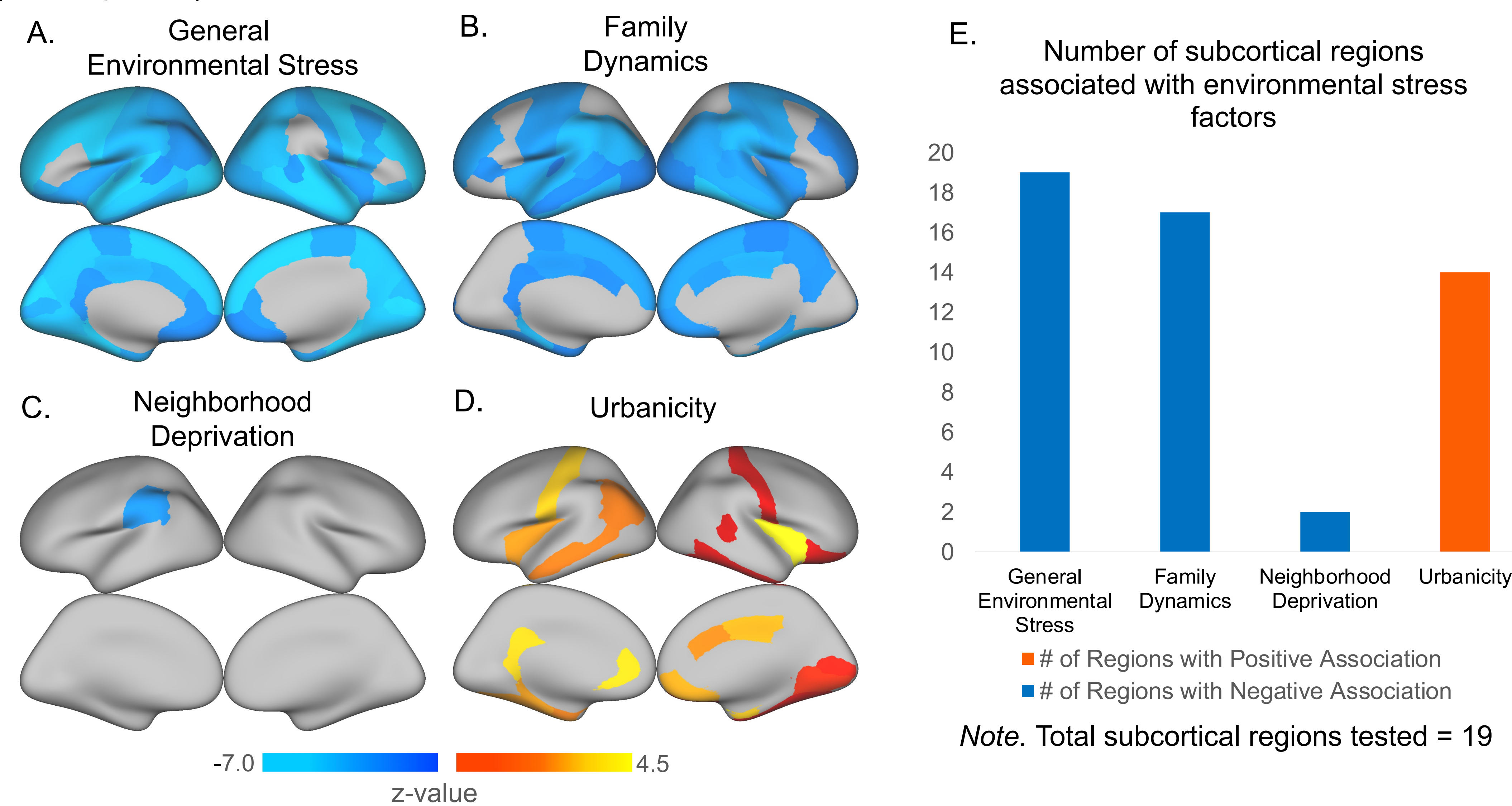


Figure 3. Regions with significant associations between regional cortical thickness and environmental stress factors (FDR; $q < .05$)

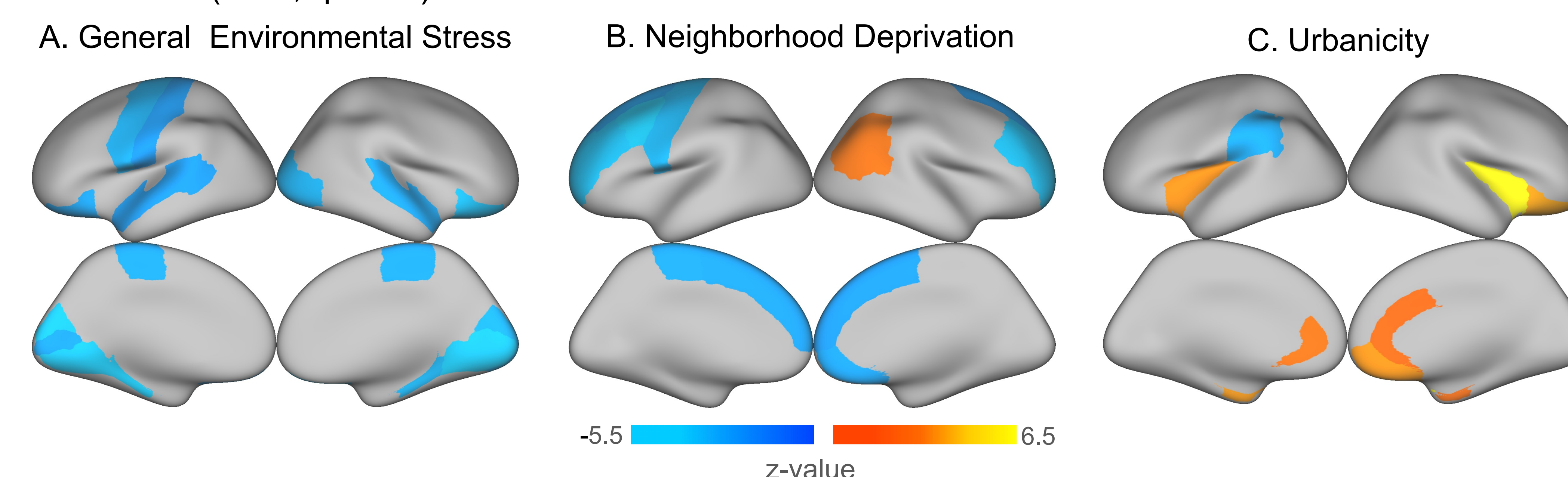


Table 1. Regression coefficients (β) indicating the relationship between environmental stress factors and psychopathology dimensions (FDR; $q < .05$)

Predictor	General Environmental Stress	Family Dynamics	Interpersonal Support	Neighborhood Deprivation	Urbanicity
General Psychopathology	-0.03 ^{ns}	0.84 ^{***}	-0.15 ^{***}	0.02 ^{ns}	-0.02 ^{ns}
Internalizing	0.08 ^{***}	-0.00 ^{ns}	0.08 ^{**}	0.05 ^{ns}	-0.02 ^{ns}
ADHD	0.09 ^{***}	0.84 ^{***}	-0.25 ^{***}	0.08 ^{***}	-0.04 [*]
Conduct Problems	0.09 ^{***}	0.92 ^{***}	-0.23 ^{***}	0.08 ^{***}	-0.03 ^{ns}

Conclusions

- The current study found the hierarchical structure of environmental stress, which is consistent with prior theories of environmental influence on child development
- Bronfenbrenner's ecological systems theory¹ suggests that child development is affected by multiple levels of child's environment from the immediate family/school characteristics to the broad influence of the society.
- The general and specific factors of environmental stress may possess risk on brain-behavior outcomes.
- On the other hand, the "unique" variance of urbanicity might be distinctive from other stress factors in terms of its influence on brain development

Support & Disclosures

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References

¹ Bronfenbrenner U: The Ecology of Human Development: Experiments by Nature and Design. Cambridge, MA, Harvard University Press, 1979