The Effects of Maternal Depression during Pregnancy on the Neurodevelopment of Social Cognition in Kindergarten-Aged Children

Amy Anderson-Zose1*, Anjana Muralidharan1,3, Opal Ousley1,2, Zachary Stowe1, D. Jeffery Newport1, Tim Ely1 and Clinton Kilts1

1 Department of Psychiatry and Behavioral Sciences, Emory University, Atlanta, USA
2 Emory Autism Center, Emory University, Atlanta, USA
3 Department of Psychology, Emory University, Atlanta, USA

Children exposed to prenatal maternal depression have increased risk for anxiety, depression, and other developmental and affective problems. The specific impact of prenatal maternal depression on the neurodevelopmental processes that underlie this risk remains poorly characterized. I explored the behavioral and neurodevelopmental trajectories of these children to test the overarching hypothesis that prenatal maternal depression represents a neurodevelopmental teratogen that disrupts child emotional, social and cognitive development and thus confers risk for psychological and developmental problems later in the child’s life.

In collaboration with the Emory Women’s Mental Health Program, I identified ~50 children whose mothers’ depression severity and medication were monitored during pregnancy and in the post-partum period. I used functional magnetic resonance imaging (fMRI) during a joint attention task to define the neurodevelopment of social cognition for 4.5-6 year old offspring of these mothers. Offspring were categorized by the severity and gestational timing of prenatal maternal depression, based on 4-16 separate clinical interviews during pregnancy. Current clinical status and behavior of the offspring are measured via parent questionnaires and a clinical interview with the mother.

To date, we have collected and analyzed complete fMRI and behavioral data for ten children (ages 58-78 months, 4 boys/6 girls, 5 low/5 high depression). The preliminary task-related neural responses were consistent with the children’s processing of social signals and affect regulation (vACC/subgenual ACC), effortful control of joint attention (right IFC, pSTS), and the processing of happy facial expressions (right fusiform gyrus, dmPFC). All results are shown at p < 0.005, k > 5 voxels and were not significantly changed when age and IQ were controlled for. In addition, a regression analysis of the impact of the severity of prenatal maternal depression on task-related neural responses indicated that a more severe prenatal burden of MDD was associated with lesser right dlPFC response to cognitive interference in the joint attention task in offspring (p < 0.01, k > 5 voxels). The results of these regressions with individual prenatal maternal MDD severity were unaffected after adjusting for differences in child age or IQ. However, task performance (reaction times) was not related to maternal depression burden. In addition, emotional, social, and behavior problems from the behavioral questionnaires were not correlated with maternal depression burden.

While preliminary, these results suggest that prenatal maternal depression dramatically compromises the childhood maturation of self-regulatory functions of the dlPFC. This neurological deficit is not manifested in task performance or current child behavior, thus it may represent a plausible neurodevelopmental risk factor for future psychological and developmental problems seen in children exposed to maternal depression during pregnancy. This demonstrates the importance of identifying biological markers of risk, which may appear developmentally prior to observable symptoms.