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Prenatal alcohol exposure alters brain activity in the frontal-striatal areas

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Heavy prenatal alcohol exposure does not always lead to fetal alcohol syndrome (FAS); sometimes it can lead to cognitive and behavioral deficits in the absence of craniofacial features needed to make an FAS diagnosis. A new study has found that children and adolescents prenatally exposed to alcohol have altered responses in frontal-striatal areas, brain regions that may inhibit behavior.

Results are published in the August issue of *Alcoholism: Clinical & Experimental Research*.

"Prenatal alcohol exposure is a major public health concern, both here in the U.S. and internationally," said Susanna L. Fryer, a fourth-year graduate student in the San Diego State University/University of California, San Diego joint doctoral program in Clinical Psychology. "Experts estimate that nine per 1000 births in this country show evidence of clinically significant effects of prenatal alcohol exposure."

Inattention and behavioral disinhibition are considered hallmark features of prenatal alcohol exposure, added Fryer, also the study's corresponding author.

"Anecdotal observations from parents, other caregivers, and teachers of individuals with prenatal alcohol exposure tell of poor behavioral regulation," said Fryer. According to the study, individuals with FASD are at greater risk for attention deficit hyperactivity disorder and other psychiatric diseases linked with poor inhibitory control. “Also, in a

possible reflection of poor behavioral regulation, individuals with histories of prenatal alcohol exposure are thought to be over-represented in the criminal-justice system," she said.

Previous research had suggested that the frontal-subcortical brain regions that are thought to be responsible for behavioral inhibition are damaged by prenatal exposure to alcohol.

For this paper, researchers examined 22 children and adolescents (ages 8 to 18), part of a larger study at the Center for Behavioral Teratology, San Diego State University, which is overseen by study co-author and laboratory director Edward P. Riley. All participants – 13 with and nine without histories of heavy prenatal alcohol exposure – underwent functional magnetic resonance imaging (fMRI) while performing a response inhibition (go/no-go) task, designed to test their ability to inhibit or curb a previously encouraged response.

"We found two regions within the prefrontal cortex where the youth with alcohol-exposure histories had increased brain activation and one area in the subcortex (called the caudate nucleus) where the alcohol-exposed youth had decreased brain activation," said Fryer. "Exactly what these differences in brain activation indicate is not known, as the nature of the blood oxygen level dependent (BOLD) response patterns, measured via fMRI, is still under study. One possible explanation is that the increase in prefrontal cortical activation means that the alcohol-exposed youth need to devote more cortical resources than their typically developing peers to complete the task. Another possibility is that the connectivity - [meaning] how different brain regions cooperate and communicate together - between frontal-striatal regions is altered in brains with prenatal alcohol exposure."

Fryer thinks that these findings may have implications for the brains of chronic adult alcohol users. "There is research showing that individuals

who have been exposed to alcohol during gestation are more likely to develop substance-use disorders themselves," she said. "This finding is independent of other factors that might also influence development of alcoholism, like having biological relatives with alcoholism."

Fryer said that this neuroimaging study supports 30 years of previous research. "Prenatal alcohol exposure can cause damage to the brain that results in significant problems with regulating behavior and optimal thinking and learning," she said.

Source: San Diego State University