Deficits in number processing in children with ADHD and alcohol exposure: Similar but different

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In children, the brain is in a constant state of flux as it analyzes and evaluates stimuli from the environment. Fetal alcohol exposure and ADHD represent two disorders that can affect children's ability to learn and process information from a very young age.

Both ADHD and fetal alcohol exposure are linked to poor academic performance in cognition and attention, so the researchers decided to try to pinpoint the exact brain areas affected by each disorder with the hope that this research could lead to the creation and development of new and improved treatments.

The results will be published in the March 2011 issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

Joseph L. Jacobson, lead author of the study and Professor in the Department of Psychiatry and Behavioral Neurosciences at the Wayne State University School of Medicine, said that the goal of the study was to determine if alcohol-related deficits in magnitude comparison (the ability to mentally represent and evaluate relative quantities) seen in children with prenatal alcohol exposure would also be true for ADHD.

"We thought it very interesting that this is not the case. The arithmetic deficit in ADHD is mediated primarily by poorer executive function and

attention problems rather than magnitude comparison, which is more often impaired in children with fetal alcohol exposure."

The researchers assessed 262 African-American adolescents at 14 years of age. Their mothers were recruited during pregnancy and interviewed extensively regarding their use of alcohol to determine the amount of alcohol the child was exposed to prior to birth. The children were evaluated for ADHD symptoms at ages 7.5 and 14 by parent/guardian and teacher reports, and their number processing abilities were assessed at 14 years.

The results showed that children with fetal alcohol exposure demonstrated strong deficits in number comparison, while children with ADHD demonstrated deficits in attention and memory. Thus, although number processing is affected in both ADHD and fetal alcohol exposure, the exact cause of the difficulties appears to be different.

In a related study using functional magnetic resonance imaging (fMRI) conducted in Cape Town, South Africa, the researchers found that, when given simple number processing problems, alcohol-exposed children appear to be able to recruit different brain regions to compensate for the damage done to the areas of the brain. However, the recovery is never complete and is variable at best depending on the child.

"The extent of the brain damage experienced by the individuals is an important predictor of recovery of function and is influenced by the quantity and duration of alcohol consumed while in utero and various genetic and metabolic characteristics of the mother and fetus," said Julie A. Kable, an Assistant Professor in the Department of Pediatrics at the Emory University School of Medicine. "More extensive damage leads to less available resources to compensate."

However, Jacobson does not consider the performance of the children in

this study to constitute recovery. He said that the alcohol-exposed children in the fMRI study performed as well as the control group on the arithmetic tasks only because of the relatively easy nature of the problems selected for that study.

"In our view, the alternate strategies these children use are less efficient than those used by the controls. As a result, these strategies are not likely to be as effective as the problems get harder."

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