

Breathing dirty air during pregnancy raises odds of childhood ADHD-related behavior problems

November 5 2014



Children with ADHD find it more difficult to focus and to complete their schoolwork. Credit: public domain image

Prenatal exposure to polycyclic aromatic hydrocarbons, or PAH, a component of air pollution, raises the odds of behavior problems

associated with attention deficit hyperactivity disorder, or ADHD, at age 9, according to researchers at the Columbia Center for Children's Environmental Health at the Mailman School of Public Health. Results are published online in the journal *PLOS ONE*.

The researchers followed 233 nonsmoking pregnant women and their children in New York City from pregnancy into childhood, and found that children born to mothers exposed to high levels of PAH during pregnancy had five times the odds of a higher-than-usual number and degree of symptoms that characterize ADHD—specifically inattentive-type ADHD at age 9—compared with children whose mothers did not have high PAH exposure. The study is the first to explore the connection between prenatal PAH and ADHD in school-age children over time.

"This study suggests that exposure to PAH encountered in New York City air may play a role in childhood ADHD," says lead author Frederica Perera, DrPH, PhD, director of the Center and professor of Environmental Health Sciences at the Mailman School. "The findings are concerning because attention problems are known to impact school performance, social relationships, and occupational performance."

The Centers for Disease Control estimates that around 10 percent of American children have ADHD in one of three types: inattentive ADHD, in which children have a hard time focusing and are easily distracted and disorganized; hyperactive and impulsive ADHD; or a combination of the two. Little is known about what causes ADHD, but, in addition to genes, environmental factors are known or suspected to play a role.

PAH are toxic air pollutants generated by many sources, such as traffic, residential boilers, and electricity generating plants using fossil fuel. Researchers measured levels of maternal PAH exposure using PAH-DNA adducts in maternal blood obtained at delivery. Childhood PAH

exposure was measured by PAH metabolites in urine at ages 3 or 5 years. ADHD behavior problems were assessed using the Conners' Parent Rating Scale.

The current findings build on the Center's previous studies linking prenatal PAH exposure with behavioral and cognitive issues, including associations with developmental delay at age 3, reduced IQ at age 5, and symptoms of anxiety/depression and attention problems at ages 6 and 7.

The mechanism by which PAH exposure increases the likelihood of ADHD is not fully understood, but the paper lists several possibilities, including the disruption of the endocrine system, DNA damage, oxidative stress, and interference with placental growth factors resulting in decreased exchange of oxygen and nutrients.

Although more research is needed to fully understand this relationship, the researchers say these results are of concern since [children](#) with ADHD are at greater risk for risk-taking behaviors, poor academic performance, and lower earnings. Moreover, ADHD imposes large annual costs to society, estimated between \$36 and \$52 billion in the U.S. and to individuals, estimated to be \$12,005 to \$17,458.

Provided by Columbia University's Mailman School of Public Health

Citation: Breathing dirty air during pregnancy raises odds of childhood ADHD-related behavior problems (2014, November 5) retrieved 27 April 2024 from <https://medicalxpress.com/news/2014-11-dirty-air-pregnancy-odds-childhood.html>

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