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Prenatal exposure to air pollution linked to impulsivity, emotional problems in children

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Exposure to common air pollutants during pregnancy may predispose children to problems regulating their thoughts, emotions, and behaviors later on, according to a new study led by researchers at the Columbia Center for Children's Environmental Health within Columbia University's Mailman School of Public Health and New York State Psychiatric Institute. The new study is the first of its kind to examine the effects of early life exposure to a common air pollutant known as PAH (polycyclic aromatic hydrocarbons) on self-regulating behaviors and social competency that incorporates multiple assessment points across childhood. Children with poor self-regulation skills have difficulty managing disruptive thoughts, emotions, and impulses; poor social competency limits their ability to get along with others. The study appears in the *Journal of Child Psychology and Psychiatry*.

PAH are ubiquitous in the environment from emissions from motor vehicles; oil, and coal burning for home heating and power generation; tobacco smoke; and other combustion sources. (More on PAH and ways to limit exposure can be found on the CCCEH website.) Prenatal exposure to PAH has been associated with ADHD; symptoms of anxiety, depression and inattention; and also behavioral disorders, which are all thought to be related to deficits in self-regulation.

Lead investigator Amy Margolis, assistant professor of medical psychology in the Department of Psychiatry at Columbia University Medical Center and New York State Psychiatric Institute, and colleagues analyzed maternal blood samples and child tests results from 462 mother-

child pairs, a subset of CCCEH's ongoing urban birth cohort study in New York City, from pregnancy through early childhood. Maternal exposure to PAH was determined by presence of DNA-PAH adducts in a maternal blood sample.

Children were tested with the Child Behavior Checklist at ages 3-5, 7, 9, and 11. Scores obtained from the CBCL were used to create a composite score for the Deficient Emotional Self-Regulation Scale (DESR), and higher scores on the DESR indicated reduced capabilities to self-regulate. Investigators found that children whose mothers had higher exposure to PAH in pregnancy had significantly worse scores on the DESR at ages 9 and 11 than children whose mothers had lower exposure to PAH in pregnancy. Over time, low-exposure children followed a typical developmental pattern and improved in self-regulatory function, but the high-exposed children did not, underscoring the long-term effect of early-life exposure to PAH. Additionally, researchers found that DESR score had a mediating effect on tests of social competence, indicating that self-regulation is an important factor in developing social competence.

The evidence that prenatal exposure to PAH leads to long-term effects on self-regulatory capacities during early and middle childhood suggests that PAH exposure may be an important underlying and contributing factor to the genesis of a range of childhood mental health problems. In terms of a potential mechanism, researchers suggest that prenatal exposure to PAH damages neural circuits that direct motor, attentional, and emotional responses. Further deficits in self-regulation may predispose children to becoming engaged in high-risk adolescent behaviors.

"This study indicates that prenatal exposure to air pollution impacts development of self-regulation and as such may underlie the development of many childhood psychopathologies that derive from

deficits in self-regulation, such as ADHD, OCD, substance use disorders, and eating disorders," says Margolis.

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