NIEHS-funded study shows ADHD-air pollution link

By Tim Paul and Joe Balintfy

Researchers from the Columbia Center for Children's Environmental Health *(http://ccceh.org/)* at the Mailman School of Public Health, funded by NIEHS and the U.S. Environmental Protection Agency, have found that children born to mothers who were exposed to higher levels of air pollution during pregnancy had an increased number and degree of symptoms related to attention deficit hyperactivity disorder (ADHD). Study results *(http://www.ncbi.nlm.nih.gov/pubmed/25372862)* were published online Nov. 5 in the journal PLOS ONE.

The study is the first to explore the connection between prenatal PAH exposure and ADHD in school-age children over time, according to a university news release. *(http://www.mailman.columbia.edu/news/adhd-air-pollution-link)*

"This research follows other discoveries by this center linking air pollution to asthma, developmental delay, lower IQ scores, and behavior problems," explained NIEHS health scientist administrator Kimberly Gray, Ph.D. "This study highlights how increased susceptibility to environmental hazards begins during fetal development."

Perera pointed out that ADHD imposes large annual costs to society — an estimated total between $36 and $52 billion in the U.S. — and to individuals — estimated at $12,005 to $17,458. (Photo courtesy of Columbia University Mailman School of Public Health)

A connection between PAHs and ADHD

The researchers followed 233 nonsmoking pregnant women and their children in New York City from pregnancy into childhood. The study showed that exposure to toxic air pollutants called polycyclic aromatic hydrocarbons, or PAHs, during the prenatal period was associated with fivefold higher odds of behavior problems associated with ADHD at age 9. PAHs are generated by many sources, such as traffic, residential boilers, and electricity generating plants using fossil fuel.

Levels of maternal PAH exposure were measured 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 Child Behavior Checklist and the Conners Parent Rating Scale - Revised.

"This study suggests that exposure to PAH encountered in New York City air may play a role in childhood ADHD," said lead author Frederica Perera, Dr.P.H., Ph.D., *(http://www.mailman.columbia.edu/our-faculty/profile?uni=fpp1)* director of the center and professor of Environmental Health Sciences. "The findings are concerning, because attention problems are known to impact school performance, social relationships, and occupational performance."

Gray noted that the NIEHS Centers for Children's Environmental Health and Disease Prevention Research program conducts webinars on the second Wednesday of every month. (Photo courtesy of Steve McCaw)

Linked Video

Watch a webinar that features Perera as the first of four presenters, talking about her studies with the New York City cohort (01:25:00)

The Centers for Disease Control and Prevention estimates that around 10 percent of American children ages 4 to 17 have ADHD. "ADHD is an important indicator of future achievement," added Gray. "But there are treatments and, most importantly, prevention strategies for ADHD, like reducing environmental exposures."

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 or attention problems at ages 6 and 7.

Although more research is needed to fully understand the mechanism by which PAH exposure increases the likelihood of ADHD, the researchers say these results are significant, since children with ADHD are at greater risk for risk-taking behaviors and poor academic performance.

Citation: Perera FP, Chang HW, Tang D, Roen EL, Herbstman J, Margolis A, Huang TJ, Miller RL, Wang S, Rauh V. *(http://www.ncbi.nlm.nih.gov/pubmed/25372862)*
2014. Early-life exposure to polycyclic aromatic hydrocarbons and ADHD behavior problems. PLoS One 9(11):e111670.

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