

# Mix of stress and air pollution may lead to cognitive difficulties in children

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Children with elevated exposure to early life stress in the home and elevated prenatal exposure to air pollution exhibited heightened symptoms of attention and thought problems, according to researchers at Columbia University Mailman School of Public Health and Columbia Psychiatry. Early life stress is common in youth from disadvantaged backgrounds who also often live in areas with greater exposure to air pollution.

Air pollution has negative effects on [physical health](#), and recent work has begun to also show [negative effects](#) on [mental health](#). Life stress, particularly early in life, is one of the best-known contributors to mental health problems. The new study is one of the first to examine the combined effects of [air pollution](#) and early [life stress](#) on [school-age children](#). Results appear in the *Journal of Child Psychology and Psychiatry*.

"Prenatal exposure to [polycyclic aromatic hydrocarbons](#), a neurotoxicant common in air pollution, seems to magnify or sustain the effects of early life social and economic stress on mental health in children," says first author David

Pagliaccio, Ph.D., assistant professor of clinical neurobiology in psychiatry at Columbia Psychiatry.

"Air pollutants are common in our environment, particularly in cities, and given socioeconomic inequities and environmental injustice, children growing up in disadvantaged circumstances are more likely to experience both life stress and exposure to neurotoxic chemicals," says senior author Amy Margolis, Ph.D., assistant professor of medical psychology in psychiatry at Columbia Psychiatry.

"These exposures have a combined effect on poor mental health outcomes and point to the importance of public health programs that try to lessen exposure to these critical risk factors, to improve not only physical, but psychological health," says Julie Herbstman, Ph.D., associate professor of environmental health science and director of the Columbia Center for Children's Environmental Health at Columbia Mailman School of Public Health.

Data were from the CCCEH Mothers and Newborns longitudinal birth cohort study in Northern Manhattan and the Bronx, which includes many participants who self-identify as African American or Dominican. Mothers wore an air monitoring backpack during the third trimester of pregnancy to measure exposure to air pollutants in their daily lives. When their children were 5 years old, mothers reported on stress in their lives, including neighborhood quality, material hardship, intimate partner violence, perceived stress, lack of social support, and general distress levels. Mothers then reported on their child's psychiatric symptoms at ages 5, 7, 9 and 11.

The combined effect of air pollution and early life stress was seen across several measures of thought and attention problems/ADHD at age 11. (Thought problems included obsessive thoughts and behaviors or thoughts that others find strange.)

The effects were also linked to PAH-DNA adducts—a dose-sensitive marker of air pollution exposure.

The researchers say PAH and early life stress may serve as a "double hit" on shared biological pathways connected to attention and thought problems. Stress likely leads to wide-ranging changes in, for example, epigenetic expression, cortisol, inflammation, and brain structure and function. The mechanism underlying the effects of PAH is still being interrogated; however, alterations in brain structure and function represent possible shared mechanistic pathways.

Earlier studies making use of the same longitudinal cohort data found that [prenatal exposure](#) to air pollution combines with material hardship to significantly increase ADHD symptoms in [children](#). A separate study found a combination of air pollution and poverty lowered child IQ.

**More information:** David Pagliaccio et al, Prenatal exposure to polycyclic aromatic hydrocarbons modifies the effects of early life stress on attention and Thought Problems in late childhood, *Journal of Child Psychology and Psychiatry* (2020). [DOI: 10.1111/jcpp.13189](https://doi.org/10.1111/jcpp.13189)

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