



No. 9 Impacts of air pollution on learning and longer term health

Top line: Evidence is growing on the adverse neurodevelopmental effects of exposure to combustion-related air pollution on learning and longer-term health.

Children are exposed prenatally and in early childhood to multiple environmental stressors that can adversely affect their cognitive abilities, academic performance and consequent educational trajectories, adult health, wealth, and social status. Exposure to higher nitrogen dioxide (NO₂) may have a negative effect on cognition, especially early in life, even at low exposure levels.¹ Other studies have linked roadway proximity, traffic-related PM, elemental carbon, or nitrogen dioxide to decreased cognitive function, including deficits in memory and attention. The effect of polycyclic aromatic hydrocarbon exposures during fetal development on cognitive and behavioural outcomes is magnified by material hardship or maternal demoralization. Low-income communities are thus disproportionately exposed and uniquely vulnerable because of family and community economic hardship. Increasing evidence links prenatal exposure to traffic-related air pollutants and PM_{2.5} to autism spectrum disorder.² The impact on cognitive development of the exposure to air pollution during commuting was explored directly for the first time in a Spanish study.³ The researchers found adverse associations between the levels of Black Carbon and PM_{2.5} during commuting between home and school and working memory.

Exposures to PM₁, PM_{2.5} and PM₁₀ during the first three years of life were associated with the increased risk of autism spectrum disorder (ASD) and there appeared to be stronger effects of ambient PM pollution on ASD in the second and the third years after birth.⁴ UK research suggests that British children with intellectual deficiencies (ID) are significantly more likely than their peers to live in localities with high rates of outdoor air pollution and exposure to diesel.⁵

This UK study was the first to use population-level data to estimate the risk of exposure to outdoor air pollution among children with ID. The results are of importance given the well-established association between exposure to outdoor air pollution and a range of adverse health outcomes. Public health policies that reduce combustion-related air pollution will improve not only cardiovascular and respiratory function but also neurodevelopment.⁶

¹ Freire, C. et al, 2010. Association of traffic related air pollution with cognitive development in children, *Journal of Epidemiology and Community Health*, 64: 223-228.

² Payne-Sturges, D. et al, 2019. Healthy Air, Healthy Brains: Advancing Air Pollution Policy to Protect Children's Health, *American Journal of Public Health*, 109(4): 550-554.

³ Alvarez-Pedrerol, M. et al, 2017. Impact of commuting exposure to traffic-related air pollution on cognitive development in children walking to school, *Environmental Pollution*, 231, Part 1: 837-844.

⁴ Chen, G. et al, 2018. Early life exposure to particulate matter air pollution (PM₁, PM_{2.5} and PM₁₀) and autism in Shanghai, China: A case-control study, *Environment International*, 121, Part 2: 1121-1127.

⁵ Emerson, E. et al, 2019. Risk of exposure to air pollution among British children with and without intellectual disabilities, *Journal of Intellectual Disability Research*, 63(2): 161-167.

⁶ Payne-Sturges, D. et al, 2019.