

# Fine particles in the air associated with higher blood pressure in London teens

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A study of adolescents aged 11–16 in London has found long-term exposure to  $PM_{2.5}$  is associated with higher blood pressure, with stronger associations seen in girls.

Findings also show that exposure to high levels of nitrogen dioxide is associated with lower blood pressure in this group.

The paper, published today in *PLOS ONE* by researchers from King's College London, examines the possible effects of long-term exposure to air pollution in children attending 51 schools across the capital.

Senior author Professor Seeromanie Harding, from King's College London, said, "This longitudinal study provides a unique opportunity to track exposures of adolescents living in deprived neighborhoods. Given that more than 1 million under 18s live in neighborhoods where air pollution is higher than the recommended health standards, there is an urgent need for more of these studies to gain an in-depth understanding of the threats and opportunities to young people's development."

Air pollution particles are inhaled into the body and can get into the bloodstream, causing damage to [blood vessels](#) and airways. While the effect of [air pollution](#) on adult blood pressure is well known, few [longitudinal studies](#) have examined adolescents.

The period between 11 and 16 years of age is particularly important as adolescents continue to grow and develop. Negative effects on their organs at this stage could lead to life-long complications.

Researchers analyzed data from 3,284 adolescents and followed up from ages 11–13 and 14–16 years old. They measured systolic and [diastolic blood pressure](#) at participants schools.

The results show [particulate matter](#) (PM<sub>2.5</sub>), tiny pollutants in the air that come from car exhaust fumes, building and industry materials, were associated with higher blood pressure across all ages, and were particularly felt among girls (a µg/m<sup>3</sup> increase in PM<sub>2.5</sub> was associated with 1.34 mmHg increase in systolic BP for girls and 0.57 mmHg

increase in systolic BP for boys). Higher blood pressure can raise the risk of hypertension, heart attacks and strokes in adulthood.

Interestingly, nitrogen dioxide ( $\text{NO}_2$ ), a pollutant which in London is predominately due to diesel traffic, was associated with lower blood pressure. Systolic blood pressure decreased by  $\sim 5$  mmHg for boys and  $\sim 8$  mmHg for girls when  $\text{NO}_2$  almost doubled from a low to a high concentration .

Previous research has shown  $\text{NO}_2$  may have [damaging effects](#) on the respiratory system, but the impacts of the pollutant on the cardiovascular system is less clear. However, a recent [study](#) from this group found that sitting next to a lit gas cooker—which emits  $\text{NO}_2$ —acutely lowers blood pressure in healthy adult volunteers by  $\sim 5$  mmHg. That effect was explained by a rapid increase in circulating nitrite ( $\text{NO}_2^-$ ) concentration in the blood.

Co-author Dr. Andrew Webb from King's College London said, "The effect of  $\text{NO}_2$  on blood pressure is similar to what we and other researchers have observed previously after ingesting green leafy vegetables or beetroot juice. These are rich in dietary nitrate ( $\text{NO}_3^-$ ) which increases circulating nitrite ( $\text{NO}_2^-$ ) concentration in the blood and lowers blood pressure, an effect which may also be sustained over weeks or months with continued ingestion of nitrate-rich vegetables.

"As  $\text{NO}_2$  also increases circulating nitrite ( $\text{NO}_2^-$ ) concentration, this provides a potential explanation as to why elevated  $\text{NO}_2$  appears to be associated with [lower blood pressure](#) in the adolescents over years."

Researchers also found adolescents from ethnic minority groups were exposed to higher annual average concentrations of pollution at home than their white U.K. peers, but impact of pollutants on blood pressure did not vary according to ethnicity, BMI, or economic status.

A [study in 2021](#) found that 3.1m children across England go to schools in areas exceeding WHO limits on PM<sub>2.5</sub> and 98% of schools in London are in areas exceeding World Health Organization pollution limits.

Corresponding author Dr. Alexis Karamanos, from King's College London, said, "The findings highlight the potential detrimental role of exposure to higher concentrations of particulate matter on adolescents' blood pressure levels.

"Further studies following the same adolescents over time in different socio-economic contexts are needed to understand whether and how exposure to higher pollutant concentrations may affect differently the cardiovascular health of children and adolescents."

Data was taken from the DASH study, a multi-ethnic [longitudinal study](#) which reflects the diversity of London. DASH seeks to understand what contributes to ethnic differences in physical and mental health over the life course and is one of few studies worldwide which includes BP measurement data in childhood and adolescence.

**More information:** Associations between air pollutants and blood pressure in an ethnically diverse cohort of adolescents in London, England, *PLoS ONE* (2023). [DOI: 10.1371/journal.pone.0279719](https://doi.org/10.1371/journal.pone.0279719)

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