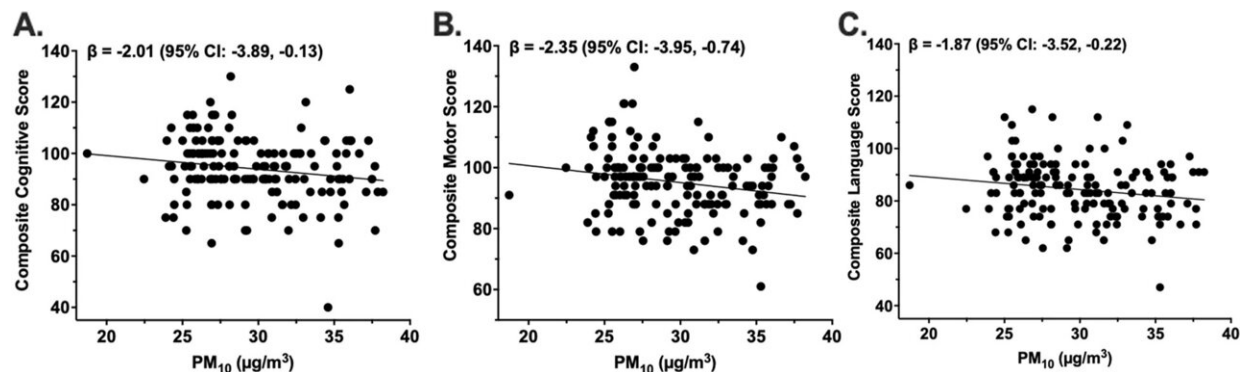


# Prenatal pollution linked to lower cognitive scores in infants

January 24 2023, by Lisa Marshall



Associations Between Prenatal  $PM_{10}$  Exposure and Composite Cognitive, Motor, and Language Scores at 2 Years. Average prenatal exposure to  $PM_{10}$  ( $\mu g/m^3$ ) was inversely associated with composite cognitive score (A), composite motor score (B), and composite language score (C). Unadjusted plots and regression lines for neurodevelopmental scores and prenatal  $PM_{10}$  are shown. Figures show betas ( $\beta$ ) and 95% confidence intervals (CIs) that were scaled to a 1SD difference in exposure (SD  $NO_2$  = 2.43 ppb, SD  $PM_{10}$  = 3.94  $\mu g/m^3$ , SD  $PM_{2.5}$  = 1.24  $\mu g/m^3$ ) from multivariable linear regression models that adjusted for socioeconomic status (SES), breast feedings per day, gestational age, pre-pregnancy BMI, infant birthweight, and infant sex. Credit: *Environmental Health* (2023). DOI: 10.1186/s12940-022-00951-y

Toddlers whose moms were exposed to higher levels of air pollution during mid- to late-pregnancy tend to score lower on measures of cognition, motor coordination and language skills, according to new

University of Colorado Boulder research.

Published today in the journal *Environmental Health*, the study of Latino mother-child pairs is among the first to assess the link between prenatal pollution exposure and [brain development](#) in infancy. It adds to a growing body of evidence suggesting that exposure to dirty air during critical windows of development can have potentially lasting impacts on children's health.

"Our findings suggest that [pollution exposure](#), particularly during mid- to late-pregnancy, may negatively impact neurodevelopment in [early life](#)," said senior author Tanya Alderete, an assistant professor of integrative physiology at CU Boulder.

For the study, the research team followed 161 healthy mother-infant pairs residing in Southern California and enrolled in the Mother's Milk Study, a longitudinal study of infant health. Participants provided detailed histories of where they had lived. Researchers then used the U.S. Environmental Protection Agency's Air Quality System, which records data from ambient monitoring stations around the country, to calculate the mothers' exposure to pollutants from roadside traffic, industry, wildfire smoke and other sources during pregnancy.

When the children reached age 2, they underwent a series of neurodevelopmental tests, assessing cognitive, motor and [language skills](#).

After taking into consideration [socioeconomic status](#), number of times the baby was breastfed per day, whether the infant was early, late or on time, the mother's weight, the baby's birthweight and other factors that could influence results, the study found that 2-year-olds exposed prenatally to more inhalable particulate matter (PM 10 and PM 2.5) scored significantly lower on cognitive tests. For instance, those exposed to PM10 levels at the 75th percentile compared to the 25th percentile

scored about 3 points lower.

Put another way, 16% of participants had a composite cognitive score that indicated some degree of impairment. If all participants had been exposed to as much pollution as the 75th percentile, the prevalence of cognitive impairment at age 2 would be 22%.

## **Mid- to late-pregnancy key**

When the exposure occurred mattered, according to the study, with exposures in mid- to late-pregnancy proving particularly detrimental to neurodevelopment, said first author Zach Morgan, who graduated in May with a master's degree in integrative physiology.

"The brain develops differently at different stages of pregnancy and when you have a disruption at a critical window that can affect the trajectory of that development," he said.

He explained that during mid- to late-pregnancy, key circuits within the brain form to support sensory, communication and motor systems.

While more research is needed to understand just how pollution impacts the [developing brain](#), previous research suggests inhaled pollutants may come into direct contact with the fetus, causing systemic inflammation and oxidative stress that can interfere with neurodevelopment.

Alderete's own research has also shown that exposure to air pollution can impact a baby's gut microbiome in ways that promote inflammation, which could also impact the brain.

Other studies in older children have found associations between prenatal exposure to pollutants and reductions in [white matter](#), cortex thickness and blood flow in the brain as well as lower IQ scores.

The study was restricted to Latino infants, so it is not yet clear whether the results hold for the general population.

Alderete noted that 90% of the world's population is exposed to particulate matter levels exceeding recommended levels, and the burden of exposure is often higher among racial and ethnic minorities and low-income populations. (One EPA study found that [racial minorities](#) are exposed to as much as 1.5 times more airborne pollutants than white counterparts). Additionally, other research by Alderete has shown that Latinos in Southern California tend to live in adverse environmental conditions, including those that have been linked with poor neurodevelopmental outcomes.

"Our findings highlight the importance of addressing the impact of pollution on disadvantaged communities and point to additional steps all families can take to protect their health," said Alderete.

She cautioned that just because a woman was exposed to high levels of pollution while pregnant does not mean that her child will have lasting cognitive deficits.

But she does recommend that [pregnant women](#) be vigilant in avoiding airborne pollutants when possible, particularly in the second and third trimester. They should also avoid exercising outdoors on high [pollution](#) days; invest in an air filtration system inside the home; open the windows while cooking; and steer clear of secondhand smoke.

"This is just one of the many things parents-to-be should be aware of to give their child the best start possible," she said.

**More information:** Zachariah E. M. Morgan et al, Prenatal exposure to ambient air pollution is associated with neurodevelopmental outcomes at 2 years of age, *Environmental Health* (2023). [DOI:](#)

[10.1186/s12940-022-00951-y](https://doi.org/10.1186/s12940-022-00951-y)

Provided by University of Colorado at Boulder

Citation: Prenatal pollution linked to lower cognitive scores in infants (2023, January 24)  
retrieved 25 April 2024 from

<https://medicalxpress.com/news/2023-01-prenatal-pollution-linked-cognitive-scores.html>

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