Smoggier skies, lower scores? A Brazilian study examines the effects of air pollution on students' cognitive performance

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A new study published in the *Journal of the Association of Environmental and Resource Economists* looks at the causal relationship

between outdoor air pollution levels on nationwide university entry examination day and students' cognitive performance in Brazil.

In "The Effects of Air Pollution on Students' Cognitive Performance: Evidence from Brazilian University Entrance Tests," authors Juliana Carneiro, Matthew A. Cole, and Eric Strobl use Brazilian data on concentrations of ozone (O3) and particulate matter (PM10) and a data set of students' scores to examine the impact of air pollution on academic performance in national examinations. The air pollution data focuses on Rio de Janeiro and São Paulo—Brazil's most industrialized states—using air pollution and weather monitoring station data to build a unique data panel from 2015–17.

The authors constructed individual-level panel data for the two days of exams across three years and applied student fixed effects to address potential endogeneity concerns. "In addition," they note, "We take advantage of plausibly exogenous spatial and temporal variation in PM10 across municipalities in the states of Rio de Janeiro and São Paulo and utilize an instrumental variable approach based on wind direction."

The findings suggest that an increase of 10 micrograms per cubic meter (mg/m3) of PM10 on the day of the examination decreases students' scores by 6.1 points (8% SD). "Even when including a more flexible measure of our treatment that is utilizing a dummy variable to account for the days in which PM10 exceeded the WHO's acceptable threshold, our findings still point to negative effects of air pollution on cognitive performance during examinations," they note. Placebo tests, sensitivity checks, and falsifications tests reinforced the main findings: evidence of a link between air pollution and exam performance.

Consistent with previous studies, the authors also find evidence that the effect of air pollution on exam performance appears to affect males more adversely than females. "Our results also suggest that poorer

students may be more susceptible to air pollution than wealthier exam takers," they write, adding, "Our findings provide plausible evidence to suggest that cognitive performance may be hindered by poor air quality, but unequally so."

More information: Juliana Carneiro et al, The Effects of Air Pollution on Students' Cognitive Performance: Evidence from Brazilian University Entrance Tests, *Journal of the Association of Environmental and Resource Economists* (2021). DOI: 10.1086/714671

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