

Office air quality affects workers' cognitive function, study shows

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Feeling sluggish at work? Poor ventilation and pollution might play a part.

A new study by scientists at Harvard has found that the air quality inside an office can have a significant impact on employees' cognitive function, including response times and ability to focus.

"We have a huge body of research on the exposure to outdoor pollution, but we spend 90 percent of our time indoors," Jose Guillermo Cedeno Laurent, a research fellow and lead author of the paper published Thursday in *Environmental Research Letters*, told AFP.

The limited amount of prior studies on indoor settings had focused on measures like thermal comfort and satisfaction, rather than on cognitive outcomes, he added.

Cedeno Laurent and colleagues designed a study that followed 302 office workers across six countries (China, India, Mexico, Thailand, the United States of America, and the United Kingdom) over a period of a year.

It ended in March 2020 when the COVID-19 pandemic brought global lockdowns.

All participants were aged between 18 and 65, worked at least three days in an office building, and had a permanent workstation within the office.

Their workspaces were fitted with an environmental sensor to monitor real time concentrations of fine particulate matter 2.5 micrometers and smaller, PM2.5, as well as carbon dioxide, temperature, and relative humidity.

The participants were given a custom-designed app on their phones to carry out the cognitive tests. They were prompted to take the tests at prescheduled times or when the sensors detected PM2.5 and CO₂ levels that fell below or exceeded certain thresholds.

CO₂ concentrations serve as a proxy for ventilation levels. Outside, concentrations are around 400 ppm (parts per million), while 1000 ppm is cited as an upper limit for indoors.

There were two tests. The first required employees to correctly identify the color of displayed words that spelled out another color.

This evaluated cognitive speed and the ability to focus on relevant stimuli when irrelevant stimuli are being presented.

The second test involved basic addition and subtraction with two-digit-long numbers, to assess cognitive speed and working memory.

Open a window

Results showed that an increase of 10 micrograms per cubic meter of PM_{2.5} led to about a one percent reduction in response times to both tests, and more than a one percent reduction in accuracy.

For a frame of reference, the outdoor PM_{2.5} levels in the US capital Washington were 13.9 micrograms per cubic meter on Thursday, according to the IQAir tracking site, while it was 42 micrograms per cubic meter in New Delhi.

In terms of CO₂, an increase of 500 ppm (parts per million), which is not an unusual level of variation, led to a more than one percent drop in response times, and more than two percent drop in accuracy across both tests.

The research comes as US Congress is poised to pass an infrastructure package, and Cedeno Laurent argues now is the time to plan for energy efficient, high performance buildings that provide the right amount of ventilation and air filtration.

While past studies have shown that prolonged exposure to PM2.5 inflames the central nervous system and crosses the blood-brain-barrier to cause long term neurodegenerative disease, this is the first to show short term effects, he added.

For employees returning to in-person office work, there are some solutions.

Opening a window is one, said Cedeno Laurent. If the outdoor air quality isn't good, upgrading the building's filtration systems or adding high quality portable air cleaners are good ideas.

More information: Jose Guillermo Cedeño Laurent et al, Associations between acute exposures to PM2.5 and carbon dioxide indoors and cognitive function in office workers: a multicountry longitudinal prospective observational study, *Environmental Research Letters* (2021). [DOI: 10.1088/1748-9326/ac1bd8](https://doi.org/10.1088/1748-9326/ac1bd8)

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