

# Exposure to air pollution can worsen patient outcomes from COVID-19

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Data from a new USC study shows a significant increase in the risk of severe outcomes for COVID-19 patients exposed to fine particles (PM2.5) and nitrogen dioxide (NO2), two common (and correlated) components of ambient air pollution in Southern California. Produced by ground and air traffic, industrial burning and other sources, these air pollutants can exacerbate the effects of the SARS-CoV-2 virus over both the short and long term.

"Our research demonstrated that one-year average exposure to PM2.5 translated to a 20-30 percent increase in the risk of hospitalization, intensive respiratory support and ICU admissions from COVID-19. Exposure to NO2 for one month carried an increased risk of 12-18 percent," said Zhanghua Chen, assistant professor of population and public health sciences at the Keck School of Medicine of USC and co-first author of the study. "We also saw that long-term PM2.5 exposure was associated with a higher risk of mortality from COVID-19."

The study appears in the *American Journal of Respiratory and Critical Care Medicine*.

Researchers collaborated with Kaiser Permanente Southern California (KPSC) to examine a cohort of more than 74,000 COVID-19 patients diagnosed from March to August 2020. With detailed residential address history linked to Kaiser Permanente members' [electronic medical records](#) (EMR), investigators were able to accurately predict exposure history for specific pollutants.

## Individual-level results

Earlier in the pandemic, a number of studies using national data in ecological analyses found a link between long-term air pollution exposure and increased COVID-19 incidence and mortality. However, this approach raised important questions and concerns.

"Ecological analyses are subject to a lot of biases, and it wasn't clear whether the findings could be applied beyond the community level," Chen said. "In our population cohort study, we were able to leverage the sophistication of EMR to create a well-defined classification of the severity of COVID-19 outcomes tied to air pollution exposure at the *individual* level."

The results were clear, noted coauthor and Professor of Population and Public Health Sciences Frank Gilliland, MD, Ph.D. "Our study demonstrates that breathing clean air may reduce the severity of the infection. When someone is infected, reducing their exposure to [air pollutants](#) maybe beneficial, as it may decrease the risk for poor outcomes and also has many other health benefits."

## A compelling cohort

In addition to providing individual-level results, utilizing the Kaiser Permanente cohort for the study conferred other benefits as well.

"Kaiser Permanente has enriched patient background information—also known as covariates—encompassing factors including race, ethnicity, sex and [socioeconomic status](#), which enabled us to adjust for social demographics and comorbidities like diabetes, obesity and asthma," said corresponding author Anny Xiang, Ph.D., MS, a senior research scientist at KPSC's Department of Research & Evaluation. "Also, whereas other studies were more focused on older populations, which are more

susceptible to COVID-19, ours has a much broader representation of age range because Kaiser Permanente covers such a large percentage of Southern California residents."

Based on their findings, Chen and her colleagues now plan to examine intervention approaches—such as using air purifiers—to reduce individual levels of PM2.5 exposure. "We're starting some crossover [clinical trials](#) to investigate these types of strategies on a personal level, to see whether they can help reduce cardiometabolic disease risk," she said.

**More information:** Zhanghua Chen et al, Ambient Air Pollutant Exposures and COVID-19 Severity and Mortality in a Cohort of COVID-19 Patients in Southern California, *American Journal of Respiratory and Critical Care Medicine* (2022). [DOI: 10.1164/rccm.202108-1909OC](#)

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