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SCIENCE FOR ENVIRONMENT POLICY

Air pollution exposure may increase severity and fatality of COVID-19 infections



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Marquès, M., Correig, E., Ibarretxe, D., Anoro, E., Arroyo, J. A., Jericó, C., Borrallo, R. M., Miret, M., Näf, S., Pardo, A., Perea, V., Pérez-Bernalte, R., Ramírez-Montesinos, R., Royuela, M., Soler, C., Urquizu-Padilla, M., Zamora, A., Pedro-Botet, J., Masana, L. and Domingo, J. L. (2022) Long-term exposure to PM₁₀ above WHO guidelines exacerbates COVID-19 severity and mortality. *Environment International* 158(106930).

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Researchers evaluate the increased risk of severe and fatal COVID-19 in those patients exposed to air pollutants. This study uses data from hospitals in Catalonia, Spain, to assess whether patients from more polluted areas were more likely to have a severe or fatal COVID-19 response. It finds that exposure to high levels of particulates (microscopic airborne particles) increases the risk of severe disease and death.

The severity and mortality risk of COVID-19 infections is influenced by both demographic factors (including age, sex and race) and clinical factors (including hypertension, cardiovascular diseases, obesity, and diabetes). Exposure to air pollution can increase risks from various respiratory conditions, however, the impacts on COVID-19 infection are not well understood. This study considered long-term exposure to air pollution in the form of particulate matter (PM₁₀) and nitrous oxide (NO₂) and its association with severe and fatal COVID-19 infections.

The study used data from 2 112 patients admitted to 15 hospitals in Catalonia between April and June 2020. The researchers matched each hospital with the nearest research cabin (measurement point) of the [Catalan Atmospheric Pollution Monitoring and Forecasting Network](#) and used data from January 2014 to March 2020 to calculate average long-term pollution exposure. They classified exposure levels as 'high' if they exceeded [World Health Organization](#) (WHO) air-quality guideline levels (annual averages of 20 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for PM₁₀ and 40 $\mu\text{g}/\text{m}^3$ for NO₂). City hospitals were assigned the average value of all measurement points in the city. The researchers analysed the severity of COVID-19 infection (mild, severe or fatal) against multiple variables including age, sex, a range of clinical factors (including obesity, high blood pressure, asthma and diabetes) and air-pollution exposure.

The researchers report that exposure to high levels of PM₁₀ pollution was the second most important variable in explaining severe COVID-19 cases (after age) and the fourth most important in explaining mortality (after age, heart failure and high blood pressure). They estimate that an increase in PM₁₀



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levels of $1 \mu\text{g}/\text{m}^3$ could lead to 3.1% more patients suffering severe symptoms and 2.7% more deaths. Mild COVID-19 cases were more common in areas with low PM_{10} levels, whilst mortalities were more common in areas with high levels, they say. They report that no significant effect of NO_2 exposure was detected by the analysis.

This study adds to a body of literature that associates air pollution with COVID-19 infection outcomes, according to the researchers, and agrees with previous findings that severity correlates with age, obesity, and sex (males being at greater risk). The researchers acknowledge that the study is limited in assuming that hospital patients had lived in the corresponding area for some time and been exposed to the assigned air pollution levels, and in assessing a limited number of air contaminants.

The researchers propose that these findings demonstrate the importance of limiting air pollution, particularly particulates, to benefit human health – and, in particular, the outcomes of COVID-19 infection. They posit that many current guideline levels should be lowered, including those of the WHO, the [United States Environmental Protection Agency](#) and the EU [Air Quality Standards](#) (Directive 2008/50/EC), which stipulate a guideline of $40 \mu\text{g}/\text{m}^3$ annual average for PM_{10} ². Urgent revision is needed, they say, to mitigate the impact of viral infections, including COVID-19, and reduce healthcare costs.

Further information



Caveat:

It is suggested that more research is needed – specifically on the effects of finer particulates included in PM_{10} (such as $\text{PM}_{2.5}$ and PM_1 particles). As they are smaller they can reach deeper into the lungs than the coarser PM_{10} particles and, therefore, might be more specifically linked to COVID outcomes.

1. WHO guideline levels were revised in 2021 to $15 \mu\text{g}/\text{m}^3$ for PM_{10} and $10 \mu\text{g}/\text{m}^3$ for NO_2 .

2. The EU is currently [revising the Air Quality Standards](#) with public consultation completed in December 2021 and Commission adoption planned for the third quarter of 2022.