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COVID-19 cases may rise in cool, dry, wind-free areas with high air pollution, suggests Italian study



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Lolli, S., Chen, Y., Wang, S. and Vivone, G. (2020) Impact of meteorological conditions and air pollution on COVID-19 pandemic transmission in Italy. *Scientific Reports*, 10(1).

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Weather variables and air pollution may favour COVID-19 pandemic transmission, leading to a higher number of deaths, finds a new study conducted in Northern Italian cities during the first lockdown of 2020, when all non-essential activities ceased. The researchers paired data on COVID-19 patients in intensive care units (ICUs), in Milan, Trento and Florence, alongside weather variables and air pollution data for the first wave of the pandemic to establish if the water content of the air (humidity), temperature or air pollution¹, were positively or negatively correlated to the high numbers of COVID-19 patients in ICU admissions.

More than 111 million people globally have been infected with the highly contagious SARS-CoV-2 virus, and over 2.4 million people have died as a result². Italy was the first European country to experience a rapid increase in confirmed cases of COVID-19 infection, with nearly 96 000 Italian citizens having now lost their lives to the associated coronavirus disease².

In early April 2020, Italy reported the highest number of deaths globally. Research suggested that local climatic conditions and air pollution had played a (secondary) role in this rapid transmission — something that has since been suggested for other severely affected regions. In Singapore, for example, a study³ found that higher humidity was related to increases in the number of COVID-19 cases in the city, whereas increased wind velocity led to a decrease (purportedly by causing dispersion of air pollution).

The [European Commission's Joint Research Centre](#) subsequently produced [a critical review](#) of studies on the air pollution-COVID-19 connection⁴ which suggested that evidence of the long-distance transmissibility of SARS-CoV-2 via air pollution was insufficient and, therefore, inconclusive, but that the population may have been made susceptible to more severe COVID-19 symptoms due to pre-existing health conditions related to air pollution.

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COVID-19 cases may rise in cool, dry, wind-free areas with high air pollution, suggests Italian study (continued)

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1. i.e. the atmospheric particulate matter concentration less than 2.5 micrometres (μm) in diameter.

2. Accurate according to the World Health Organisation on 24/02/2021 <https://covid19.who.int/> [Accessed 24 February 2021]

3. Pani, S. K., Lin, N.-H. & Babu, S. R. (2020) Association of COVID-19 pandemic with meteorological parameters over Singapore. *Science of the Total Environment* 740: 2.

4. Dobricic, S., Pisoni, E., Pozzoli, L., Van Dingenen, R., Lettieri, T., Wilson, J. and Vignati, E. (2020) *Do environmental factors such as weather conditions and air pollution influence COVID-19 outbreaks?* Publications Office of the European Union, Luxembourg. doi: 10.2760/6831.

5. Wu, F. et al. (2020) A new coronavirus associated with human respiratory disease in China. *Nature* 579, 265–269; Fattorini, D. and Regoli, F. Role of the chronic air pollution levels in the Covid-19 outbreak risk in Italy (2020) *Environ. Pollut.* 2: 114732; Frontera, A., Martin, C., Vlachos, K. and Sgubin, G. (2020) Regional air pollution persistence links to COVID-19 infection zoning. *J. Infect.* 4: 2.

In this study, the researchers seek to understand whether meteorological and air pollution factors in industrialised northern Italian areas correlate with the number of people hospitalised in ICUs during the first wave of COVID-19 transmission. Cutting air pollution is one of the goals of the [European Green Deal](#), the EU’s action plan to foster a clean, sustainable circular economy, restore biodiversity, reduce pollution and [achieve climate neutrality by 2050](#). Understanding whether environmental factors accelerated the transmission of COVID-19 in Europe will aid authorities in their preparedness to tackle the ongoing COVID-19 pandemic and future diseases, suggest the researchers.

The researchers gathered meteorological and air pollution data from monitoring stations at airports in Florence, Trento and Milan from 19 February to 19 June 2020. They collected publicly available daily data of people with COVID-19 in the ICUs of hospitals across the same areas and time period. Meteorological data included measurements related to temperature, dew point, humidity, wind speed and atmospheric pressure, as well as levels of air pollutants (nitrogen dioxide and fine particulate matter with a diameter of 2.5 micrometres or less ($\text{PM}_{2.5}$)).

Following statistical analysis, the results showed that virus transmission tended to decrease when temperatures and humidity were higher, but increased with higher levels of $\text{PM}_{2.5}$. Increased wind speeds in Milan and Florence correlated to lower levels of virus transmission, perhaps due to their dispersion of air pollution. This suggests that COVID-19 transmission levels rise in dry, cool environments with high air pollution and low wind speeds.

The results suggest that — as do other studies worldwide⁵ — air pollution and meteorological conditions may have played a role in the spread of the COVID-19 pandemic in Northern Italy. However, the researchers highlight that it remains unclear whether air pollution particles carry the virus on them, or whether they turn mild cases into those severe enough to require hospitalisation. The study also only covers a very small number of locations in Italy.

The researchers posit that, while the epidemiological aspects are of paramount importance and play a primary role in COVID-19 transmission, both weather variables and air pollution are co-factors in the disease’s acceleration.