

Improved Air Quality During First Wave of COVID-19 Prevented Around 150 Premature Deaths in Major Spanish Cities

For the first time, researchers have estimated the impact of lockdown-related air pollution reduction on mortality in 47 provincial capital cities

Barcelona, 11 May 2021. Air quality in Spain temporarily improved during the first wave of COVID-19, largely as a result of mobility restrictions. Until recently, however, the effect of this improvement on the health of the population was poorly understood. A new study led by the Barcelona Institute for Global Health (ISGlobal), a centre supported by the "la Caixa" Foundation, together with the Barcelona Supercomputing Center (BSC-CNS), has estimated that **this improvement in air quality prevented around 150 premature deaths** in Spain's provincial capital cities.

Several analyses have estimated the mortality reduction from improved air quality during lockdown periods in China and Europe and found that a **substantial number of premature deaths have been avoided**. The new study, published in *Environmental Pollution*, is the first to focus on Spain, specifically **47 provincial capitals**. First, the researchers assessed changes in levels of air pollution —nitrogen dioxide (**NO₂**) and ozone (**O₃**)— during the lockdown period (57 days) and deconfinement period (42 days) of the **first wave of COVID-19**, which occurred between March and June 2020. The team then estimated the impact of these air quality changes on mortality at the population level.

Lead author **Hicham Achebak**, a researcher at ISGlobal and at the Centre for Demographic Studies (CED), explained the methodology used in the study. "We used machine-learning techniques to take into account the **influence of meteorological factors** when quantifying the effect of lockdown on air quality levels," he noted. "To estimate changes in mortality, we specifically fitted epidemiological models based on **historical health and air pollution data** in each provincial capital city."

The authors found that **NO₂ levels decreased by 51% and 36% during the lockdown and deconfinement periods**, respectively, during the first wave of COVID-19. The level of **ozone** decreased much less on average—by **1.1% and 0.6%**, respectively—although it increased in some of the most populous cities.

Regarding the impact of the reduction in NO₂ on premature mortality, the authors estimated that **around 120 and 50 deaths were avoided during lockdown and deconfinement**, respectively, for a total of approximately 170 premature deaths avoided. COVID-19 lockdowns led to "**unprecedented reductions** in NO₂ concentrations, especially when the most stringent measures to reduce viral spread were applied, reaching up to 65% in some of the cities studied," explained **Hervé Petetin**, researcher at BSC-CNS, who was responsible for the application of machine-learning techniques. Most of the NO₂ emissions in cities come from vehicles, in particular those with diesel-powered engines.

In the case of ozone, the decrease was so small that no premature deaths could be attributed to it. In fact, the researchers estimated that premature mortality attributable to this pollutant increased by approximately **20 deaths** during the study period. **Carlos Pérez García-Pando**, ICREA research professor, AXA professor and head of the **BSC-CNS Atmospheric Composition Group**, which participated in the study, explained: "Even though, on average, there was a small reduction in ozone during the study period, **ozone levels increased in the most populous cities, especially Barcelona and Madrid.**" He

added: “Ozone is a secondary pollutant that can increase when levels of nitrogen oxides decrease in environments that are saturated with this pollutant, such as large urban areas.” The study shows that “potential trade-offs between **multiple pollutants** should be taken into account when evaluating the health impacts of environmental exposures,” he concluded.

Joan Ballester, researcher at ISGlobal and coordinator of the study, commented: “The number of deaths prevented by improvements in air quality in Spain **could be greater.**” The researcher cited **two main reasons** for this assertion: “First, our study focused on provincial capitals, but there are **other cities with high levels of air pollution.** Second, we did not take into account **reductions in fine particulate matter**, which were relatively modest compared to the reductions in NO₂ but most likely contributed to a further decrease in premature mortality.”

“These findings demonstrate the **major short-term health benefits associated with reducing air pollution,**” added Ballester. “With permanent reductions in emissions, the positive effects could be even greater.” In addition to reducing premature mortality, improvements in air quality “could **reduce the disease burden of epidemics that cause respiratory infections such as COVID-19,** since diseases caused by long-term exposure to air pollution are in turn risk factors for the severity and mortality of coronavirus infection,” concluded the researcher.

Reference

Hicham Achebak, Hervé Petetin, Marcos Quijal-Zamorano, Dene Bowdalo, Carlos Pérez García-Pando, Joan Ballester. Trade-offs between short-term mortality attributable to NO₂ and O₃ changes during the COVID-19 lockdown across major Spanish cities. *Environmental Pollution*. 4 May 2021. doi.org/10.1016/j.envpol.2021.117220.

About ISGlobal

The Barcelona Institute for Global Health, ISGlobal, is the fruit of an innovative alliance between the “la Caixa” Foundation and academic and government institutions to contribute to the efforts undertaken by the international community to address the challenges in global health. ISGlobal is a consolidated hub of excellence in research that has grown out of work first started in the world of health care by the Hospital Clínic and the Parc de Salut MAR and in the academic sphere by the University of Barcelona and Pompeu Fabra University. The pivotal mechanism of its work model is the transfer of knowledge generated by scientific research to practice, a task undertaken by the institute’s Education and Policy and Global Development departments. ISGlobal has been named a Severo Ochoa Centre of Excellence and is a member of the CERCA system of the Generalitat de Catalunya.

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