

COVID-19, Air Pollution, and Racial Inequity: Connecting the Dots

Tanujit Dey and Francesca Dominici*



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ABSTRACT: COVID-19 pandemic is a public health emergency. Exposure to air pollution represents a serious health issue in overall mortality worldwide. The health risks of some racial subgroups are spiraling as they have higher levels of exposure to air pollutants, hence being more susceptible to mortality from COVID-19.

As of November 16, 2020, severe acute respiratory syndrome coronavirus 2 has infected millions of people worldwide and caused more than 1.3 million COVID-19 deaths. The highest single contributor to this pandemic—the United States—accounts for more than 246,000 of these deaths. Recent studies have shown the connection between demographic, racial, and environmental factors and the increased severity of COVID-19 health outcomes. First, the elderly and people with multiple clinical conditions are at a higher risk of hospitalization and death due to COVID-19.¹ Second, there is an increasing amount of evidence that short- and long-term exposure to air pollution increases the risk of hospitalization and death due to COVID-19. Third, it has been widely documented that racial disparities play a major role in this pandemic, which is known as “the color of coronavirus”.

Numerous studies have provided consistent evidence that both long- and short-term exposure to fine particulate matter (PM_{2.5}) and other pollutants increase the risk of mortality and morbidity from diseases like asthma, chronic obstructive pulmonary disease, coronary heart failure, diabetes, dysrhythmia, hypertension, myocardial infarction, respiratory conditions, pneumonia, and upper respiratory infection. Our group conducted a recent study² that documented a statistically significant association between long-term exposure to PM_{2.5} and O₃ and risk of acute respiratory distress syndrome among older adults in the United States. Most patients with COVID-19 pneumonia fall under the Berlin definition of acute respiratory distress syndrome.³ We also found that the mortality risk associated with the same increase to long-term PM_{2.5} exposure is three times higher for African Americans.⁴ Furthermore, among zip codes with high levels of PM_{2.5}, 90% were predominantly African American. In summary, African Americans are at higher risk of dying from exposure to air in air pollution, and African Americans consistently breathe higher levels of air pollution.

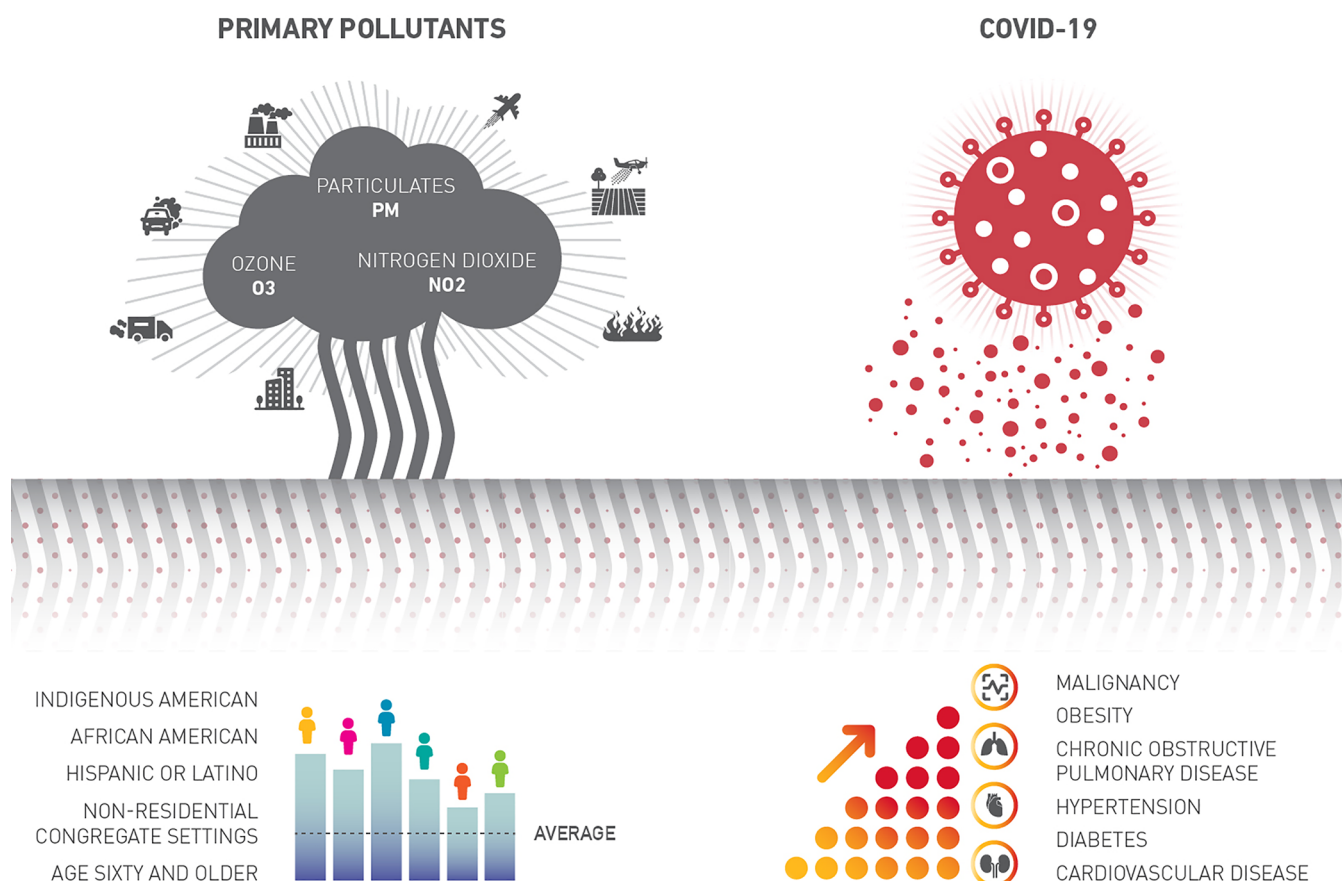
We conducted a large-scale study⁵ where we hypothesized that long-term exposure to PM_{2.5} may increase the risk of death among COVID-19 patients. We estimated the association between long-term PM_{2.5} exposure on COVID-19 mortality rates in the United States. Our study included 3087 counties in the United States and covered 98% of the population. We leveraged our previous efforts that estimated the long-term

effects of PM_{2.5} on mortality among 60 million United States' Medicare enrollees.⁴ Recognizing the limitations of an ecological study design, we found that an increase of 1 μg/m³ in long-term PM_{2.5} exposure is associated with an 8%–11% increase in COVID-19 mortality rate. Our findings align with numerous studies in China and Italy that report similar findings. This is a rapidly evolving research area, and we anticipate that more studies will appear in peer-reviewed literature in the near future.

In addition to the growing evidence that air pollution might increase vulnerability to COVID-19 resulting in hospitalization and/or death, there is another serious aspect revealed as the pandemic progresses—racial disparity. The APM Research Lab (apmresearchlab.org) reported that there are wide disparities by race; the COVID-19 mortality rates are higher among African Americans and Indigenous Americans compared to White Americans. However, when age-adjusted, the mortality rates for Latinos was much higher than any other groups. In our nationwide study,⁵ we reported that counties that have with a higher proportion of African Americans residents are at higher risk of COVID-19 mortality. We also found a 45% increase in COVID-19 mortality rate (CI: 32%, 60%) associated with a 1 standard deviation (per 14.2%) increase in percent African American residents. Underprivileged neighborhoods of Detroit, Chicago, and St. James Parish in Louisiana have experienced some of the country's highest mortality rates from the virus. For example, in Louisiana, 70.5% of deaths have occurred among African Americans, although they only represent 32.2% of the state's population.⁶

The death rate from COVID-19 is six times higher in African American counties than in White American counties.⁶ Even though these are prefatory data and further studies are needed, the pattern of being infected by the virus and the resulting mortality are undeniable. A recent study by Sutter Health

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(<https://www.sutterhealth.org>) shows that after adjusting for comorbidities, minorities are still more vulnerable to the adverse outcomes of COVID-19. This pandemic spotlighted racial disparities and the urgent need to address the causes underlying these inequities. First, racial/ethnic minority populations have a disproportionate burden of underlying comorbidities related to diabetes, cardiovascular disease, asthma, human immunodeficiency virus, morbid obesity, liver disease, and kidney disease. Second, racial/ethnic minorities in urban areas live in more crowded conditions and are more likely to be employed in public-facing roles (e.g., services, transportation, and construction), which limits physical distancing.

When social determinants operate along with health disparities, there is an increase in chronic diseases. Minorities are at a higher risk as a result of limited access to health care, lack of insurance, or minimal access to healthcare providers for routine health assessment, and limited access to green space. Healthcare establishments need to work together to identify and extend their role in addressing the underlying causes that contribute this disparity. They should re-evaluate their outlook, actions, administration, and legislation to address the conditions that contribute to health disparities in these populations.⁷ The COVID-19 pandemic will end, but without action, the inequities will remain. We need to thoroughly evaluate environmental racism—systems that produce and perpetuate inequalities in exposure to environmental pollutants and their long-term health effects.

■ AUTHOR INFORMATION

Corresponding Author

Francesca Dominici – Department of Biostatistics, Harvard T. H. Chan School of Public Health, Boston, Massachusetts 02446, United States; orcid.org/0000-0002-9382-0141; Email: fdominic@hsph.harvard.edu

Author

Tanujit Dey – Center for Surgery and Public Health, Department of Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts 02120, United States

Complete contact information is available at: <https://pubs.acs.org/10.1021/acs.chemrestox.0c00432>

Notes

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■ REFERENCES

- (1) Cevik, M., Kuppalli, K., Kindrachuk, J., and Peiris, M. (2020) Virology, transmission, and pathogenesis of SARS-CoV-2. *BMJ* 371, m3862.
- (2) Rhee, J., Dominici, F., Zanobetti, A., Schwartz, J., Wang, Y., Di, Q., Balmes, J., and Christiani, D. C. (2019) Impact of Long-Term Exposures to Ambient PM_{2.5} and Ozone on ARDS Risk for Older Adults in the United States. *Chest* 156 (1), 71–79.

(3) Bernardo, R. (2020) COVID-19 and ARDS: Ten Things the Cardiologist Needs To Know When on Call. <https://www.acc.org/latest-in-cardiology/articles/2020/05/22/08/29/covid-19-and-ards> (accessed September 28, 2020).

(4) Di, Q, Wang, Y., Zanobetti, A., Wang, Y., Koutrakis, P., Choirat, C., Dominici, F., and Schwartz, J. D. (2017) Air Pollution and Mortality in the Medicare Population. *N. Engl. J. Med.* 376 (26), 2513–2522.

(5) Wu, X., Nethery, R. C., Sabath, M. B., Braun, D., and Dominici, F. (2020) Air pollution and COVID-19 mortality in the United States: strengths and limitations of an ecological regression analysis. *Science Advances* 6, eabd4049.

(6) Yancy, C. W. (2020) COVID-19 and African Americans. *JAMA* 323 (19), 1891–1892.

(7) Evans, M. K. (2020) COVID's Color Line – Infectious Disease, Inequality, and Racial Justice. *N. Engl. J. Med.* 383, 408–410.