

COVID-19 PM2.5

A national study on long-term exposure to air pollution and COVID-19 mortality in the United States

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Exposure to air pollution and COVID-19 mortality in the United States (Updated April 5, 2020)

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Background: United States government scientists estimate that COVID-19 may kill between 100,000 and 240,000 Americans. The majority of the pre-existing conditions that increase the risk of death for COVID-19 are the same diseases that are affected by long-term exposure to air pollution. We investigate whether long-term average exposure to fine particulate matter (PM_{2.5}) increases the risk of COVID-19 deaths in the United States.

Methods: Data was collected for approximately 3,000 counties in the United States (98% of the population) up to April 04, 2020. We fit zero-inflated negative binomial mixed models using county level COVID-19 deaths as the outcome and county level long-term average of PM_{2.5} as the exposure. We adjust by population size, hospital beds, number of individuals tested, weather, and socioeconomic and behavioral variables including, but not limited to obesity and smoking. We include a random intercept by state to account for potential correlation in counties within the same state.

Results: We found that an increase of only 1 $\mu\text{g}/\text{m}^3$ in PM_{2.5} is associated with a 15% increase in the COVID-19 death rate, 95% confidence interval (CI) (5%, 25%). Results are statistically significant and robust to secondary and sensitivity analyses.

Conclusions: A small increase in long-term exposure to PM_{2.5} leads to a large increase in COVID-19 death rate, with the magnitude of increase 20 times that observed for PM_{2.5} and all-cause mortality. The study results underscore the importance of continuing to enforce existing air pollution regulations to protect human health both during and after the COVID-19 crisis. The data and code are publicly available.

Data and Code:

Our data and code is available on github [here](#).

Manuscript and Supplemental Material

- [Manuscript](#)

- [Supplemental Material](#)

- MedRxiv: <https://www.medrxiv.org/content/10.1101/2020.04.05.20054502v1>

- Citation: Exposure to air pollution and COVID-19 mortality in the United States. Xiao Wu, Rachel C. Nethery, Benjamin M. Sabath, Danielle Braun, Francesca Dominici. medRxiv 2020.04.05.20054502; doi: <https://doi.org/10.1101/2020.04.05.20054502>

Acknowledgments

We appreciate the work of Aaron Van Donkelaar, Randall Martin, and his team for providing us with access to their estimates of PM2.5 exposure. Their data (V4.NA.02.MAPLE) can be found on Randall Martin's website here: <https://sites.wustl.edu/acag/datasets/surface-pm2-5/>

The data was produced as part of the following paper:
van Donkelaar, A., R. V. Martin, C. Li, R. T. Burnett, Regional Estimates of Chemical Composition of Fine Particulate Matter using a Combined Geoscience-Statistical Method with Information from Satellites, Models, and Monitors, Environ. Sci. Technol., doi: 10.1021/acs.est.8b06392, 2019.

We would like to thank Lena Goodwin, for editorial assistance in the preparation of this manuscript.

Chinese Translation 中文翻译

美国空气污染和人群中新型冠状病毒（COVID-19）死亡率的关系

背景：美国官方科学家估计，新型冠状病毒可能导致10万至24万美国人死亡。大多数增加COVID-19死亡风险的既往病史与由于长期暴露于空气污染而形成的疾病相同。我们研究了在美国的人群中长期暴露于细颗粒物（PM_{2.5}）是否会增加COVID-19死亡的风险。

方法：我们收集了截至2020年4月4日美国约3000个县（占总人口的98%）的数据。我们以各县的COVID-19死亡率为因变量，以各县的PM_{2.5}长期平均暴露量为自变量，拟合零膨胀负二项混合效应回归模型。我们控制人口规模、医院床位、受检测人数、天气、社会经济和行为方式变量（包括但不限于肥胖指标和吸烟率）作为协变量。我们在模型中包括了一个随机截距项，以解释在同一个州内各县的潜在相关性。

结果：PM_{2.5}长期平均暴露量仅增加1微克每立方米就与新型冠状病毒死亡率增加15%（95%置信区间，5%~25%）相关。这项结果在统计学上具有显著相关性，并且对敏感性分析稳健。

结论：长期暴露于PM_{2.5}可导致新型冠状病毒死亡率大幅度上升，是PM_{2.5}和全因死亡率相关性的20倍。这项研究结果强调了在新型冠状病毒疫情期间以及今后继续执行严格的空气污染防治法律法规以保护人类健康的重要性。这项研究开源了所有数据和代码。

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