Paper critique

The paper presents several strengths in its approach to studying the relationship between wildfire-induced PM2.5 exposure and COVID-19 cases and deaths. Notably, the authors employ a Bayesian hierarchical zero-inflated negative binomial distributed lag model, adeptly handling the lagged effects of PM2.5 on COVID-19 outcomes over a 28-day period, accounting for zero-inflated counts and incorporating county-level heterogeneity. This model choice is well-suited to address the complexities of both exposure timing and data sparsity in COVID-19 counts, enhancing the study's reliability. Additionally, the use of an aggregate effect measure—capturing the percentage increase in cases and deaths due to sustained exposure—aligns with the nature of wildfire events, where high PM2.5 levels persist over multiple days. The paper also includes comprehensive sensitivity analyses, adding robustness to its findings by exploring potential variations and validating the counterfactual PM2.5 values using historical data.

However, several limitations are noteworthy. The study’s focus on wildfire-affected counties may limit generalizability, as it assumes PM2.5 is a uniform pollutant without accounting for potential differences in toxicity between wildfire-generated PM2.5 and PM2.5 from other sources. This assumption could impact the interpretation of health outcomes, especially given evidence that wildfire-related PM2.5 may be more harmful than other types. Additionally, the study does not consider possible mediators, such as variations in public health measures (e.g., mask-wearing), which could influence COVID-19 cases independently of PM2.5 exposure. Finally, the absence of testing rate data poses a limitation, as changing testing practices could introduce bias.

Reference: Zhou, X., Josey, K., Kamareddine, L., Caine, M.C., Liu, T., Mickley, L.J., Cooper, M. and Dominici, F., 2021. Excess of COVID-19 cases and deaths due to fine particulate matter exposure during the 2020 wildfires in the United States. *Science advances*, *7*(33), p.eabi8789.