"Although the epidemiology of COVID-19 is evolving, we have determined that there is a large overlap between causes of deaths of COVID-19 patients and the diseases that are affected by long-term exposure to fine particulate matter (PM2.5)."

It is a great leap from overlap to claiming PM2.5 results in "excess" mortality from COVID-19. But what the heck, why let the fear generated by COVID-19 go to waste?

Let’s begin with the data. The researchers used COVID-19 related deaths by county as compiled by Johns Hopkins. And while it is true that it is the most comprehensive source, the data is based upon death certificates which may not be wholly reliable.

The PM2.5 data comes from averaged prediction data from these counties collected between 2000 and 2016 and are averaged by geography and time, so they are at best an estimate of the predicted long-term presence of PM2.5 in the county. [1] They are not a measure of exposure for two reasons. First, they are not actual measurements but predicted values. Second, those values are “statistically smoothed” using geographical and temporal factors. More importantly, these
values do not measure indoor values, and it is indoors where we spend most of our time – and indoor air pollution may play a substantial role in our total pollution exposure.

The authors also considered confounders, that is, variables that are also associated with the exposure (presence of PM\textsubscript{2.5}) and outcome (COVID-19 deaths). Those variables included population density, percent of the population over age 65, poverty, educational level, BMI, and ever-smoking [2]. Every one of these confounders is also associated with a variety of medical conditions, including diabetes, hypertension, cardiovascular disease, and respiratory disease. These, in turn, are COVID-19 risk factors.

The researchers made use of 1783 counties across the country in which all data was available. In doing so, they increased the population density being considered from 446 persons/mile\textsuperscript{2} to 608 persons/mile\textsuperscript{2}. Since population density bears a direct relationship to the spread of COVID-19 and subsequent deaths, that artificially heightens the effect they subsequently report.

They concluded that a 1 µg/m\textsuperscript{3} increase in PM\textsubscript{2.5} resulted in an excess of 15% more COVID-19 deaths. But, as described above, they never determined the actual PM\textsubscript{2.5} exposure. Nor do they account for the duration of exposure, the second component of dose. When people move from one area to another, they do not magically acquire the locations attributable dose. Moreover, they never separate PM\textsubscript{2.5} from its fellow travelers, all of which are associated with adverse health. A more pertinent finding would be the adverse effect of PM\textsubscript{2.5} relative to more readily identifiable health risks, like cardio-respiratory diseases or population density.

The bias in the study can be identified in juxtaposing two of the authors’ statements.

“We hypothesize that because long-term exposure to PM\textsubscript{2.5} adversely affects the respiratory and cardiovascular system, it can also exacerbate the severity of the COVID-19 infection symptoms and may increase the risk of death in COVID-19 patients. …

The results of this study also underscore the importance of continuing to enforce existing air pollution regulations during the COVID-19 crisis. Based on our result, we anticipate a failure to do so can potentially increase the COVID-19 death toll and hospitalizations, further burdening our healthcare system and drawing resources away from COVID-19 patients.”

How can a short-term relaxation of air quality standards be responsible for excess deaths they attribute to long-term exposures? If short term effects are so impactful, why hasn’t that been identified? Most current atmospheric studies show cleaner air due to reduced traffic and energy production.

And then there is this, from the New York Times:
“The paper found that if Manhattan had lowered its average particulate matter level by just a single unit, or one microgram per cubic meter, over the past 20 years, the borough would most likely have seen 248 fewer Covid-19 deaths by this point in the outbreak.”

The phrasing makes it seem that PM$_{2.5}$ has remained static, but according to the researcher’s data, during those 20 years, PM$_{2.5}$ in Manhattan was reduced from 12 µg/m$^3$ to 8.5 µg/m$^3$.

[1] The data is based on satellite images fused with a model of atmospheric dispersion and actual ground-level measurements. During the period in question, US PM$_{2.5}$ was reduced from 12 µg/m$^3$ to 8.5 µg/m$^3$ further complicating a determination of actual exposure.

[2] An ever smoker is someone who has smoked at least once. It does not describe their pack years or current smoking status.

Source: “Exposure to air pollution and COVID-19 mortality in the United States [2]”


Links