When exposed to smoke, it is easier to become infected from the novel coronavirus

ー**Michiyuki Matsuzaki, Director, Japan Society for Tobacco Control**
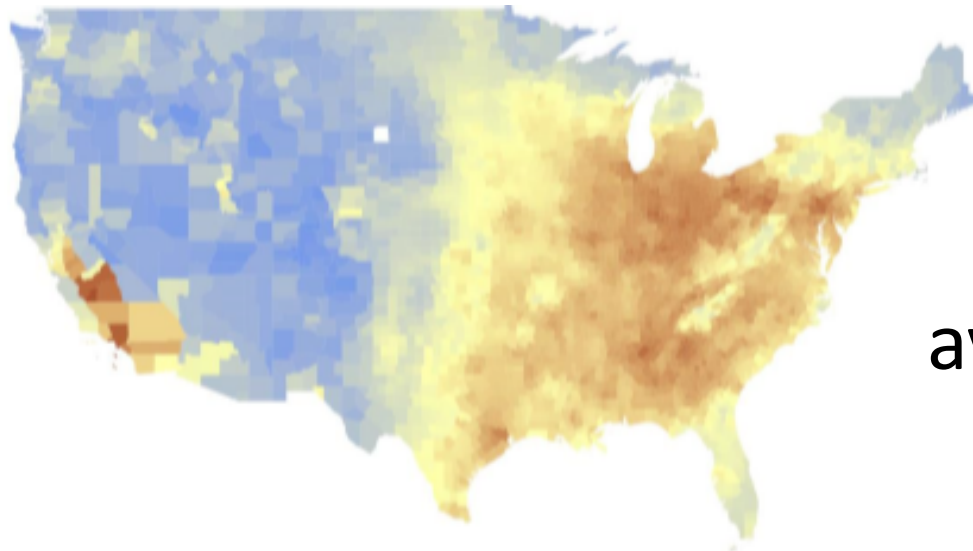
PM$_{2.5}$

1. PM$_{2.5}$ exposure increases significantly from smoking

2. Increased PM$_{2.5}$ exposure increases the expression of ACE2 receptors

3. An increase in PM$_{2.5}$ exposure by $1\mu g/m^3$ increases mortality from the novel coronavirus by 8%

Exposure to particulate matter (ex., PM$_{2.5}$) raises the risk of infection from the novel coronavirus

Reasons why PM$_{2.5}$ raises the risk of infection from the novel coronavirus

- The ACE2 receptor is the point where the novel coronavirus can penetrate cells
- Increased expression of respiratory ACE2 receptors from exposure to PM$_{2.5}$ and other particulate matter has been confirmed in animal and human alveolar cell experiments
- Epidemiological studies have confirmed that PM$_{2.5}$ exposure increases mortality risk from the novel coronavirus
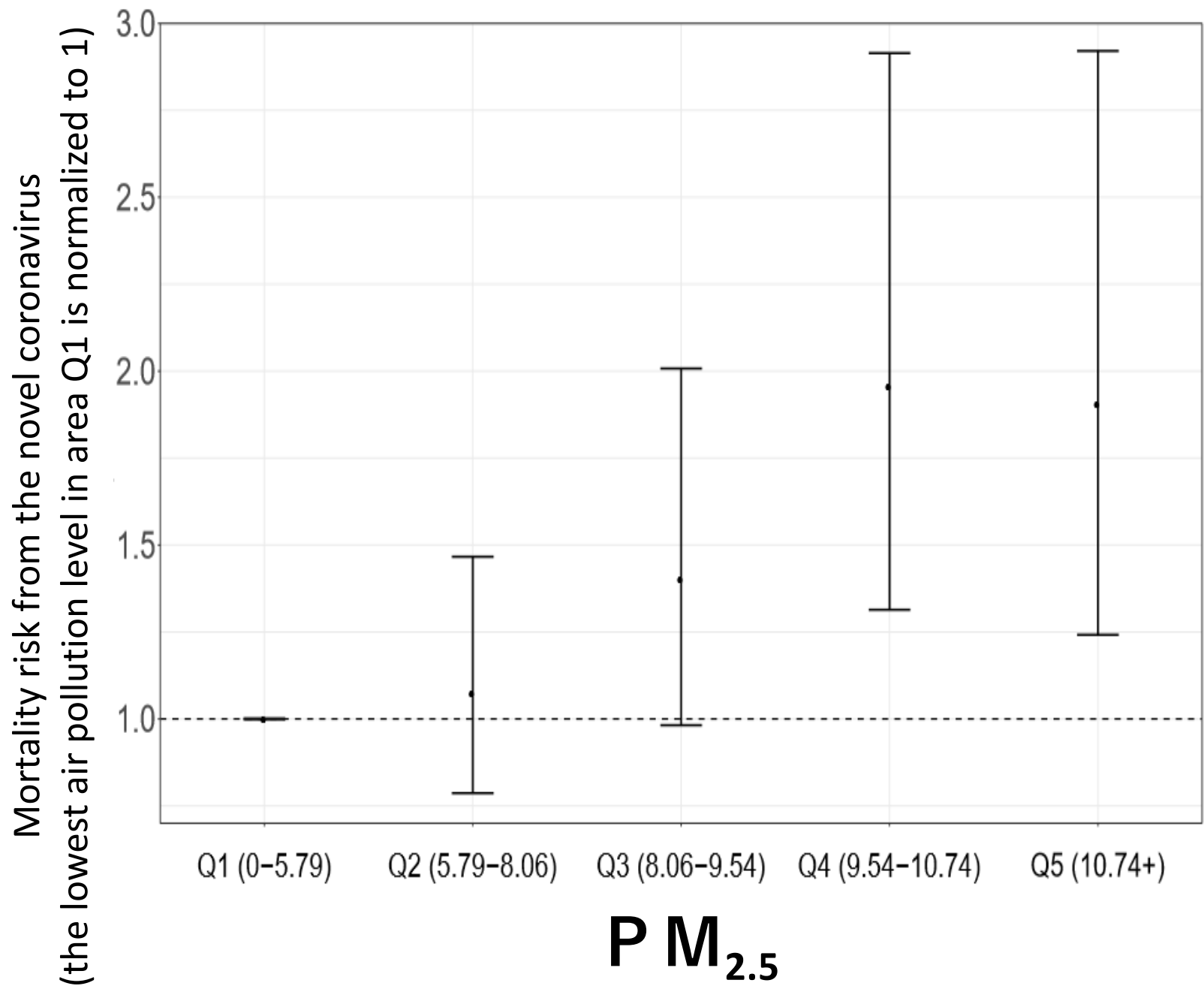
average PM$_{2.5}$ level

PM$_{2.5}$ 0   3   6   9   12*

Mortality rates from the novel coronavirus

COVID-19 deaths per 1 million   0   5

Wu and others, *medRxiv*. 2020;2020.04.05.20054502

Wu X and others medRxiv [Preprint]. 2020 Apr7:2020.04.05.20054502

An increase in PM$_{2.5}$ exposure by 1 μg/m^3 increases the mortality risk from the novel coronavirus by 8%

The relationship between PM$_{2.5}$ exposure (2000-2016 average level) and the mortality rate from the novel coronavirus in 3000 counties in the United States was examined, and the mortality rate was shown to increase 8% for every 1μg/m^3 increase in PM$_{2.5}$ exposure (95% confidence interval 2%-15%) after controlling for 20 variables including population, age distribution, population density, number of days since an outbreak, number of days since an announcement of a stay at home order, number of hospital beds, number of PCR tests, weather, obesity rate and the tobacco smoking rate.

Wu X, Nethery RC, Sabath BM, Braun D, Dominici F. Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study. Preprint. medRxiv. 2020;2020.04.05.20054502. Published 2020 Apr 7. doi:10.1101/2020.04.05.20054502

PM$_{2.5}$ exposure increases by about 10 μg/m^3 to 100 μg/m^3 from indoor passive smoking (so that a 10μg/m^3 increase in exposure increases mortality rate by 80%)

It is therefore imperative to quit smoking and to eliminate exposure passive smoking indoors protect against infection from the novel coronavirus

$PM_{2.5}$

1. $PM_{2.5}$ exposure increases significantly from smoking

2. Active smoking creates $PM_{2.5}$ exposure of 20,000μg/m^3

3. Increased $PM_{2.5}$ increases ACE2 receptor expression

4. As $PM_{2.5}$ exposure increases by 1μg/m^3, the mortality rate from infection of the novel coronavirus increases by 8%

5. The same relationship applies to passive smoking, and indoor passive smoking creates $PM_{2.5}$ exposure of about 10 μg/m^3 to 100 μg/m^3