Exposure to Air Pollutants and Mortality Rate of Novel Coronavirus Disease: Potential Risk in Occupational Safety

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To the editor,

Workers of many occupations (e.g., heavy metal smelting, public transport, power station, construction) are frequently exposed to higher concentration of air pollutants which might bring them extra risk of COVID-19, as (indoor or outdoor) air pollutants are the most proximal determinants of the morbidity and mortality of respiratory diseases. Differential occupational risk of COVID-19 infection and mortality has been noticed.\(^1\) A large quantity of fine particles on which the infectious pathogens attach can facilitate the spread of infection and exacerbate the pre-existing symptoms, and thus can make people more easily get infected by COVID-19.\(^2\) Hazardous chemicals released to the air, such as nitrogen oxides, sulfur dioxide, ozone and carbon monoxide, would impose additional risk on people with acute and chronic respiratory symptoms,\(^3\) where the nitrogen dioxide has been evidenced to contribute to the mortality of COVID-19 in Italy, Spain, France and Germany.\(^4\) The long-term exposure to air pollution can exacerbate the comorbidities,\(^5\) such as cardiovascular, asthma and lung disease that are closely associated with the severity of COVID-19.\(^6\)\(^-\)\(^7\) Besides, the aerosols can serve as active transmission channel of COVID-19,\(^8\) as the fine particulate matter is composed of solid and liquid particles that allow the pathogens to maintain prolonged survival, suspend in the airflow and spread over long distances.\(^9\)

In order to examine the relationship between exposure to air pollutants and mortality rate of COVID-19, we collect the daily data of COVID-19 cases and air pollutants during 02/01/2020 - 03/18/2020 of 307 cities in China (i.e., PM\(_{2.5}\), PM\(_{10}\), SO\(_2\), NO\(_2\), O\(_3\), CO, in the unit of mg/m\(^3\); all are based on 24hour-moving average at time 12:00, except for ozone that is based on 8hour-moving average at time 12:00). The spatial distributions of mortality rate of COVID-19 and air pollutants are clearly illustrated (please see Fig 1 and Fig 2). Results of bivariate regressions (pooled panel model) show that the mortality rate of COVID-19 is significantly associated with the concentration of each air pollutant (PM\(_{2.5}\), 0.028; PM\(_{10}\), 0.014; SO\(_2\), 0.102; NO\(_2\), 0.072; O\(_3\), 0.050; CO, 0.002; all coefficients with \(p<0.01\)).

Besides, the bivariate relationships between the concentration of each air pollutant (with time lag) and mortality rate of COVID-19 are respectively examined. It is shown that the influence magnitude of most air pollutants (i.e., PM\(_{2.5}\), PM\(_{10}\), NO\(_2\), CO) on mortality rate would become greater as time goes by (i.e., the influence of lag-15 day is greater than that of lag-1 day), suggesting that the long-term exposure can be more harmful (please see Fig 3).

Many workers have no opportunities to earn their living through teleworking during the pandemic. The passive exposure to air pollutants is inevitable for many occupations. The exposure to high concentration of air pollutants would impose great risk on them during this special period. For example, it is shown that the municipal firefighter is classified as one of occupations with the top risk of COVID-19 within the Standard Occupational Classification (SOC) system of the US Bureau of Labor Statistics (BLS).\(^10\) We suggest that special attention
should be paid to industries in which worker are passively exposed to higher concentration of air pollutants. Relevant industries should reserve sufficient personal protective equipment for workers in order to better prepare for forthcoming reopening.

Reference


Fig 1. The spatial distribution of mortality rate (02/01/2020 - 03/18/2020 on average).

*Mortality rate = death cases/confirmed cases.*

Fig 2. The spatial distribution of concentration of air pollutants (02/01/2020 - 03/18/2020 on average). (A) PM$_{2.5}$, (B) PM$_{10}$, (C) SO$_2$, (D) NO$_2$, (E) CO, (F) O$_3$. 

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Fig 3. The influence magnitude of exposure to different air pollutants on mortality rate (A) PM$_{2.5}$, (B) PM$_{10}$, (C) SO$_2$, (D) NO$_2$, (E) O$_3$, (F) CO. Each sub-figure is illustrated by regressing the mortality rate of COVID-19 on each air pollutant using bivariate regressions (pooled panel model is applied; each type of air pollutants with different time lag is respectively included in the regression, from 1-day-lag to 15-day-lag, one by one to avoid multicollinearity; time span of the total sample is from 02/01/2020 to 03/18/2020).