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Commentary

LONG-TERM COMPONENT OF PARTICULATE MATTER (PM 2.5) AND RESPIRATORY HEALTH: EMISSION CONTROL IS IMPERATIVE

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DESCRIPTION

Extensive studies have shown that short-term exposure to ambient air pollution has acute adverse effect on cardiovascular and respiratory health. Short-term fluctuations in pollutants are mainly influenced by meteorological changes. However, conventional time-series analyses could not capture the effect of long-term variations in air pollution which are mainly driven by regional emission levels. Emission control and subsequent air quality improvement is a gradual process. Since China adopted the Air Pollution Prevention and Control Action Plan in 2013, the concentration of major air pollutants continued to decrease(Huang, et al., 2018). such long-term improvement in air quality may lower hospitalizations for chronic respiratory diseases.

Approximately 100 million people in China have Chronic Obstructive Pulmonary Disease (COPD) (Wang, et al., 2018). Acute Exacerbation of COPD (AECOPD) is an important contributor to disease burden in China. Fine particulate matter (PM 2.5) is a risk factor for AECOPD (Lirong, et al., 2019). But little is known about the relative importance of short- and long-term PM 2.5 variations in triggering AECOPD. In a recent study in Atmospheric Pollution Research (Lyu, et al., 2022), Lyu, et al. used Kolmogorov-Zurbenko (KZ) filter to decompose PM 2.5 concentration into short-term (<33 days), seasonal (33-365 days), and long-term (>365 days) parts, then investigated the association between these components and hospitalization for AECOPD in Beijing. This is a city-wide time-series study from 2010 to 2019. During the study period, daily PM 2.5 observations were collected from the US Beijing Embassy. Daily counts of AECOPD hospitalization were obtained from the hospitalization database in Beijing. Results showed that short-term and long-term components of PM 2.5 were associated with AECOPD, and the effect of long-term component was stronger. There was a "U" shape relationship between the seasonal component and AECOPD.

A major feature of this study is using a time-series decomposing method to simultaneously evaluate short-term, seasonal and long-term effects of PM 2.5 with exactly same air quality observation data set among the same population. The KZ filter is a series of iterations of a moving average filter. It has been used in environmental studies to separate the trend of pollutant concentration into different time scales (Zhang, et al.,2018). Lyu et al. further made use of health data and fitted a Generalized Additive Model (GAM) to estimate the relative risk of each component. This approach provides a new way to assess emission-related health effect because emission is a major factor for PM 2.5 variations in annual temporal scale.

These findings have several implications. First, the trend of the long-term PM 2.5 component had a significant decreasing trend after 2014, reflecting the effect of emission control policies in Beijing. Second, using the raw PM 2.5 concentration to predict health outcomes might be insufficient since different time scale components had inconsistent effects. Decomposing PM 2.5 concentration using KZ filter or other methods might improve the accuracy of risk prediction. Future studies are needed to investigate the application of KZ filter in risk assessment of air pollutants. Third, the observed larger effect of long-term component indicated that a large health gain would be achieved by stringent emission control measures. Emission control measures that result in long-term reduction in PM 2.5 would bring strong public health benefits concerning AECOPD.

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