Spatiotemporal Assessment of Health Burden and Economic Losses attributable to short-term exposure to Ozone During 2015 - 2018 in China

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Abstract

Ground-level Ozone (O_3) pollution is currently the main severe environmental problem in China. Although existing studies have quantified the O_3 -related health impact and economic loss, few have focused on the acute health effects of short-term exposure to O_3 and have been limited to a single temporal and spatial dimension. Based on the O_3 concentration obtained from ground monitoring networks in 334 Chinese cities in 2015 - 2018, this study used a two-stage exposure parameter weighted Log-linear exposure-response function to estimate the cause-specific mortality for short-term exposure to O_3 . The value of statistical life (VSL) method that were used to calculate the economic loss at the city-level. Our results show that in China, the national all-cause mortality attributed to O_3 was 0.18 (95% CI: 0.09 - 0.36) to 0.26 (95% CI: 0.13 - 0.45) million across 2015 - 2018. The estimated economic loss caused by O_3 was 253.83 (95% CI: 128.44 - 590.96) to 397.09 (95% CI: 203.54 - 759.27) billion CNY, accounting for 0.34% to 0.46% of total reported GDP. Overall, the O_3 attributed health and economic burden has begun to decline in China since 2017. However, highly polluted areas still face severe burden, and undeveloped areas suffer from high GDP losses. There are substantial health impacts and economic losses related to short-term O_3 exposure in China. The government should pay attention to the emerging Ozone pollution, and continue to strengthen the intervention in traditional priority areas while solving the pollution problem in non-priority areas.

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Figures

Figure 1

The city-specific annual 90th daily maximum 8-h O₃ concentrations in 2015 (a), 2016 (b), 2017 (c) and 2018 (d).

Figure 2

The city-specific nonattainment rate of CNAAQs Grade 1 (a - d) and Grade 2 (e - h) during 2015 - 2018

Figure 3

The city-specific O₃-related all-cause mortality in 334 Chinese cities in 2015 (a), 2016 (b), 2017 (c) and 2018 (d).

Figure 4

Provincial-level all-cause (a), cardiovascular (b) and respiratory (c) disease premature death (thousand) due to Ozone short-term exposure during 2015 – 2018.

Figure 5

The city-specific economic losses of O₃-related all-cause mortality in 334 Chinese cities in 2015 (a), 2016 (b), 2017 (c) and 2018 (d).

Figure 6

The city-specific GDP impact of O₃-related all-cause mortality in 334 Chinese cities in 2015 (a), 2016 (b), 2017 (c) and 2018 (d).

Figure 7

Provincial-level economic loss (billion) (a) and GDP impact (%) (b) due to premature death attributable to O₃ short-term exposure during 2015 – 2018.

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