## Consideration of local geographical variations in $PM_{2·5}$ concentrations in China

Global efforts have been made to reduce air pollution. The *Lancet* Commission on pollution and health estimates that in 2015, air pollution was responsible for 9 million premature deaths and 268 million disability-adjusted life-years, with the most severe effects on individuals residing in low-income and middle-income countries.[1,2] Although various factors have been used to understand air pollution-related mortalities in low-income and middle-income countries,[2] geographical variations of air pollution concentrations in low-population dense and rural regions are often overlooked.

Environmental programmes monitoring air pollution, including fine particulate matter ($PM_{2·5}$), have widely been accredited to understanding their effect on people in urban areas, often ignoring people in low-population dense and rural regions.[3,4] Most areas of China (including rural regions) have recently increased industrialisation, which has generated $PM_{2·5}$ concentrations that not only exceed the WHO air quality annual mean threshold,[5] but also are three times higher than the national guideline.[4] High $PM_{2·5}$ concentrations in low-population dense and rural regions increase the chances of air pollution-related mortality.[6] Thus, neglecting local variations in $PM_{2·5}$ concentrations can potentially undervalue air pollution's full effects on human health.[1]

In *The Lancet Public Health* (October, 2018), Tiantian Li and colleagues [7] studied all-cause mortality from long-term exposure to $PM_{2·5}$ in both Chinese men and women aged 65 years and older from 2008 to 2014. Specifically, the authors note a higher hazard ratio in rural than in urban regions of southern versus northern China, in regard to exposure of lower versus higher $PM_{2·5}$ concentrations.[7] However, they omitted nine Chinese provinces from their analysis because of low-population densities in 2008. By excluding individuals in these provinces from their analysis, the authors could be underestimating or overestimating the effect that $PM_{2·5}$ concentrations can have on individuals residing in rural or urban regions of China.

With regard to $PM_{2·5}$ exposure associated with all-cause mortality, the authors note that their results differ from the Global Burden of Disease Study (GBD) estimates in 2010.[7] The neglected local geographical variations in $PM_{2·5}$ concentrations among low-population dense and rural regions might promote a smaller or larger difference of results in comparison with GBD estimates.

Furthermore, individuals residing in low-population dense and rural regions have lifestyles that might contribute to relatively higher $PM_{2·5}$ concentrations.[3] These individuals are often limited by their resources and rely on burning biomass for basic daily necessities, such as cooking or farming purposes, leading to adverse health effects over time and increased possibility of mortality due to air pollution.[3]

Moreover, to fully understand the long-term relationship between mortality risk and $PM_{2·5}$ concentrations in individuals aged 65 years and older, not only for China, but overall in low-income and middle-income countries, local geographical variations in $PM_{2·5}$ concentrations, particularly a comparison of the effects of air pollution on low-population or high-population dense areas should be incorporated in future analyses. Understanding local geographical variations in $PM_{2·5}$ concentrations can also be included in the new GBD-Pollution and Health Initiative targeted to reduce air pollution-related mortalities along with avoiding environmental tragedies that have plagued past development.[1]

I declare no competing interests.

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