



## Consideration of local geographical variations in PM<sub>2.5</sub> concentrations in China

### Authors' reply

Haris Majeed commented on our study,<sup>1</sup> pointing out that geographical variations in air pollution concentrations, even in low-population densities and rural regions, are important to understand the full effect of air pollution, and suggesting that not including nine provinces could affect our analysis. These are valid concerns, especially when a nationally representative cohort is used.

Although some provinces were not included in the original cohort design, we do have coverage of about 800 counties and districts in 22 provinces, and this accounts for one-third of counties in China. We believe although some provinces were not included, the heterogeneity of the regions is captured through the diverse geographical dispersion of research subjects.

We also agreed that indoor PM<sub>2.5</sub> exposure could be an important variable that might influence the association of ambient PM<sub>2.5</sub> exposure with mortality. In our Article,<sup>1</sup> we used household income, which can be a proxy for exposure to indoor air pollution. Previous research reported that household income was a key factor related to biomass consumption.<sup>2</sup> Additionally, sensitivity analysis showed our models were robust. Therefore, we think the hazard ratio (HR) of long-term PM<sub>2.5</sub> and mortality in our study are representative of China.

Additionally, although data from nine provinces were not used to calculate HR, we considered the concentration of PM<sub>2.5</sub> and the populations of the nine provinces in the estimation of mortality burden from long-term PM<sub>2.5</sub> exposure for the whole of China in 2010. Our

estimation of the mortality burden attributable to PM<sub>2.5</sub> (1.77 million) is higher than that in the Global Burden of Diseases Study (GBD; 1.11 million in total).<sup>3</sup> This might be because of the different endpoint in our study, which was total death. In the GBD study, only five cause-specific deaths were included: ischaemic heart disease, cerebrovascular disease, lung cancer, chronic obstructive pulmonary disease, and lower respiratory infection.

In conclusion, even without the nine provinces, to our knowledge, our study has the largest coverage, with the widest range of the PM<sub>2.5</sub> (7–113 µg/m<sup>3</sup>), compared with other studies in China, and provided crucial and representative information about the mortality risk associated with long-term exposure of people aged 65 years and older to PM<sub>2.5</sub> in China.

We declare no competing interests.

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- 2 Xing X, Zhou Y, Lang J, et al. Spatiotemporal variation of domestic biomass burning emissions in rural China based on a new estimation of fuel consumption. *Sci Total Environ* 2018; **626**: 274–86.
- 3 Cohen A J, Brauer M, Burnett R, et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. *Lancet* 2017; **389**: 1907–18.