Air pollution and China's ageing society

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During the cold winter of 1952, low temperature and high concentrations of air pollution from factories and coal-burning homes caused an excess of 4000 deaths in London.[1] This episode, commonly known as the Great Smog of London, instigated public recognition of, and scientific research into, the harms of air pollutants. More than half a century later, China is similarly experiencing a burgeoning public awareness of fine particulate matter ($PM_{2.5}$). In 2008, the US Embassy in Beijing began collecting real-time air-quality data on its rooftop and disseminated readings on Twitter. Demands for ambient air-quality information followed, leading to more than 5000 monitoring stations built across the country by 2017.[2] Mandates were given to governmental authorities at various levels to monitor air pollutants (including $PM_{2.5}$, PM_{10}, sulphur dioxide, nitrogen dioxide, ozone, and carbon monoxide), although data reliability has been questioned.[3]

Declining concentrations of $PM_{2.5}$ can have an important effect on the lifespan of Chinese people. According to WHO, air pollution alone causes 6·5 million deaths worldwide each year.[4] Air pollution is a particularly important risk factor in China: according to estimates from the Global Burden of Disease study,[5] air pollution is the fourth leading cause of death and disability combined (behind dietary risks, high blood pressure, and tobacco). With China aiming to raise the average life expectancy from 76·3 years in 2015 to 79·0 years by 2030, as described in the Healthy China 2030 plan,[6] air pollution must be curbed. Increased political will and tightened regulations have led to progress: average $PM_{2.5}$ concentrations in the Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River Delta regions were 39·6%, 34·3%, and 27·7% lower, respectively, in 2017 than in 2013.[7] However, urban air pollution remains high, with average $PM_{2.5}$ concentrations in 2017 of 58 μg/m³ in Beijing and 39 μg/m³ in Shanghai. These concentrations are still far from the WHO air quality annual mean threshold of 10 μg/m³.

An ageing society and urbanisation change the number of people exposed to harmful air pollution. In the past few decades, China has experienced a large rural-to-urban migration, with more than half of the country's population now residing in cities.[6] Identifying the harms of air pollution is crucial to improve policy making. In *The Lancet Public Health*, Tiantian Li and colleagues[8] present timely research on the association between $PM_{2.5}$ exposure and premature mortality. The study is based on the Chinese Longitudinal Healthy Longevity Survey of individuals aged 65 years and older, which has more than 14 years of follow-up and which surveys participants roughly every 2 years. This cohort includes individuals from 22 of 31 provinces to encompass China's geographical diversity. The investigators used residential addresses of participants to ascertain $PM_{2.5}$ exposure concentrations through remote sensing in 1 km×1 km satellite-imaging grids. Study participants had varying dates of entry into the study, and the investigators used a Cox proportional hazards model to account for time at risk and calculated hazard ratios (HRs) for risk of mortality that were adjusted for confounders and predictors. The investigators estimated an adjusted HR of 1·08 (95% CI 1·06–1·09) for each 10 μg/m³ increase in $PM_{2.5}$ concentration. This estimate is similar to those from other large cohort studies of low-concentration air pollution.[9]

China is a heterogeneous country: although most cities have high concentrations of $PM_{2.5}$, many places have reasonably low concentrations. In the study by Li and colleagues, the annual average $PM_{2.5}$ concentration ranged from 7 to 113 μg/m³. The authors found a higher risk of premature mortality in areas with lower concentrations of $PM_{2.5}$ (<60·9 μg/m³; HR 1·14 [95% CI 1·11–1·17]) than in areas with higher concentrations of $PM_{2.5}$ (≥60·9 μg/m³; 1·07 [1·01–1·12]). This finding is informative, showing risks at different concentrations of pollutants in different populations.[10] The authors also provide insight on differences between urban versus rural settings and northern versus southern regions. In particular, individuals living in rural or southern regions of China were more susceptible to the effects of air pollution than were individuals living in urban or northern regions. The concentration–response finding from this study confirms that there is no safe concentration of $PM_{2.5}$.

Some questions remain to be explored. First, evidence is sparse for ozone and its interactive effect with $PM_{2.5}$ on mortality. Second, China has the largest number worldwide of people who smoke, and epidemiological evidence is needed for the interactive effect of smoking and $PM_{2.5}$ exposure, particularly on incidence of lung

cancer, which is increasing in the country. Third, cause-specific mortality in addition to all-cause mortality should be studied to further understand the effect of $PM_{2.5}$. Lastly, air pollution avoidance behaviours, such as use of filtration devices and real-time monitoring systems (eg, smog alerts), need to be assessed as viable public health intervention strategies.

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I declare no competing interests.

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