FINE PARTICULATE MATTER CONSTITUENTS AND CARDIOPULMONARY MORTALITY IN A HEAVILY-POLLUTED CITY

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Background and Aims: Although ambient $PM_{2.5}$ has been linked to adverse human health effects, the chemical constituents that cause harm are unknown. No previous studies exist in developing country to investigate the health impact of $PM_{2.5}$ constituents. This study aimed to examine the short-term association between $PM_{2.5}$ constituents and daily mortality in Xi'an, a heavily-polluted Chinese city.

Methods: We obtained daily mortality data and daily concentrations of $PM_{2.5}$, organic carbon (OC) and elemental carbon (EC) between January 1, 2004 and December 31, 2008. We also measured concentrations of fifteen elements between January 1, 2006 and December 31, 2008, and ten water-soluble ions between March 22, 2006 and March 23, 2007. We analyzed the data with over-dispersed generalized linear Poisson models.

Results: During our study period, the mean daily average concentration of $PM_{2.5}$, OC and EC in Xi'an were 182.2 $\mu g/m^3$, 28.3 $\mu g/m^3$, and 12.0 $\mu g/m^3$. We found consistent associations of mortality with $PM_{2.5}$ mass, OC, EC, S, Cl, Ni, Na^+, K^+, Mg^{2+}, Cl^-, and NO_3^-. Many of the constituents demonstrated higher excess risks than $PM_{2.5}$ mass. For transition metals, mortality risk associated with Ni was particularly elevated. Even below the levels of proposed $PM_{2.5}$ standard in China (24-hour average: 75 •g/m^3), we were still able to observe apparent health effects of $PM_{2.5}$.

Conclusions: This first study in developing countries adds to the growing body of evidence linking $PM_{2.5}$ constituents with mortality and indicates that excess risks may vary with the specific $PM_{2.5}$ constituents.