Differential mortality risks associated with PM2.5 components. A multi-country, multi-city study

Epidemiology

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Abstract

Background: The association between fine particulate matter (PM2.5) and mortality widely differs between as well as within countries. Differences in PM2.5 composition can play a role in modifying the effect estimates, but there is little evidence about which components have higher impacts on mortality. Methods: We applied a 2-stage analysis on data collected from 210 locations in 16 countries. In the first stage, we estimated location-specific relative risks (RR) for mortality associated with daily total PM2.5 through time series regression analysis. We then pooled these estimates in a meta-regression model that included city-specific logratio-transformed proportions of seven PM2.5 components as well as meta-predictors derived from city-specific socio-economic and environmental indicators. Results: We found associations between RR and several PM2.5 components. Increasing the ammonium (NH_4^+) proportion from 1% to 22%, while keeping a relative average proportion of other components, increased the RR from 1.0063 (95% confidence interval [95% CI] = 1.0030, 1.0097) to 1.0102 (95% CI = 1.0070, 1.0135). Conversely, an increase in nitrate (NO_3^-) from 1% to 71% resulted in a reduced RR, from 1.0100 (95% CI = 1.0067, 1.0133) to 1.0037 (95% CI = 0.9998, 1.0077). Differences in composition explained a substantial part of the heterogeneity in PM2.5 risk. Conclusions: These findings contribute to the identification of more hazardous emission sources. Further work is needed to understand the health impacts of PM2.5 components and sources given the overlapping sources and correlations among many components.