HIGH TEMPERATURES AND AIR POLLUTION: INVESTIGATING INTERACTIVE EFFECTS ON CARDIOVASCULAR MORTALITY

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Background and Aims: Numerous studies have shown associations between human health and air pollution or air temperature. Whether both exposures have synergistic effects on health outcomes has so far only received limited attention. The aim of this study was to examine potential interactive effects of high air temperature and air pollution on cardiovascular mortality in Munich and Augsburg, Germany, as well as in Beijing, China.
Methods: We used data from Munich as well as Augsburg, Germany, for the period 1990 to 2006 (May to September), including daily cardiovascular death counts, meteorological variables, and air pollution concentrations (24-h averages of particulate matter with a diameter < 10µm (PM_{10}) and daily maximum 8-h ozone (O_3)). Additionally, we obtained cardiovascular death counts, meteorological variables, and PM_{10} concentrations from the urban area of Beijing, China, for the period 2004 to 2005. Data were analyzed using Poisson regression models adjusting for long-term trend, calendar effects, and other meteorological factors. We fitted bivariate models using tensor product smooth terms to explore joint response surfaces of 2-day average air temperature and 2-day means of PM_{10} or O_3. To quantify the interactive effects, we categorized air pollutant concentrations into three levels, and then included an interaction term for the pollutant categories and air temperature.
Results: A 1°C increase in 2-day average air temperature in Munich was associated with a 0.4% (95% confidence-intervals (95%-CI): -0.7%; 1.6%), 1.0% (95%-CI: 0.6%; 1.3%), and 1.3% (95%-CI: 0.5%; 2.1%) increase in mortality for low, moderate, and high 2-day average PM_{10} levels, respectively. Similar results were observed for Augsburg and Beijing. There were no interactive effects observed with O_3 in Munich and Augsburg.
Conclusions: Enhanced adverse temperature effects were found at higher levels of PM_{10}, which implies that it is important to evaluate synergistic effects and not only pure temperature or air pollution effects.