MORTALITY IMPACTS OF SULPHUR CONCENTRATIONS IN AIR IN 20 EUROPEAN CITIES IN THE APHEKOM PROJECT: A CASE-CROSSOVER DISTRIBUTED LAG APPROACH

Ariana Zeka, *Brunel University, Uxbridge, United Kingdom*
Susann Henschel, *Dublin Institute of Technology, Dublin, Ireland*
Patrick Goodman, *Dublin Institute of Technology, Dublin, Ireland*
Richard Atkinson, *St. George's, University of London, London, United Kingdom*
Antonis Analitis, *Department of Hygiene, Epidemiology and Medical Statistics, Medical School, University of Athens, Athens, Greece*
Klea Katsouyanni, *Department of Hygiene, Epidemiology and Medical Statistics, Medical School, University of Athens, Athens, Greece*
Alain Le Tertre, *French Institute for Public Health Surveillance, InVS, Paris, France*
Olivier Chanel, *French Institute for Public Health Surveillance, InVS, Paris, France*
Sylvia Medina, *French Institute for Public Health Surveillance, InVS, Paris, France*

Background and Aims: The implementation of three EU directives to reduce sulphur content in fuel was assessed for mortality impacts in 20 European cities, between 1990 and 2007 in the APHEKOM project. This specific study aimed to examine whether different lag structures apply to the relationships between cardiovascular and respiratory events and SO_2 concentrations, which will therefore result in differences in mortality impacts from regulation implementation. Prior evidence has shown that cardiovascular mortality is more likely to be affected by SO_2 concentrations on the same or the previous day of the event, while respiratory mortality more likely to show a delayed effect of exposure to the same pollutant.
Methods: City-specific data on SO_2 concentrations and all-cause and cause-specific mortality were obtained for 20 European cities. A city-specific distributed lag case-crossover design was implemented with two simultaneous lags in the model: average SO_2 concentration for lag 0 to 1 days (L01); and lag 2 to 5 days prior to the mortality event (L25). Pooled estimates of the city specific results were calculated using a random effects meta-analysis model.
Results: Pooled results showed a 1.17% (95% CI: 0.53%-1.80%) increase in all-cause mortality for every 10µg/m^3 change in SO_2 concentrations for L01, and no effect for L25. Respiratory mortality increased by 1.31% (95% CI: 0.04%-2.59%) with L25, and showed no effect with L01. Cardiovascular deaths showed a 0.94% (95% CI: 0.32%-1.57%) increase with L01 but not with L25. These associations were greater than those observed in no-lag models for both mortality causes.
Conclusion: The application of different lags in the association between cause-specific mortality and SO_2 concentrations showed stronger and more precise effect estimates than the no-lag approach. Considering the important decline in SO_2 concentration levels following regulation implementation, these lagged effects imply greater reductions in mortality than those suggested by no-lag models.