

AN APPLICATION OF A RISK SET CALIBRATION METHOD TO A STUDY OF AIR POLLUTION EFFECTS ON ALL CAUSE MORTALITY IN THE NURSES' HEALTH STUDY

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Background and Aims: Chronic exposure to air pollution has been consistently associated with increased risk of all-cause mortality. The majority of these studies have relied on ambient exposure monitoring to assign individual exposure levels. However, the impact of measurement error has not been incorporated into the estimates of risk. Here, we adjust for exposure measurement error using validation data from 9 cities where ambient exposure has been compared to personal exposure.

Methods: 57,574 women from the Nurse's Health Study living in Northeastern and Midwestern metropolitan areas of the United States were followed from 2000-2006 for 3,776,360 person-months, during which time 3642 deaths occurred. GIS-based spatial smoothing models were used to predict monthly exposure to particulate matter less than 2.5 microns in diameter (PM_{2.5}) at each participant's residence. Data on risk factors, residence and health outcomes are updated biennially. Using validation data from 9 cities -- Baltimore, Boston, Steubenville, Atlanta, Los Angeles, Seattle, Research Triangle Park, Nashville and Utrecht, Netherlands - from 432 subjects over 950 person-months, a risk set regression calibration method was utilized to correct relative risk (RR) estimates for measurement error by re-calibrating the measurement error model within each risk set observed in the main study by its counterpart in the validation study.

Results: After adjusting for age in months, calendar year, state of residence and season, the RR for all cause mortality for a 10 µg/m³ increase in the 12-month moving average of PM_{2.5} was 1.35 (95% CI: 1.09-1.68) ; after error correction it was 1.63 (95% CI: 0.95-2.80).

Conclusions: These measurement-error corrected results confirm and strengthen the evidence that chronic PM_{2.5} exposure is associated with the risk of all-cause mortality. The effects of chronic exposure PM_{2.5} are likely stronger than previously considered. These findings may have implications for the formulation of environmental policy.