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Short- and long term effects of nitrogen dioxide on mortality and respiratory health - with emphasis on results from the APHEA and the SAPALDIA study

The APHEA-2 study investigated short term effects of different air pollutants on mortality and hospital admissions across 30 European cities. This presentation focuses on the short-term effects of nitrogen dioxide on total, cardiovascular and respiratory mortality across these cities.

Combined evidence was obtained using hierarchical models implemented in two stages. In the first stage, data from each city were analyzed separately, whereas in the second stage the city specific air pollution estimates were regressed on city specific covariates to obtain overall estimates and to explore sources of possible heterogeneity of effects.

These analyses have revealed significant adverse health effects of NO₂ on total, cardiovascular and respiratory mortality, with stronger effects on cause-specific mortality. The estimated increase in the daily number of deaths from a) natural causes, b) cardiovascular causes, and c) respiratory causes, following a 10 µg/m³ increase in the average value of the 1-hr maximum of NO₂ of the same and the preceding day, was a) 0.30% (95% confidence interval: 0.22-0.38), b) 0.40% (95% CI: 0.29-0.52), and c) 0.38% (95% CI: 0.17-0.58), respectively. There was evidence of confounding of NO₂-effects on respiratory mortality by black smoke and SO₂ suggesting that NO₂ also acts as a surrogate for other health relevant components of air pollution. The effect of NO₂ on total and cardiovascular mortality was observed mainly in western and southern European cities and was larger when the smoking prevalence was lower and household gas consumption was higher. The effect of NO₂ on respiratory mortality was higher in cities with larger proportion of elderly persons in the population and higher levels of PM₁₀.

The results of this large study are consistent with an independent effect of NO₂ on mortality, but the role of nitrogen dioxide as a surrogate of other unmeasured pollutants cannot be completely ruled out.

To round off the picture, the presentation will also include a few results on potential long term effects of NO₂. Among other, the SAPALDIA-study (Swiss Cohort Study on Air Pollution and Lung Diseases in Adults) has found forced vital capacity of the lung to be negatively associated with estimated average NO₂-exposure not only across but also within the eight study areas in its population-based random sample of 9651 adults.

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