Mortality attributable to ambient fine particulate matter and nitrogen dioxide in Switzerland in 2019: use of two-pollutant effect estimates

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4694323
Author(s) Castro, A.; Künzli, N.; de Hoogh, K.; Kappeler, R.; Kutlar Joss, M.; Vienneau, D.; Röösli, M.
Author(s) at UniBasel Castro Fernández, Alberto ; Künzli, Nino ; de Hoogh, Kees ; Kappeler, Ron ; Kutlar Joss, Meltem ; Vienneau, Danielle ; Röösli, Martin ;
Year 2023
Title Mortality attributable to ambient fine particulate matter and nitrogen dioxide in Switzerland in 2019: use of two-pollutant effect estimates
Journal Environmental research
Volume 231
Number Pt 1
Pages / **Article-Number** 116029
Mesh terms Particulate Matter, analysis; Environmental Pollutants; Nitrogen Dioxide, analysis; Switzerland, epidemiology; Environmental Exposure, analysis
INTRODUCTION: Air pollution health risk assessments have traditionally used single-pollutant effect estimates for one proxy ambient air pollutant such as PM(2.5). Two-pollutant effect estimates, i.e. adjusted for another correlated pollutant, theoretically enable the aggregation of pollutant-specific health effects minimizing double-counting. Our study aimed at estimating the adult mortality in Switzerland in 2019 attributable to PM(2.5) from a single-pollutant effect estimate and to the sum of PM(2.5) and NO(2) from two-pollutant estimates; comparing the results with those from alternative global, European and Swiss effect estimates. METHODS: For the single-pollutant approach, we used a PM(2.5) summary estimate of European cohorts from the project ELAPSE, recommended by the European Respiratory Society and International Society for Environmental Epidemiology (ERS-ISEE). To derive the two-pollutant effect estimates, we applied ELAPSE-based conversion factors to ERS-ISEE PM(2.5) and NO(2) single-pollutant effect estimates. Additionally, we used World Health Organization 2021 Air Quality Guidelines as counterfactual scenario, exposure model data from 2019 and Swiss lifetables. RESULTS: The single-pollutant effect estimate for PM(2.5) (1.118 [1.060; 1.179] per 10 mug/m(3)) resulted in 2240 deaths (21,593 years of life lost). Using our derived two-pollutant effect estimates (1.023 [1.012; 1.035] per 10 mug/m(3) PM(2.5) adjusted for NO(2) and 1.040 [1.023; 1.058] per 10 mug/m(3) NO(2) adjusted for PM(2.5)), we found 1977 deaths (19,071 years of life lost) attributable to PM(2.5) and NO(2) together (23% from PM(2.5)). Deaths using alternative effect estimates ranged from 1042 to 5059. DISCUSSION: Estimated premature mortality attributable to PM(2.5) alone was higher than to both PM(2.5) and NO(2) combined. Furthermore, the proportion of deaths from PM(2.5) was lower than from NO(2) in the two-pollutant approach. These seemingly paradoxical results, also found in some alternative estimates, are due to statistical imprecisions of underlying correction methods. Therefore, using two-pollutant effect estimates can lead to interpretation challenges in terms of causality.
ISSN/ISBN 1096-0953
URL https://doi.org/10.1016/j.envres.2023.116029
edoc-URL https://edoc.unibas.ch/95250/
Full Text on edoc Available;
Digital Object Identifier DOI 10.1016/j.envres.2023.116029
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/37149029

ISI-Number WOS:001001321300001
Document type (ISI) Journal Article