

Exposure-response functions of long-term exposure to ambient NO₂ and COPD

Exposure-response functions (ERFs) are essential to quantify the health impact of risk factors and inform policy. First, we meta-analyzed relative risk estimates and observed a positive association between long-term ambient NO₂ exposure and COPD incidence and mortality, with higher relative risks in Europe. The shape of the relationship was assessed using natural cubic splines and the MR-BRT approach. The former displayed greater variability compared to the smoother, more conservative Burden of Proof Risk Function.

Methods

Step 1: Systematic literature review

Step 2: Meta-Analysis: Global and European pooled risk estimate

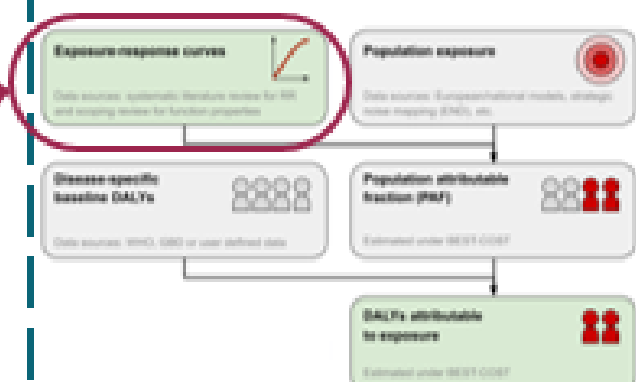
- COPD Incidence + Mortality
- Random-effects models (REML)
 - Subgroup analysis: COPD incidence, COPD mortality, exposure assessment, pollutant assessment.
 - Sensitivity analysis: excluding studies trimmed in MR-BRT

Step 3: Meta-Regression: Global and European ERFs

- Natural Cubic Splines
- Meta Regression-Bayesian Regularized Trimmed (MR-BRT)

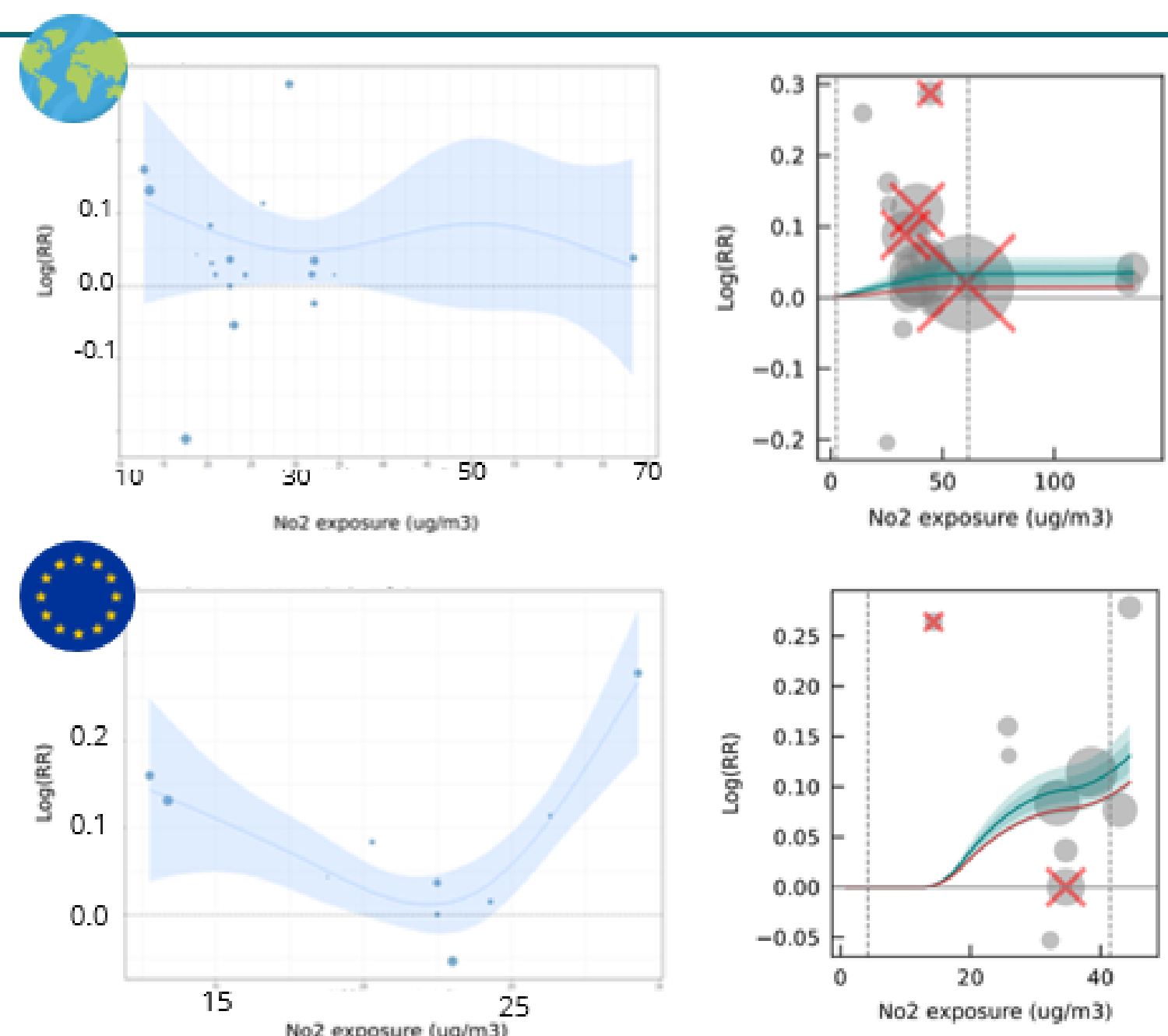
BEST-COST

Improve understanding of the socioeconomic cost of air and noise pollution in Europe.



Results

- 24 reports included
 - Mortality (n=12), incidence (n=8), prevalence (n=5)
 - Europe (n=12),
 - Single-pollutant models (n=15)
- Mean NO₂ exposure:
 - 12.7—68.4 µg/m³
 - 12.7—29.3 µg/m³
- 10 µg/m³ increase in NO₂ & COPD incidence and mortality
 - RR= **1.04**, 95%CI: **1.00—1.09**
 - I²=95.1%, PI=0.89—1.23
 - RR= **1.08**, 95%CI: **1.01—1.15**
 - I²=92.4%, PI=0.89—1.32
- Sensitivity analysis: excluding 4 reports
 - RR= **1.03**, 95%CI: **1.01—1.05**
 - I²=95.1%, PI=0.89—1.23
 - Downward trend



Discussion

To improve relevance and applicability of ERFs, methodological choices should align with available exposure data, regional exposure patterns, the expected shape of the exposure-response relationship, and the objective of the analysis. If available, we recommend employing both approaches in sensitivity analyses to assess the robustness of the results and provide insights into how methodological assumptions influence findings.