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Outdoor air pollution and the burden of childhood asthma across Europe

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A significant proportion (up to 33%) of incident childhood asthma cases across Europe may be attributable to outdoor air pollution. These cases are largely preventable, underlying an urgent need to reduce children's exposure to NO₂, PM_{2.5} and black carbon. <http://bit.ly/2SxGCv4>

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ABSTRACT

Background: Emerging evidence suggests that air pollution may contribute to childhood asthma development. We estimated the burden of incident childhood asthma that may be attributable to outdoor nitrogen dioxide (NO₂), particulate matter ≤ 2.5 μm in diameter (PM_{2.5}) and black carbon (BC) in Europe.

Methods: We combined country-level childhood incidence rates and pooled exposure-response functions with childhood (age 1–14 years) population counts, and exposure estimates at 1 540 386 1 km \times 1 km cells, across 18 European countries and 63 442 419 children. Annual average pollutant concentrations were obtained from a validated and harmonised European land-use regression model. We investigated two exposure reduction scenarios. For the first, we used recommended annual World Health Organization (WHO) air quality guideline values. For the second, we used the minimum air pollution levels recorded across 41 studies in the underlying meta-analysis.

Results: NO₂ ranged from 1.4 to 70.0 $\mu\text{g}\cdot\text{m}^{-3}$, with a mean of 11.8 $\mu\text{g}\cdot\text{m}^{-3}$. PM_{2.5} ranged from 2.0 to 41.1 $\mu\text{g}\cdot\text{m}^{-3}$, with a mean of 11.6 $\mu\text{g}\cdot\text{m}^{-3}$. BC ranged from 0.003 to 3.7×10^{-5} m^{-1} , with a mean of 1.0×10^{-5} m^{-1} . Compliance with the NO₂ and PM_{2.5} WHO guidelines was estimated to prevent 2434 (0.4%) and 66 567 (11%) incident cases, respectively. Meeting the minimum air pollution levels for NO₂ (1.5 $\mu\text{g}\cdot\text{m}^{-3}$), PM_{2.5} (0.4 $\mu\text{g}\cdot\text{m}^{-3}$) and BC (0.4×10^{-5} m^{-1}) was estimated to prevent 135 257 (23%), 191 883 (33%) and 89 191 (15%) incident cases, respectively.

Conclusions: A significant proportion of childhood asthma cases may be attributable to outdoor air pollution and these cases could be prevented. Our estimates underline an urgent need to reduce children's exposure to air pollution.