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Estimated global mortality attributable to smoke from landscape fires

Fay H Johnston¹, Sarah B Henderson, Yang Chen, James T Randerson, Miriam Marlier, Ruth S Defries, Patrick Kinney, David M J S Bowman, Michael Brauer

Affiliations

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Abstract

Background: Forest, grass, and peat fires release approximately 2 petagrams of carbon into the atmosphere each year, influencing weather, climate, and air quality.

Objective: We estimated the annual global mortality attributable to landscape fire smoke (LFS).

Methods: Daily and annual exposure to particulate matter $\leq 2.5 \mu\text{m}$ in aerodynamic diameter (PM(2.5)) from fire emissions was estimated globally for 1997 through 2006 by combining outputs from a chemical transport model with satellite-based observations of aerosol optical depth. In World Health Organization (WHO) subregions classified as sporadically affected, the daily burden of mortality was estimated using previously published concentration-response coefficients for the association between short-term elevations in PM(2.5) from LFS (contrasted with $0 \mu\text{g}/\text{m}^3$ from LFS) and all-cause mortality. In subregions classified as chronically affected, the annual burden of mortality was estimated using the American Cancer Society study coefficient for the association between long-term PM(2.5) exposure and all-cause mortality. The annual average PM(2.5) estimates were contrasted with theoretical minimum (counterfactual) concentrations in each chronically affected subregion. Sensitivity of mortality estimates to different exposure assessments, counterfactual estimates, and concentration-response functions was evaluated. Strong La Niña and El Niño years were compared to assess the influence of interannual climatic variability.

Results: Our principal estimate for the average mortality attributable to LFS exposure was 339,000 deaths annually. In sensitivity analyses the interquartile range of all tested estimates was 260,000–600,000. The regions most affected were sub-Saharan Africa (157,000) and Southeast Asia (110,000). Estimated annual mortality during La Niña was 262,000, compared with 532,000 during El Niño.

Conclusions: Fire emissions are an important contributor to global mortality. Adverse health outcomes associated with LFS could be substantially reduced by curtailing burning of tropical rainforests, which rarely burn naturally. The large estimated influence of El Niño suggests a relationship between climate and the burden of mortality attributable to LFS.

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Figures

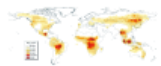


Figure 1 Estimated annual average (1997–2006) PM ...



Figure 2 WHO subregions classified as sporadically...



Figure 3 Map showing the principal estimates...

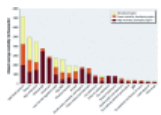


Figure 4 Annual mortality estimate for LFS...

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