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COMMENT

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Where dirty air is most dangerous

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Exposure to poor air quality can damage human health and incur associated costs. The severity of these impacts is not uniform around the globe, but depends on the health and density of the populations.

Air pollution has multifaced impacts on the environment and human health. The entrainment of emissions of gases, fine particles and other aerosols into the atmosphere can reduce air quality and, in turn, deteriorate the environment and human health. Given its links to premature death and increased burden of disease, air pollution is considered one of the leading risk factors to global health[1,2].

The health impacts of air pollution vary with pollutant type, toxicity, and exposure. The sources, chemical composition and physical properties of air pollutants are manifold and variable in space and time. Urban areas are typically dominated by local emissions of anthropogenic pollutants stemming from transport, industry, and combustion processes (Fig. 1). Natural pollutants, which include various aerosols entrained into the atmosphere during wildfires, dust storms and volcanic eruptions, may be much more sporadic in their occurrence and distribution. The spatial variability in pollutant sources and their transport results in similarly heterogeneous variations in air quality.

Tackling air pollution and mitigating the associated impacts on the environment and human health is an issue of local and global concern[3]. Effective mitigation strategies rely on a deep understanding of atmospheric concentrations and distributions of pollutants and, importantly, human exposure to these pollutants. Estimating exposure is not a simple case of where populations are exposed to how much pollution, but also who is exposed and to what. Indeed, for some regions, such as Asia, even severe reductions in emissions would not be sufficient to offset the increased incidence of premature mortality attributable to poor air quality, because the population is growing and aging so fast[1]. In other words, the characteristics of the population exposed to pollutants is more important for health outcomes than the level of pollutants[1].

Assessing the risks to human health from air pollution is key in developing mitigation strategies that most effectively reduce related health burdens. The central importance of linking health impact assessment models with Earth system models to identify hotspot areas of exposure is becoming increasingly apparent[1]. Such approaches can account for the impact of population density, characteristics and behaviour in determining exposure alongside the toxicity and concentration of atmospheric pollutants. That emission fluxes of anthropogenic pollutants may vary across countries due to differences in socioeconomic status and emission regulation will also need to be considered in mitigation strategies. Holistic consideration of these issues can support insightful exposure and health risk assessments and guide efforts to reduce atmospheric aerosols loads, which is one of the most promising strategies to improve air quality.

Levels of premature mortality and the global health burden of air pollution are of paramount concern. Mitigation will require severe air quality control measures based on a sound knowledge of exposure risk, which inherently accounts for the toxicity, concentration and distribution of air pollutants as well as the characteristics and vulnerability of the population in question.

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Fig. 1 Polluted air. Metropolitan regions are often affected by reduced air quality caused by high aerosols concentrations. Credit: kasia1104pilarczyk from Pixabay. https://pixabay.com/photos/paris-smog-eiffel-tower-tourism-1698146/.

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Additional information

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