

Science for Environment Policy

Global health impact of PM_{2.5} air pollution assessed

PM_{2.5} air pollution can have a significant impact on human health, not only for local populations, but also in regions far from its source of emission, shows a new study. The study calculates 'damage factors' to human health of PM_{2.5} and in different parts of the world.

PM_{2.5}, made up of any particles smaller than 2.5 micrometres in diameter, is emitted from various sources, including the combustion of fossil fuels and other organic matter. It has been linked to serious [health](#) problems, including heart, lung diseases and premature deaths, and that can be transported long distances in the air. This means that it may affect people in countries, regions and continents far from its source.

This study investigated the impact of [PM_{2.5}](#) on human health at the global level. The researchers used a global chemical transport model to estimate the fate of PM_{2.5} in ten world regions¹. They considered primary emissions of PM_{2.5}, as well as the fraction of secondary PM_{2.5}. Primary PM_{2.5}, such as black carbon and organic carbon, is emitted directly into the atmosphere. Secondary PM_{2.5} is formed in the air through the chemical transformation of 'precursor' gases, such as nitrogen oxides, sulphur dioxide and ammonia.

The study's authors then estimated the occurrence of death and disease as a result of exposure to PM_{2.5} in populations of all ten regions. Using these results, they calculated 'damage factors' to human health. Damage factors were expressed as Disability Adjusted Life Years (DALYs), or the number of healthy years of life lost to illness, disability or premature death per kilogram of black carbon, organic carbon, nitrogen oxides and sulphur dioxide in all ten regions.

In all regions, the damage factors of the primary PM_{2.5} components black and organic carbon combined were calculated to be about five times greater than damage factors of secondary PM_{2.5}, formed by the gaseous pollutants.

India and China had the largest damage factors, mainly due to the large populations exposed to PM_{2.5} in these countries. Europe and Japan had the next highest damage factors, largely because there are high concentration of emissions in these regions. The Middle East had the third highest damage factors as it receives a significant amount of transboundary PM_{2.5} pollution from India.

Importantly, the study revealed that transported PM_{2.5} has a clear impact on neighbouring regions downwind from the source of emissions. The Middle East was found to be responsible for about 40% of the health damage beyond its own region. Similarly, Europe and Russia accounted for about 30% of the health damage outside of their own regions.

In particular, sulphur dioxide emissions from Europe, North America, Russia, China and Japan, were shown to cause increases in sulphate PM_{2.5} in areas downwind from these regions.

Although the damage factors partly depend on the size of the regions defined in this study, the researchers say their results highlight the importance of the global transport of PM_{2.5}, and this should be taken into account when calculating damage factors.



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1. North America, Europe, Russia, China, Japan, India, Oceania, Central and South America, the Middle East region and Africa.