Health impacts of the new WHO air quality guidelines in European cities

Air pollution is a major global environmental health threat that causes a range of adverse health effects, even at the lowest observable concentrations.[1] Every year millions of people die prematurely around the world and many more get ill because of air pollution. The health effects of air pollution include, but are not limited to, cardiovascular and respiratory disease, cancer, effects on the brain, and birth outcomes.[2] Due to its capacity to penetrate the bloodstream and cause inflammation, air pollution has the potential to damage almost every organ and system in the body.

Finally, after 16 years, WHO updated its 2005 Global Air Quality Guidelines in September, 2021.[3] These guidelines for air quality are much lower than the previous ones, and based on a much larger body of research than before. They recommend aiming for annual mean concentrations of $PM_{2·5}$ not exceeding 5 μg/m³ and nitrogen dioxide (NO_2) concentrations not exceeding 10 μg/m³.[3] For reference, the corresponding 2005 WHO guidelines recommended an annual mean concentration of $PM_{2·5}$ of 10 μg/m³ and NO_2 concentrations not exceeding 40 μg/m³.[4]

Cities are hotspots of air pollution. In January, 2021, we conducted a quantitative Health Impact Assessment to estimate the impact of air pollution exposure ($PM_{2·5}$ and NO_2) on natural-cause mortality for adult residents (aged ≥20 years) of 969 cities and 47 greater cities in 31 European countries (168 180 047 adults representing 32% of the population).[5] We estimated the annual premature mortality burden preventable upon achievement of the 2005 WHO recommended values and 2015 lowest measured values among the European cities (ie, 3·7 μg/m³ for $PM_{2·5}$ and 3·5 μg/m³ for NO_2). Using the same methods and population, we have now estimated the annual premature mortality burden preventable upon achievement of new WHO recommended values.

Considering all cities together, we estimated that the new number of preventable deaths would be 109 188 (95% CI 72 846–145 947) for $PM_{2·5}$ and 57 030 (0–155 257) for NO_2 if the new WHO air quality guidelines would be achieved (table), equivalent to is approximately 57 975 more premature deaths due to $PM_{2·5}$ and 56 130 premature deaths due to NO_2 than if the 2005 WHO air quality guidelines were met.

A much larger number of premature deaths in European cities could be prevented annually by lowering recommended air pollution levels to the new WHO Air Quality Guidelines compared with the 2005 WHO Air Quality Guidelines. Lowering air pollution levels to the lowest observed levels in any city in Europe would even further reduce the number of premature deaths (table); no safe level has been observed for air pollution.

Urgent action is needed to reduce air pollution levels in European cities. The new WHO air quality guidelines offer a fresh opportunity to gain health and we hope will encourage cities to make an additional effort to reduce air pollution.

	$PM_{2·5}$ (95% CI)	Nitrogen dioxide (95% CI)
2005 WHO Global Air Quality Guidelines	51 213 (34 036–68 682)	900 (0–2476)
2021 WHO Global Air Quality Guidelines	109 188 (72 846–145 947)	57 030 (0–155 257)
Lowest level in any city	124 729 (83 332–166 535)	79 435 (0–215 165)

Table: **Number of premature deaths that could be prevented in European cities if $PM_{2·5}$ and nitrogen dioxide concentrations met guidelines or lowest levels**

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For the **latest data on air quality and health** see https://www.stateofglobalair.org/

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