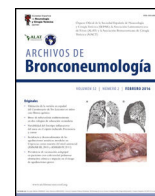




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Clinical Letter

Health Impact of Breathing Small Particles (PM_{2.5}). Health Criteria or Administrative Criteria: A Citizen Science Project

To the Director,

The World Health Organization (WHO) established in 2021 an annual health limit of 5 $\mu\text{g}/\text{m}^3$ for outdoor PM_{2.5} concentrations (cPM_{2.5}) and recommended that levels should not exceed 15 $\mu\text{g}/\text{m}^3$ on 3–4 days per year.¹ However, current government limits set by public administrations are higher (20 $\mu\text{g}/\text{m}^3$) and only consider the annual average as toxic. Our objective is to quantify the time during which the WHO criterion is exceeded and its impact on mortality.

The so-called citizen science aims to generate knowledge through the participation of civil society. Several professionals from different disciplines and neighborhood organizations from the Latina District in Madrid decided to carry out citizen science (civic environmental monitoring) on air quality starting in 2022.

This study was conducted using in-house resources and with the participation of the civic community. A previously validated cPM_{2.5} monitoring device² was installed outside residences near a high-traffic roadway with a daily circulation of 100,000 vehicles. In this location, the socioeconomic level is low.

The data were standardized by calculating daily averages during the observation periods. Final cPM_{2.5} values were determined using a linear regression model that accounted for cPM_{2.5} levels, temperature, relative humidity, and the intercept.² The health effects of these cPM_{2.5} levels were estimated following WHO procedures for various cPM_{2.5} concentrations. This estimation considered the disease being evaluated, average PM_{2.5} concentration, the size of the exposed population aged 25 years or older, the incidence per 100,000 inhabitants at risk per year and per disease, and the calculation method.³

Data collection spanned various periods between January and May 2024, cPM_{2.5} levels between 5 and 9 $\mu\text{g}/\text{m}^3$ were recorded 25% of the time, while levels exceeding 10 $\mu\text{g}/\text{m}^3$ occurred 29% of the time. During 54% of the observation period, cPM_{2.5} values were equal to or exceeded 5 $\mu\text{g}/\text{m}^3$. Values above 15 $\mu\text{g}/\text{m}^3$ were detected 6% of the time. Considering data from the affected population (393,295 inhabitants), the estimated annual COPD mortality is 54 cases (95% CI: 34–75), cardiovascular mortality is 14 cases (95% CI: 11–17), and all-cause natural mortality is 682 cases (95% CI: 521–837).

A Canadian study with a total of 36,377,506 person-years of follow-up, stratified by various variables, reported that the 5th percentile of cPM_{2.5} was 5 $\mu\text{g}/\text{m}^3$.⁴ The hazard ratio (HR) for non-accidental mortality risk at that PM_{2.5} level was 1.035 (1.029–1.041). With that cPM_{2.5} and after adjusting for various covariates, the HRs for acute coronary disease, stroke, lung cancer,

and chronic obstructive pulmonary disease (COPD) were 1.02, 1.10, 1.13, 1.22, and 1.17, respectively. The conclusion is that there is no safe threshold for human health.

Among non-smokers, each 10 $\mu\text{g}/\text{m}^3$ increase in cPM_{2.5} concentration was associated with a 15–27% relative risk increases in lung cancer mortality,⁵ after adjustments for potential confounders such as radon exposure, passive smoking, and occupational exposure.

In conclusion, the official limits on the toxicity of PM_{2.5} in the air underestimate its impact on health. From a public health perspective, at a minimum, the WHO's criterion is the ideal one.

Generative AI

The entire manuscript have not been, neither completely nor partially, produced with the help of any generative artificial intelligence software or tool.

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Conflicts of Interest

The authors declare not to have any conflicts of interest that may be considered to influence directly or indirectly the content of the manuscript.

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