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Long-term air pollution exposure and Parkinson's disease mortality in a large pooled European cohort: An ELAPSE study

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Abstract

Background: The link between exposure to ambient air pollution and mortality from cardiorespiratory diseases is well established, while evidence on neurodegenerative disorders including Parkinson's Disease (PD) remains limited.

Objective: We examined the association between long-term exposure to ambient air pollution and PD mortality in seven European cohorts.

Methods: Within the project 'Effects of Low-Level Air Pollution: A Study in Europe' (ELAPSE), we pooled data from seven cohorts among six European countries. Annual mean residential concentrations of fine particulate matter (PM_{2.5}), nitrogen dioxide (NO₂), black carbon (BC), and ozone (O₃), as well as 8 PM_{2.5} components (copper, iron, potassium, nickel, sulphur, silicon, vanadium, zinc), for 2010 were estimated using Europe-wide hybrid land use regression models. PD mortality was defined as underlying cause of death being either PD, secondary Parkinsonism, or dementia in PD. We applied Cox proportional hazard models to investigate the associations between air pollution and PD mortality, adjusting for potential confounders.

Results: Of 271,720 cohort participants, 381 died from PD during 19.7 years of follow-up. In single-pollutant analyses, we observed positive associations between PD mortality and PM_{2.5} (hazard ratio per 5 µg/m³: 1.25; 95% confidence interval: 1.01-1.55), NO₂ (1.13; 0.95-1.34 per 10 µg/m³), and BC (1.12; 0.94-1.34 per 0.5 × 10⁻⁵m⁻¹), and a negative association with O₃ (0.74; 0.58-0.94 per 10 µg/m³). Associations of PM_{2.5}, NO₂, and BC with PD mortality were linear without apparent lower thresholds. In two-pollutant models, associations with PM_{2.5} remained robust when adjusted for NO₂ (1.24; 0.95-1.62) or BC (1.28; 0.96-1.71), whereas associations with NO₂ or BC attenuated to null. O₃ associations remained negative, but no longer statistically significant in models with PM_{2.5}. We detected suggestive positive associations with the potassium component of PM_{2.5}.

Conclusion: Long-term exposure to PM_{2.5}, at levels well below current EU air pollution limit values, may contribute to PD mortality.

Keywords: Adults; Air pollution; Long-term exposure; Low-level exposure; Parkinson's Disease; Pooled-cohort study.

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Cole-Hunter T, Zhang J, Lim YH, Samoli E, Chen J, Strak M, Wolf K, Weinmayr G, Zitt E, Hoffmann B, Jöckel KH, Mortensen LH, Ketzel M, Méndez DY, Ljungman P, Nagel G, Pershagen G, Rizzuto D, Schramm S, Brunekreef B, Hoek G, Andersen ZJ.

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