

About air pollution and hip fracture

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Raised levels of air pollution have recently been linked to the induction of inflammatory phenomena at both systemic and tissue levels. Chronic inflammatory diseases, such as rheumatoid arthritis or chronic obstructive pulmonary disease, reduce bone mineral density (BMD), which leads to an increase in the release of immune cells from the bone marrow. Particulate matter is associated with oxidative damage and inflammation, which can accelerate bone loss and increase the risk of fractures in older adults. However, the association between air pollution and osteoporosis is not yet well defined in the literature.

It seems that there are other indirect routes, such as vitamin D and PTH, which may also be altered by contamination and are involved in bone remodeling¹⁻⁸. In the first place, air pollution (microparticles and ozone) presents a physical barrier to ultraviolet B solar radiation, thus contributing to a lower cutaneous production of vitamin D^{2,4,5}. Similarly, a study conducted in the United States⁹ indicated the relationship between low levels of PTH in blood and elevated levels of microparticles and carbon in the air, causing indirect harmful effects on bone mass.

To appreciate the importance of these findings, we should take into account the complex etiology of osteoporosis and its consequence of fragility fractures in the general population. Osteoporosis is a systemic disease. Approximately one third of women and one tenth of men over 50 have osteoporosis or osteopenia. The statistics allow us to calculate that approximately one in two women and one in three men over 50 will suffer a fragility fracture during their lifetime.

These patients are more apt to suffer a second fracture, in addition to developing chronic pain, greater dependence on basic activities of daily living and a reduction in their quality of life.

However, the available literature offers conflicting results. In their study, Prada et al.⁹ argue that osteoporosis and fragility fractures may be related to air pollution,

since populations in areas of higher environmental concentrations of particles smaller than 2.5 μm presented a lower BMD with higher hospital admission rates for fractures. Chang et al.¹ obtained similar results in their study in Taiwan, where they discovered that air contaminated with higher concentrations of nitrogen dioxide (NO₂), together with carbon monoxide, increased the risk of osteoporosis and fractures.

Mazzucchelli et al.¹⁰ consider the association of the levels of different air pollutants on the incidence of osteoporotic hip fracture in a region of southern Europe, detecting an association between SO₂ and NO₂ and hospital admissions due to hip fracture. In a second study¹¹, however, these same authors established that at the time of the year with the most adverse weather conditions, such as winter and autumn, there were more cases of hip fractures. Apparently, this phenomenon is due to the fact that at these stages of the year the environment is impregnated with fog and rainwater, and the ground is wet, slippery or covered with tree leaves, which increases the risk of falls and, therefore, fractures, especially those of the hip.

However, in the article published in this issue of the Journal of Osteoporosis and Mineral Metabolism, Ormeño and Quevedo¹² do not find a statistically significant association between environmental pollution and the incidence rate of hospital discharges due to osteoporotic hip fracture in Chile. To its credit, this analysis assesses more than 8,000 hospital discharges in 2017, and, in addition, considering hip fracture as the main objective. As a weakness, it is a retrospective analysis and does not assess the health habits of the population evaluated.

Given the importance of the problem and the different points of view in the literature, we believe more studies are necessary to establish the true relationship between air pollution and osteoporotic fractures. After all, we belong to an ecosystem and everything that alters it can have harmful effects on the fine balance of life.



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Bibliography

1. Chang KH, Chang MY, Muo CH, Wu TN, Hwang BF, Chen CY, et al. Exposure to air pollution increases the risk of osteoporosis. *A Nationwide Longitudinal Study. Medicine (Baltimore)*. 2015; 94(17):e733.
2. Bergin MH, Ghoroi C, Dixit D, Schauer JJ, Shindell DT. Large reductions in solar energy production due to dust and particulate air pollution. *Environ Sci Technol Lett*. 2017;4(8):339-44.
3. Calderón-Garcidueñas L, Mora-Tiscareño A, Francolira M, Torres-Jardón R, Peña-Cruz B, Palacios-López C, et al. Exposure to urban air pollution and bone health in clinically healthy six-year-old children. *Arh Hig Rada Toksikol*. 2013;64(1):23-34.
4. Manicourt DH, Devogelaer JP. Urban tropospheric ozone increases the prevalence of vitamin D deficiency among Belgian postmenopausal women with outdoor activities during summer. *J Clin Endocrinol Metab*. 2008;93(10):3893-9.
5. Agarwal KS, Mughal MZ, Upadhyay P, Berry JL, Mawer EB, Puliyl JM. The impact of atmospheric pollution on vitamin D status of infants and toddlers in Delhi, India. *Arch Dis Child*. 2002; 87(2):111-3.
6. Looker AC, Melton LJ 3rd, Harris TB, Borrud LG, Shepherd JA. Prevalence and trends in low femur bone density among older US adults: NHANES 2005–2006 compared with NHANES III. *J Bone Miner Res*. 2010;25:64-71.
7. Nguyen ND, Ahlborg HG, Center JR, Eisman JA, Nguyen TV. Residual lifetime risk of fractures in women and men. *J Bone Miner Res*. 2007;22:781-8.
8. Nguyen TV. Air pollution: a largely neglected risk factor for osteoporosis. *Lancet Planet Health*. 2017;1(8):e311-2.
9. Prada D, Zhong J, Colicino E, Zanobetti A, Schwartz J, Dagincourt N, et al. Association of air particulate pollution with bone loss over time and bone fracture risk: analysis of data from two independent studies. *Lancet Planet Health*. 2017;1(8):e337-47.
10. Mazzucchelli R, Crespi Villarias N, Perez Fernandez E, Durban Reguera ML, Garcia-Vadillo A, Quiros FJ, et al. Short-term association between outdoor air pollution and osteoporotic hip fracture. *Osteoporos Int*. 2018;29: 2231-41.
11. Mazzucchelli R, Crespi-Villarías N, Pérez-Fernández E, Durbán Reguera ML, Guzón Illescas O, Quirós J, et al. Weather conditions and their effect on seasonality of incident osteoporotic hip fracture. *Arch Osteoporos*. 2018; 13:28.
12. Ormeño Illanes JC, Quevedo Lange-negger EI. Calidad del aire e incidencia de fractura osteoporótica de cadera en Chile. *Rev Osteoporos Metab Miner*. 2019;11(4):87-91.