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Press information

When Moss Reflects Air Pollution

Despite the increasing research into and recognition of the role of particulate matter in the excess mortality caused by air pollution, it is still poorly understood. A research team from Inserm and Université Versailles Saint-Quentin-en-Yvelines used an innovative method based on the biomonitoring of metal levels in mosses in rural France. Over 15 years, the team mapped levels of metals − including lead and cadmium − in mosses. The results were then compared with mortality data from the Gazel cohort. Their findings, published in *Environment International*, point to a link between long-term exposure to atmospheric metals and excess mortality, even in areas remote from major sources of emissions. They confirm the utility of moss biomonitoring as a tool to evaluate the effects of exposure to air pollution.

External air pollution has been recognized as being responsible for 4.2 million premature deaths in 2016, and scientific evidence continues to accumulate in regard to the role played by particulate matter. Produced by both human activity and natural sources, particulate matter contains various metals. Its role in morbidity and mortality however is poorly understood, with little research into the health effects of exposure to atmospheric metals. Often limited by the absence of widespread monitoring stations, studies focus on areas of high exposure or population density (cities, proximity of major roads or polluting industries).

Biomonitoring metal levels in moss1 is an approach which, although it does not measure them directly, is able to evaluate over time the level and variations of atmospheric concentrations of heavy metals deposited on mosses.

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1 In France, the BRAMM program, managed by the French National Museum of Natural History, uses moss biomonitoring for many atmospheric metals, with the objective of monitoring levels of these metals mainly in forests and areas remote from major industrial, urban and traffic sources. This monitoring involves sampling mosses at sites across France, recording the location of each collection site and analyzing their metal content in the laboratory.

A research team from Inserm and Université Versailles St-Quentin-en-Yvelines compared moss biomonitoring data in France with epidemiological data from the Gazel cohort in order to deepen its understanding of the effects on mortality of long-term exposure to atmospheric metals in areas with low levels of exposure to human emissions.

Over 15 years – from 1996 to 2011 – the researchers mapped levels of 13 atmospheric metals (aluminum, arsenic, calcium, cadmium, chrome, copper, iron, mercury, sodium, nickel, lead, vanadium and zinc) in mosses using readings taken as part of the French National Museum of Natural History moss biomonitoring program. They distinguished between metals of natural origin and those of anthropogenic origin (human activity) – the latter being lead, cadmium, copper, mercury and zinc. The health data of over 11,000 Gazel cohort participants living in rural and suburban areas were compared with this mapping.

The researchers observed an increased risk of death from natural causes for the simultaneous exposure to all of the anthropogenic metals. Exposure at shorter distances from major roads appears linked to a higher mortality increase than exposure at longer distances, which could indicate a link between exposure to atmospheric metals produced by road traffic and mortality.

Some atmospheric metals produced by human activities could therefore be linked to excess mortality even in the areas where exposure to air pollution is low. " *Previous studies within the Gazel cohort had shown that those living in urban areas were a lot more exposed to particulate matter than those living rurally and so had a high likelihood of exposure to atmospheric metals*, states Bénédicte Jacquemin, the Inserm researcher having led the study. *City-dwellers are therefore probably more subject to the health effects of atmospheric metals. "*
And to conclude: *The results of this study confirm the utility and relevance of moss biomonitoring as a tool to evaluate the effects of exposure to air pollution. Further studies are needed in order to specify which of the metals contained in the particulate matter are likely to affect human health, which would give us a deeper understanding of the effects of atmospheric pollution on health. "*

Sources

Long-term exposure to atmospheric metals assessed by mosses and mortality in France

Emeline Lequy[1,2,3], Jack Siemiatycki[4], Sébastien Leblond[5], Caroline Meyer[5], Sergey Zhivin[3], Danielle Vienneau[6,7], Kees de Hoogh[6,7], Marcel Goldberg[3,8], Marie Zins[3,8], Bénédicte Jacquemin[1,2,9,10,11, 12*]

1: INSERM, U1168, VIMA: Aging and Chronic Diseases, Epidemiological and Public Health Approaches, F-94807 Villejuif, France.
2: University of Versailles St-Quentin-en-Yvelines, UMR-S 1168, F- 78180 Montigny-le-Bretonneux, France.
3: INSERM, UMS 011, F-94807 Villejuif, France.

4: CRCHUM (Centre de recherche du CHUM) and Department of Social and Preventive Medicine, Université de Montréal, QC, Canada.
5: UMS 2006 PatriNat, National Museum of Natural History, 12 rue Buffon, F-75005 Paris, France.
6: Swiss Tropical and Public Health Institute, Basel, Switzerland.
7: University of Basel, Basel, Switzerland.
8: Université Paris Descartes, 12, rue de l'école de médecine, F-75006 Paris, France.
9: ISGlobal-Institut de Salut Global de Barcelona, 08003 Barcelona, Spain.
10: University Pompeu Fabra (UPF), 08003 Barcelona, Spain.
11: CIBER Epidemiología y Salud Pública (CIBERESP), 08003 Barcelona, Spain.
12: Univ Rennes, Inserm, EHESP, Irset (Institut de recherche en santé, environnement et travail) – UMR_S 1085, F-35000 Rennes, France

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Researcher contact

Bénédicte Jacquemin
Inserm researcher
Unit 1168 Aging and Chronic Diseases, Epidemiological and Public Health Approaches
Unit 1085 Research Institute for Environmental and Occupational Health (IRSET)
"Exposure Assessment and Epidemiological Research on Environment, Reproduction and Development (3ERD)" team
Tel.: +33 (0)2 23 23 77 69
benedicte.jacquemin@inserm.fr

Press contact

presse@inserm.fr

Access the Inserm press room