Genetic predisposition to atrial fibrillation accelerated by air pollution, research suggests

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Research led by the Huazhong University of Science and Technology, China, has connected the effects of air pollutants on the risk of atrial

fibrillation (AF). In a paper, "Air pollution, genetic susceptibility, and the risk of atrial fibrillation: A large prospective cohort study," published in *PNAS*, the team finds long-term exposure to air pollutants increases the risk of AF, particularly among individuals with high genetic susceptibility.

Air pollutants have long been associated with cardiovascular diseases. Recent studies have linked short-term exposure to these pollutants with acute exacerbations of AF. Studies on twins suggest that genetic susceptibility plays a big part in the risk of AF, but these risk factors explain only about half of AF cases.

The current study focuses on the cumulative damage caused by long-term exposure to these pollutants, revealing an association between increased concentrations of particulate matter with aerodynamic diameters smaller than 2.5 μm ($PM_{2.5}$), particulate matter with diameters of 10 μm (PM_{10}), nitrogen dioxide (NO_2), and nitrogen oxide and the underlying genetic risk of AF.

Despite the visible haze that can come with smoke, dust or vehicle emissions, particle pollution is comprised of tiny non-visible elements under 10 μm, and these can travel deep into the lungs. For reference, the average width of human hair is around 70 μm.

The particles can be hundreds of different chemicals depending on their source. Direct emissions from agricultural, automotive, industrial, fire or construction sites will reflect what is coming from those sources. In the atmosphere, more environmentally complex sources like those emitted from power plants, heavy industries and automobile emissions can undergo reactions to produce chemicals like sulfur dioxide and nitrogen oxides.

UK Biobank, a study cohort of over 500,000 participants aged 37 to 73

from across the United Kingdom, was used to create a polygenic risk score aggregating multiple genetic variants associated with AF. As expected, those at medium or high genetic risk had elevated AF risk.

When combining genetic susceptibility with high air pollutant levels, participants exposed to high air pollutants with high genetic risk had approximately 149–182% higher risk of AF than individuals with low genetic risk factors.

The study also found a significant additive risk interaction between PM_{10} and NO_2 and genetic risk, with approximately 16.4–35.1% of cases attributable to the joint effects of these pollutants and genetic predisposition.

The combined effects of air pollutants and genetic risk showed a dose-response manner, such that exposure to high air pollutant levels and having high genetic risk resulted in high AF chances.

More information: Yudiyang Ma et al, Air pollution, genetic susceptibility, and the risk of atrial fibrillation: A large prospective cohort study, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2302708120