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RISK FACTORS

Long-term effects of air pollution

The epidemiological Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA Air) has provided new insight into how air pollution increases mortality and morbidity. As Dr Ranjini Krishnan and colleagues point out in the report of their study assessing both short-term and long-term effects of air pollution, the "data suggest that particulate matter <2.5 μm in aerodynamic diameter ($PM_{2.5}$) exerts a clinically relevant degree of effect on endothelial dysfunction."

Various studies have demonstrated an association between exposure to air pollution and increased cardiovascular mortality and morbidity. However, investigations into the mechanisms of this association have produced conflicting results. Some have found an association between short-term exposure to $PM_{2.5}$ and endothelial dysfunction, whereas others have found an association between $PM_{2.5}$ and vasoconstriction, but not endothelial dysfunction. Krishnan and colleagues, therefore, set out to determine whether short-term (3 days) exposure to $PM_{2.5}$ was associated with endothelial dysfunction, vasoconstriction, or both. They also assessed the vascular effects of long-term (1 year) exposure to $PM_{2.5}$ to ascertain whether these effects were transient or accrued over time.

The study population consisted of 3,040 MESA participants (50% female) residing in five US cities—Chicago, IL; Los Angeles, CA; New York, NY; Saint Paul, MN; and Winston-Salem, NC. Decreases in flow-mediated dilatation (FMD) of the brachial artery and in baseline arterial diameter were used as measures of endothelial dysfunction and vasoconstriction, respectively.

Short-term and long-term $PM_{2.5}$ levels were estimated to range from 1 μg/m^3 to 74 μg/m^3 (interquartile range 12 μg/m^3) and from 10.6 μg/m^3 to 24.7 μg/m^3 (interquartile range 3 μg/m^3), respectively.

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No association was found for baseline arterial diameter and short-term or long-term $PM_{2.5}$ concentrations. By contrast, long-term, but not short-term, $PM_{2.5}$ levels were statistically significantly associated with decreases in FMD. For every 3 μg/m^3 increase in annual average $PM_{2.5}$ concentration, FMD decreased by 0.3% (95% CI –0.6 to –0.03, $P = 0.03$), independently of other cardiovascular risk factors. The authors of the report highlight that this effect on endothelial dysfunction "is comparable to the effect of 5 years' increase in age, or of active tobacco smoking". Notably, they also point out that the 3 μg/m^3 increase in $PM_{2.5}$ concentration "occurs as a contrast in residential exposure between less polluted and more polluted areas in most major US metropolitan areas".

In an editorial that accompanied the study report in the *Journal of the American College of Cardiology*, Dr Robert Brook and Dr Sanjay Rajagopalan comment that "this novel observation should reawaken us to the fact that even 'invisible' elements, such as chronic exposure to low levels of air pollution commonly encountered in the US, can have significant adverse effects on cardiovascular health." They also point out that "$PM_{2.5}$ levels often average 5-to-10-fold higher across numerous regions populated by billions of people worldwide," and conclude, therefore, "that the grave global public health consequences of air pollution ... deserve serious and immediate attention."

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Original article Krishnan, R. M. *et al.* Vascular responses to long- and short-term exposure to fine particulate matter: the MESA Air (Multi-Ethnic Study of Atherosclerosis and Air Pollution). *J. Am. Coll. Cardiol.* doi:10.1016/j.jacc.2012.08.973

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