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Health effects of fine and ultrafine particles in epidemiological studies

Associations have been observed between ambient concentrations of particulate matter and morbidity and mortality consistently and coherently in epidemiological studies. These effects seemed to be attributable to fine particles (diameter below $2.5\mu\text{m}$) when measurement techniques were employed. The effects were attributable to respiratory disease exacerbation as well as cardiovascular disease exacerbation. Recent studies investigating the biological mechanisms which might be responsible for linking deposition of particles in the lung to cardiovascular disease outcomes have suggested several pathways for particle action. These include an acute phase response leading to increases in systemic marker of inflammation in the blood, modification of the autonomic control of the heart and induction of endothelial dysfunction. These changes might predispose individuals to acute ischemia or to sudden cardiac death as indicated by the time-series analyses. Unclear is so far, which role the different components of the complex particle mixture play. A new approach is to address the role of ultrafine particles (diameter below $0.1\mu\text{m}$) and to compare their health effects to those of fine particles. Data collected in Erfurt, Germany suggested that fine particles cannot be used as indicator for ultrafine particles. The limited body of studies including ultrafine measurements suggest that there might be health effects of ultrafine and fine particles independently of each other. Further research is needed to identify the particle properties responsible for the observed associations with fine particles.

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