Systematic review on health effects of long-term exposure to UFP

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Background: Due to their small size, ultrafine particles (UFP≤100nm) can reach deeply into the lungs and could exert higher toxicity on the body organs in comparison with fine particulate matter. Within the last 5 years an increasing number of epidemiological studies examined long-term UFP exposure and health effects.

Objectives: We systematically reviewed the literature on health effects of long-term exposure to UFP.

Methods: Epidemiological studies were searched comprehensively in the electronic databases PubMed and LUDOK (the Swiss literature database on air pollution and health) from January 2017 to September 2023. Articles were included after matching the following eligibility criteria: original epidemiologic studies, reported on the general or sub-populations, assessed long-term exposure of UFP measures, investigated clinical or preclinical health outcomes and reported a quantifiable measure of association. Internal validity of studies was evaluated with a risk of bias instrument.

Results: We identified 53 original studies investigating long-term associations. The vast majority were cohort studies (79.2%) conducted on the general population (62.3%). Half (54.7%) were located in western Europe and 37.7% in North America. More than a third of the studies (41.5%) used a land-use regression model (both spatial and spatio-temporal) to assess surrogates of UFP. Thirty studies adjusted for at least one other co-pollutant. Most identified outcomes were cardiometabolic outcomes (43.4%) including diabetes (N=6), hypertension (N=5), stroke (N=4), and myocardial infarction (N=3); respiratory outcomes (13.2%) including asthma (N=5) and pregnancy outcomes (13.2%) including pre-term birth (N=2). We found adverse association between long-term exposure to UFP with cardiometabolic (78.5%), respiratory (42.9%) and pregnancy (50.0%) outcomes.

Conclusion: The evidence on health effects of long-term exposure to UFP is growing rapidly and suggests adverse associations with several outcomes.