

SOURCES OF HETEROGENEITY IN THE CORRELATION BETWEEN AMBIENT, OUTDOOR AND PERSONAL CONCENTRATIONS OF PM₁₀: IMPLICATIONS FOR BIAS IN EPIDEMIOLOGIC STUDIES

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Background and Aims: Although ambient and outdoor concentrations of particulate matter $\leq 10\mu\text{m}$ (PM₁₀) are often used as surrogates for personal exposure in epidemiologic studies, the observed correlation between ambient, outdoor, and personal measurements vary. Factors underlying this variation among studies remain poorly understood despite their potential impact on exposure measurement error in PM₁₀-health associations.

Methods: We therefore conducted a systematic review of seven electronic reference databases for literature examining the longitudinal, within-person correlation between ambient, outdoor and personal PM₁₀ concentrations.

Results: This review identified 699 studies, of which 15(2%) met inclusion criteria. The studies were published between 1990 and 2009, conducted in five countries, and included 336 participants (age range: 7, 86 years; 14% with chronic obstructive pulmonary disease (COPD)). Of 19 populations represented by the studies, 9(47%) examined ambient-personal correlations and 10(53%) outdoor-personal correlations. The median correlation coefficient (r), based on a median of 9 ambient, outdoor-personal PM₁₀ pairs per participant, was 0.48 (range: 0.13, 0.72). There was little evidence of funnel plot asymmetry ($P_{\text{Begg}}=0.9$; $P_{\text{Egger}}=0.4$), but substantial among-study heterogeneity of r ($P<0.001$). In random-effects meta-regressions, r was higher among studies with ambient, outdoor PM₁₀ concentrations at or above the median of $28.9\mu\text{g}/\text{m}^3$ (difference in r : 0.27, 95% confidence interval 0.03, 0.48), with personal: ambient, outdoor concentration ratios below the median of 1.5 (difference in r : 0.34, 95% confidence interval 0.12, 0.53), and in participants without versus with COPD: (difference in r : 0.38, 95% confidence interval 0.10, 0.60).

Conclusions: The observed magnitude and heterogeneity of correlations between ambient, outdoor and personal PM₁₀ concentrations are similar to those described by recently published meta-analyses of PM_{2.5}. Together, the findings help quantify a common form of measurement error associated with reliance on ambient, outdoor PM mass concentrations as proxies for personal exposure to coarse and fine particulates in epidemiologic studies.

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