

Effects of Smoking and Air Pollution on Tuberculosis Development and Treatment Outcomes: A Systematic Review and Meta-analysis

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RATIONALE: Exposure to air pollution and tobacco smoke are linked to adverse health outcomes, including respiratory infections like tuberculosis (TB). Recent reviews on effects of air pollution and tobacco smoke on TB do not use state-of-the-art systematic review methods and do not assess the quality of TB diagnosis and definition. This systematic review incorporates new evidence to strengthen understanding of effects of air pollution and tobacco smoke on TB development and treatment outcomes.

METHODS: Searches for original manuscripts reporting on exposure to household air pollution (HAP), ambient air pollution (AAP), or tobacco smoke and the relationship to TB development or treatment outcomes were performed in five databases with no restrictions on publication date through 2022. Narrative review and structured assessment of potential sources of bias were used to assess validity of study designs and results. Meta-regression was used to construct summary effect estimates. Effect estimates are presented according to health outcome, study type, and TB diagnosis quality.

RESULTS: After full-text review, 359 articles were included. Studies included data from 66 countries. Smoking, HAP, and AAP were examined in 231, 62, and 66 studies, respectively. Smoking was associated with increased TB mortality, delayed time to sputum smear and culture conversion, and increased rates of relapse and drug resistance. Exposure to HAP was associated with increased risk of *Mycobacterium tuberculosis* (Mtb) infection. Exposure to AAP was associated with an increased risk of Mtb infection and TB mortality.

CONCLUSIONS: Studies of TB mortality and treatment outcomes corroborate the causal role of tobacco smoking in increasing TB mortality and worsening treatment outcomes. They strengthen the evidence for HAP and AAP as risk factors for TB incidence, and AAP as a risk factor for TB mortality. If so, tobacco control policies and efforts to improve air quality could be important levers for improvement in TB-related outcomes worldwide.