Atmospheric Dispersion of Cadmium-Bound $PM_{2.5}$ from Agricultural Burning and Its Respiratory Health Impact on Women and Children in Southeast Asia

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Abstract

Cadmium-bound PM2.5 resulting from agricultural biomass burning poses a serious respiratory health risk in rural areas of Southeast Asia, especially for women and children who are frequently exposed. This study reviews 42 peer-reviewed articles published between 2010 and 2024, primarily from Indonesia, Vietnam, Thailand, and Myanmar. These studies consistently identify agricultural burning as a major contributor to PM2.5 pollution, with cadmium commonly found as a toxic component. Cadmium typically binds to ultrafine particles (<2.5 µm), enhancing its potential for long-range transport and deep lung deposition. Peak concentrations often occur during dry-season burning and may exceed WHO air quality guidelines by more than threefold. Respiratory symptoms such as coughing, wheezing, and breathlessness are frequently reported among populations living within 5 km of burning fields. Children under 10 show increased hospital visits for acute respiratory infections, and women engaged in farming or outdoor chores are disproportionately exposed. Identified exposure pathways include direct inhalation, ingestion of contaminated food or water, and indoor smoke infiltration. Despite these risks, protective measures such as clean stoves or masks are inconsistently applied. This review underscores the need for integrated responses including low-cost air quality monitoring, sustainable residue management, and environmental risk education. Connecting pollutant behavior with health outcomes can support targeted policy and improved public health strategies across vulnerable rural communities.

Keywords: Cadmium, PM2.5, Agricultural burning, Respiratory health, Southeast Asia