

Elsevier Editorial System(tm) for
Chemosphere
Manuscript Draft

Manuscript Number:

Title: The burden of disease attributable to ambient PM_{2.5}-bound PAHs exposure in Nagpur, India

Article Type: Research paper

Section/Category: Toxicology and Risk Assessment

Keywords: disability-adjusted life years (DALYs); quantitative structure-activity relationships (QSAR); relative toxicity factor (RTF); developmental impairment; reproductive abnormally.

Corresponding Author: Dr Tunde O Etchie, PhD

Corresponding Author's Institution: Meteorology, Environment & Demographic Surveillance

First Author: Tunde O Etchie, PhD

Order of Authors: Tunde O Etchie, PhD; Saravanadevi Sivanesan, PhD; Ayotunde T Etchie, PhD; Gregory O Adewuyi, PhD; Krishnamurthi Kannan, Ph.D; K V George; Padma S Rao, PhD

Abstract: Polycyclic aromatic hydrocarbons (PAHs) bound to PM_{2.5} are genotoxic carcinogens that can also elicit non-cancer effects. Previous studies report substantial burdens of PAHs-related lung cancer, but no estimate for other cancer types or non-carcinogenic burden. Here, we assessed the burden of disease, in DALYs/person/year, attributable to thirteen priority PAHs in PM_{2.5} in Nagpur district, for several endpoints linked to benzo[a]pyrene, to inform policy decision-making for mitigation. We conducted detailed assessment of concentrations of PAHs in nine areas, covering urban, peri-urban and rural environments, from February 2013 to June 2014. PAHs concentrations were converted to benzo[a]pyrene equivalent concentration for cancer and non-cancer effects using relative potency factors and relative toxicity factors derived from quantitative structure-activity relationships, respectively. We derived severity for each endpoint using GBD 2016 dataset. The annual average concentration of total PAHs in Nagpur district was 458±246 ng/m³, and results in 0.011 DALYs/person/year (49,000 DALYs/year), much higher than the WHO reference limit of 1×10⁻⁶ DALYs/person/year. PAHs-related burden follow this order: developmental (mostly cardiovascular) impairment (55.1%) > cancer (26.5%) or lung cancer (23.1%) > immunological impairment (18.0%) > reproductive abnormally (0.4%). The estimated DALYs/person/year is high. Mitigation intervention should target combustion sources having the highest level of exposure.

Suggested Reviewers: Professor Douglas Crawford-Brown PhD
Director, Cambridge Centre for Climate Change Mitigation Research,
University of Cambridge
djc77@cam.ac.uk
Professor Crawford-Brown is a renowned expert in human health risk assessment of chemical exposures.