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Changes in Lung Function and Airway Inflammation Among Asthmatic Children Residing in a Woodsmoke-Impacted Urban Area

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Abstract

Fine particulate matter (PM_{2.5}) is associated with respiratory effects, and asthmatic children are especially sensitive. Preliminary evidence suggests that combustion-derived particles play an important role.

Our objective was to evaluate effect estimates from different PM_{2.5} exposure metrics in relation to airway inflammation and lung function among children residing in wood smoke-impacted areas of Seattle. Nineteen children (ages 6-13 yr) with asthma were monitored during the heating season.

We measured 24-h outdoor and personal concentrations of PM_{2.5} and light-absorbing carbon (LAC). Levoglucosan (LG), a marker of woodsmoke, was also measured outdoors. We partitioned PM_{2.5} exposure into its ambient-generated (*Eag*) and nonambient (*Ena*) components. These exposure metrics were evaluated in relation to daily changes in exhaled nitric oxide (FENO), a marker of airway inflammation, and four lung function measures: midexpiratory flow (MEF), peak expiratory flow (PEF), forced expiratory volume in the first second (FEV₁), and forced vital capacity (FVC). *Eag*, but not *Ena*, was correlated with combustion markers.

Significant associations with respiratory health were seen only among participants not using inhaled corti-costeroids. Increases in FENO were associated with personal PM_{2.5}, personal LAC, and *Eag* but not with ambient PM_{2.5} or its combustion markers. In contrast, MEF and PEF decrements were associated with ambient PM_{2.5}, its combustion markers, and *Eag*, but not with personal PM_{2.5} or personal LAC. FEV₁ was associated only with ambient LG.

Our results suggest that lung function may be especially sensitive to the combustion-generated component of ambient PM_{2.5}, whereas airway inflammation may be more closely related to some other constituent of the ambient PM_{2.5} mixture.