Carbon in Airway Macrophages and Lung Function in Children

PURPOSE OF THE STUDY. To define the extent of pulmonary-function abnormalities that may be attributed to exposures to particulate matter with a median aerodynamic diameter of <10 μm (PM10) as a result of fossil fuel combustion.

STUDY POPULATION. The study included 114 children (aged 8 to 15 years) without any chronic respiratory condition who were living in the same residence for 1 year. All children had a forced expiratory volume in 1 second (FEV1) of >80% predicted.

METHODS. Pulmonary-function testing and induced sputum were obtained on the same day. PM10 values from all sources were collected for 1 year. The results were controlled for passive tobacco-smoke exposure.

RESULTS. A total of 62 (56%) of the 114 subjects were able to produce sputum. An increase of 1 μg/m³ in PM10 was associated with an increase of 0.10 μm² in the carbon content of airway macrophages. Each 1.0 μm² increase in carbon content was associated with a significant decrease in pulmonary function (decrease of 17% in FEV1, 12.9% in forced vital capacity, and 34.7% in forced expiratory flow, midexpiratory phase).

CONCLUSIONS. A significant reduction in pulmonary function resulted from increased exposure to products of fossil fuel combustion.

REVIEWER COMMENTS. The authors concluded that there is an association between exposure to high levels of indoor NO2 and respiratory symptoms in children with physician-diagnosed asthma. This association, however, was limited to children who lived in multifamily homes, probably because of the smaller size (and air volume) of the apartments. The authors also suggested a strong association of NO2 exposure with housing characteristics, lower socioeconomic status, and ethnicity.

Particulate Levels Are Associated With Early Asthma Worsening in Children With Persistent Disease
Rabinovitch N, Strand M, Gelfand EW. Am J Respir Crit Care Med. 2006;173:1098–1105

PURPOSE OF THE STUDY. To determine if exposure to particulate matter has immediate effects on asthma control in children with persistent disease.

STUDY POPULATION. Seventy-three schoolchildren (aged 6–13 years) with physician-diagnosed asthma in Denver, Colorado, were studied.

METHODS. Over 2 consecutive winters, the subjects were followed daily. The association among ambient fine-particulate levels, bronchodilator use, and urinary leukotriene E4 levels was assessed.

RESULTS. Fine-particulate concentrations peaked in the morning hours during hours when children were commuting to school. Children with severe asthma had a stronger association (+8.1%) than those with mild-to-moderate disease (+1.6%), with increased bronchodilator usage at school on days with an increase of 1 interquartile range in morning maximum fine-particulate levels. Morning maximum fine-particulate levels were also associated with urinary leukotriene E4 levels measured during school hours (average increase of 6.2% per interquartile-range increase).

CONCLUSIONS. Peak concentrations of ambient fine particulate are associated with early increases in bronchodilator use and urinary leukotriene E4 levels among children with persistent asthma, despite the use of controller medications.

REVIEWER COMMENTS. Managing patients with asthma requires knowing possible triggers. This study examined the timing of particulate associations with disease control in children with moderate or severe asthma who were taking controller medications. The interval between exposure and initiation of health effects was seen to occur within the first few minutes or hours after exposure. The effects were strongest in children with more severe asthma. This effect plus the increase in urinary leukotriene E4 levels suggest that in children with persistent asthma, particulate exposure may lead to early release of mediators related to asthma worsening.
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