Ambient Daily Pollen Levels in Association with Asthma Exacerbation Among Children in Philadelphia, Pennsylvania

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Pollen from trees, grasses, and weeds can trigger asthma exacerbation in sensitized individuals. However, there are gaps in knowledge about the effects, such as the relative risks from different plant taxa and threshold levels of effect. We aimed to describe the local association between pollen and asthma exacerbation among children in the City of Philadelphia, and to evaluate whether effects are modified by children's characteristics and clinical factors (e.g., child's age, race/ethnicity, comorbidities). We conducted a time-stratified case-crossover study of pediatric (age <18 years) asthma exacerbation, with cases identified through electronic health records (EHR) of the Children's Hospital of Philadelphia (CHOP) health system from March through October in the years 2011-2016. Daily pollen counts were obtained from the local National Allergy Bureau certified pollen counter. We applied conditional logistic regression to estimate odds ratios (OR) and 95% confidence intervals (CI) for the association between the pollen level (vs. none detected) and odds of asthma exacerbation, adjusting for temperature, relative humidity, and holidays. We estimated same-day exposure effects, as well as effects from exposure lagged by up to 5 days. There were 35,040 asthma exacerbation events during the study period, with the majority occurring among black, non-Hispanic children (81.8%) and boys (60.4%). We found increased odds of asthma exacerbation among Philadelphia children in association with tree pollen, both for total tree pollen and most individual tree types. Increased odds from total tree pollen were observed at the lowest levels studied (?5 grains/m3, unlagged, OR = 1.06, 95% CI: 1.02, 1.10), and exhibited a positive exposure-response pattern of effect; tree pollen levels above 1000 grains/m3 (unlagged) were associated with 64% increased odds of asthma exacerbation (95% CI: 1.45, 1.84). Grass pollen was associated with asthma exacerbation only at levels above the 99th percentile (52 grains/m3), which occurred, on average, two days per year during the study period (with 2-day lag, OR = 1.38, 95% CI: 1.19, 1.60). There was an inverse association (reduced asthma exacerbation) with ragweed pollen that was consistent across analyses. Pollen from other weeds was associated with increased odds of asthma exacerbation, without a clear exposure-response pattern (2-day lag, significant increases ranging from 8% to 19%). Increased odds from tree pollen and weeds (other than ragweed) were higher among children with allergic rhinitis. While there are known benefits from urban vegetation for human health, there are risks as well. It is important to note, however, that pollen is released during a limited time frame each year, and advisories informed by local data can enable susceptible individuals to avoid outdoor exposure on high-risk days.

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