



Letter

Effect of aeroallergen sensitization on asthma control in African American teens with persistent asthma

Asthma control depends on many factors, including access and adherence to medications and exposure to asthma triggers. Studies of inner-city children with asthma report that exacerbations decrease when household allergen exposure is reduced¹ or with aggressive National Asthma Education and Prevention Program guidelines-based therapy.² African Americans are at higher risk of poorly controlled asthma than other races³ and experience greater asthma-related morbidity and mortality.^{4,5} We conducted an observational study of African American adolescents between August 2013 and October 2014 examining factors that influence asthma control (clinicaltrials.gov identifier: NCT01891630). We hypothesized that allergic status influences asthma control despite guidelines-based therapy. In this report, we present the data from a descriptive analysis of 25 African American teens aged 12 to 17 years with moderate or severe persistent asthma followed up in a subspecialty clinic, comparing teens with poorly controlled asthma with age-matched teens with well-controlled asthma.

Asthma control was assessed at a baseline visit and 5 follow-up visits during a 2-month period. Study physicians determined asthma control using National Heart, Lung, and Blood Institute guidelines for management of asthma, focusing on degree of impairment by assessing symptom frequency, short-acting β -agonist use, nighttime awakenings, and activity limitation.⁶ Spirometry was performed at each visit, and forced expiratory volume in 1 second was used in the asthma control assessment. At follow-up visits, asthma control determination was based on impairment, health care use, and oral corticosteroid (OCS) requirement for asthma since the last study visit.

Asthma medication use was optimized among those classified as having poorly controlled asthma at baseline, and inhaler with spacer technique was reviewed. Allergic profile was defined using peripheral blood eosinophil count and an allergy skin prick test (SPT) to indoor and outdoor allergens common to the southeastern United States. A positive SPT result was interpreted as a 3-mm wheal greater than the saline control.

Peripheral blood eosinophil count was modeled as a continuous variable. Allergy exposure was modeled using SPT data as a dichotomous variable for each individual allergen and a composite multiple allergens variable (number of allergens continuously and

≥ 4 allergens to <4 allergens). Logistic regression models were run to evaluate each allergic sensitization to asthma control. The asthma control variable was defined as those whose asthma became well controlled by visit 2 and remained controlled vs those whose asthma control was erratic or remained poorly controlled. We secondarily assessed whether OCSs were prescribed during the study for asthma exacerbation. Results from logistic regression models yielded odds ratios (ORs) and 95% confidence intervals (CIs). Each allergic profile variable and control outcome were assessed for differences by age, body mass index (BMI), sex, and tobacco smoke exposure to evaluate potential confounding by demographic variables. All analyses were conducted in SAS statistical software, version 9.4 (SAS Institute Inc, Cary, North Carolina).

Of the 25 patients with moderate to severe persistent asthma, the mean age was 14 years, mean BMI was 24.2 (calculated as weight in kilograms divided by square of height in meters), 36% were female, 14 had well-controlled asthma at the baseline visit, and 11 had poorly controlled asthma. Of those with poorly controlled asthma, 1 had asthma that became well controlled by visit 2, whereas 10 continued to have poorly controlled asthma. Eight of these 10 teens required OCSs during the study period for asthma exacerbation. Age, sex, BMI, and tobacco smoke exposure did not vary between those whose asthma was well controlled and those whose asthma was poorly controlled at baseline. Nearly 70% of allergic individuals were studied during a relevant pollen season.

We found significant associations between aeroallergen sensitization patterns and poorly controlled asthma or loss of asthma control and OCS use for asthma exacerbations (Table 1). For the loss of control variable, we compared those with poorly controlled asthma ($n = 10$) and those whose asthma was controlled by the second visit and continued to remain well controlled ($n = 15$). The odds of loss of control compared with remaining well controlled were higher in those with higher eosinophil counts (OR, 1.38; 95% CI, 0.96–2.00), higher number of allergen sensitizations (OR, 1.36; 95% CI, 0.98–1.89), and 4 allergens or more compared with those with fewer than 4 allergens (OR, 6.00; 95% CI, 0.93–38.63). Among teens who did not achieve asthma control ($n = 10$), we found significantly increased odds of sensitization to tree mix (OR, 18; 95% CI, 1.75–184.68) and weed mix (OR, 10.9; 95% CI, 1.6–75.48), excluding ragweed. For OCS requirement, we found an association ($P = .07$) between sensitization to *Dermatophagoides farinae* (OR, 5.417; 95% CI, 0.88–33.36) and weed mix (OR, 5.5; 95% CI, 0.836–36.196).

Our small study found a significant association between poorly controlled asthma and sensitization to aeroallergens, particularly seasonal outdoor allergens, despite guidelines-directed therapy in African American teens with moderate to severe persistent asthma. Our study is limited by small sample size in determining

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Table 1
Logistic Regression Model of Allergic Profiles by Outcome Asthma Control Throughout Study

	Outcome 1: Loss of control during study		Outcome 2: OCS use	
	OR (95% CI)	P value	OR (95% CI)	P value
Exposures				
Peripheral blood eosinophil count	1.38 (0.96–2.00)	.08	1.061 (0.774–1.455)	.71
Allergen sensitization (No.)	1.36 (0.98–1.89)	.06	1.306 (0.935–1.825)	.12
Sensitization to ≥ 4 allergens	6.00 (0.93–38.63)	.06	3.375 (0.524–21.729)	.20
Allergy (yes/no)				
<i>Dermatophagoides pteronyssinus</i>	1.33 (0.25–7.01)	.73	2.400 (0.423–13.600)	.32
<i>Dermatophagoides farinae</i>	1.33 (0.25–7.01)	.73	5.417 (0.880–33.360)	.07
2 Cockroach mix	2.75 (0.51–14.86)	.24	2.400 (0.423–13.600)	.32
Tree mix 10	18 (1.75–184.68)	.02 ^a	1.481 (0.265–8.267)	.65
Grass mix GS7	3.5 (0.55–22.30)	.18	6.222 (0.623–62.159)	.12
National weed mix	10.99 (1.60–75.48)	.01 ^a	5.500 (0.836–36.196)	.07
Mold mix 1	1.5 (0.30–7.53)	.62	3.056 (0.535–17.462)	.21
Cat hair extract	6.42 (1.09–37.73)	.04 ^a	3.056 (0.535–17.462)	.20
Dog epithelia	0.72 (0.06–9.22)	.80	1.071 (0.083–13.896)	.96
Ragweed mix	0.31 (0.03–3.24)	.32	1.556 (0.205–11.830)	.67

Abbreviations: CI, confidence interval; OCS, oral corticosteroid; OR, odds ratio.

^aP < .05.

associations, and although power was insufficient to test interactions between the season in which patients were studied and asthma control, most patients were studied during a relevant pollen season. Despite these limitations, we found that the likelihood of having poorly controlled asthma was higher in polysensitized individuals, consistent with the findings of several studies that suggested an association between degree of atopy and bronchial hyperresponsiveness.^{7,8} We found an 18-fold higher risk in tree pollen-sensitized and 10-fold higher risk in weed pollen-sensitized (excluding ragweed) individuals, suggesting that tree or weed pollen sensitization is an independent risk factor for asthma exacerbation. We also suspect that independent of season, by virtue of being allergic and therefore primed, our patients were more susceptible to exacerbations attributable to viruses, pollutants, and other triggers. In contrast to pediatric inner-city asthma studies, our results did not suggest a significant effect of cockroach sensitization on loss of asthma control, whereas sensitization to cat was associated with increased likelihood of poorly controlled asthma (Table 1). The effects of global climate change on human disease have become more apparent recently, with longer pollination seasons and increasing airborne pollen concentrations occurring alongside a global increase in asthma prevalence and severity.⁹ Our findings suggest that in addition to guidelines-directed asthma therapies, targeting the allergic component, particularly tree and weed pollens, is an important strategy for achieving optimal asthma control in this at-risk population. Given these findings, therapies targeting specific IgE, such as omalizumab and seasonal allergen specific immunotherapy, may be more relevant than ever for reducing asthma-related morbidity.

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