Supplemental Information

Exercise-Induced Wheeze, Urgent Medical Visits, and Neighborhood Asthma Prevalence

METHODS

Clinical Measurements

IgE antibodies against German cockroach, mouse urine, *Dermatophagoides farinae*, cat dander, dog dander, common ragweed, mixed tree pollen (Tx8), and mixed grass pollen (Gx2) were measured in serum by ImmunoCAP (Phadia, Uppsala, Sweden).[14] Seroatopy was defined as IgE $\geq$ 0.35 IU/mL against any allergen tested.

Pulmonary function tests (PFTs) were conducted by using a spirometer (Koko, nSpire Health, Longmont, CA). PFTs were scored based on acceptability criteria developed by study pulmonologists according to American Thoracic Society guidelines described previously. FEV_1/FVC was selected as the primary outcome.[12]

FeNO and ambient NO measurements were collected by the offline method described previously.[12,31] Breath samples were considered valid only if (1) the child exhaled at a consistent, correct flow and (2) either the child inhaled correctly through the NO sampling device filter or the ambient NO was $<$20 ppb. Samples collected when the ambient NO exceeded 100 ppb were excluded regardless of proper inhalation.[12]

We identified the child's waist by palpating the iliac crest. The circumference was measured during normal expiration with a flexible, cloth tape

SUPPLEMENTAL TABLE 3 Sensitivity Analyses of the Association Between Neighborhood Asthma Prevalence and EIW (n = 169)

	PRs for EIW[a,b]	
	Exposure Variable	Neighborhood Asthma Prevalence
Without exposure variable	—	1.08 (1.01-1.15)[c]
Bed dust allergens (μg/g)[d]		
Cockroach (Bla g 2)	0.97 (0.79–1.18)	1.08 (1.01–1.15)[c]
Mouse (Mus m 1)	1.03 (0.91–1.15)	1.08 (1.01–1.15)[c]
Dust mite (Der f 1)	0.93 (0.76–1.14)	1.08 (1.02–1.15)[c]
Cat (Fel d 1)	0.90 (0.76–1.07)	1.08 (1.02–1.15)[c]
Dog (Can f 1)	1.00 (0.88–1.15)	1.08 (1.01–1.15)[c]
Indoor airborne particulate matter[e]		
PM2.5 (ng/m^3)	0.99 (0.67–1.44)	1.08 (1.01–1.15)[c]
BC (ng/m^3)	1.19 (0.75–1.88)	1.07 (1.01–1.14)[c]
Community average outdoor air pollution[f]		
PM2.5 (μg/m^3)	1.00 (0.70–1.42)	1.08 (1.01–1.15)[c]
Elemental carbon (abs)	0.96 (0.17–5.4)	1.08 (1.00–1.16)
Nitrogen dioxide (ppb)	0.98 (0.91–1.06)	1.08 (1.01–1.15)[c]
Sulfur dioxide (ppb)	1.01 (0.89–1.16)	1.07 (1.00–1.1)][c]
Ozone (ppb)	0.96 (0.85–1.09)	1.08 (1.01–1.14)[c]
GIS estimated variables for surrounding 500 m[g]		
Truck route density (km/km^2)	1.02 (0.87–1.19)	1.07 (1.01–1.15)[c]
Street density (km/km^2)	1.01 (0.94–1.08)	1.08 (1.01–1.15)[c]
Traffic density	1.00 (1.00–1.00)	1.07 (1.01–1.14)[c]
Distance to major highway (m)[h]	1.00 (0.80–1.27)	1.08 (1.01–1.15)[c]
Residential buildings burning residual oil[i]	1.00 (0.99–1.01)	1.07 (1.01–1.14)[c]
Density of parks[j]	1.52 (0.13–17.5)	1.07 (1.01–1.15)[c]

[a] Sample size was restricted to those study subjects that had a complete set of variables for the exposure variables and potential confounding variables included in the models.

[b] PRs calculated by using a GEE model with community district used as a cluster variable, adjusted for gender, race, Hispanic ethnicity, maternal asthma, ETS, neighborhood income, and material hardship.

[c] $P < .05$.

[d] Allergens were measured in the child's bed dust as described previously.[14]

[e] Fine particulate matter (PM2.5) and BC in the PM2.5 were measured in air samples collected for 7 d after the home visit.[12,32]

[f] Reported by the New York City Community Air Survey at the UHF level (ie, several zip codes).[34]

[g] Geographic information system estimates for densities of traffic related measurements in the 500 m surrounding the child's home as described previously.[12]

[h] Distance in meters to the nearest major highway (A1) rather than a density variable.

[i] Buildings burning residual oil (#4 or #6) as described previously.[12]

[j] Density of parks as percentage land in the 500-m radius of the home.

measure wrapped around midaxillary line.

Bed Dust Allergens

Dust samples were collected during home visits by vacuuming the upper half of the fitted sheet and both sides of the pillows from the child's bed by using a Duststream collector (Indoor Biotechnologies, Charlottesville, NC) for 3 minutes as described previously.[14] Bed dust samples were extracted by using Phosphate buffered saline 0.05% Tween, pH 7.4, at a concentration of 50 mg/mL and stored at −20°C until analysis. Der f 1 Fel d 1, Can f 1, and Mus m 1 were measured by using multiplex bead immunoassays. Bla g 2 was measured by enzyme-linked immunosorbent assay (Indoor Biotechnologies). All results are based on the universal allergen standard curve. For results below the limit of detection (LOD), we used values of 1/2 the LOD. LODs and coefficients of variance for duplicates are described in a previous publication.[14]

Indoor Air Particulate Matter

Fine particulate matter was collected in the child's home by sampling air at 1.5 mL/minute for the 7 days after the home visit during which the clinical measures were assessed as described previously.[12] BC was quantified on filters by using multiwavelength optical absorption technique.[32]

New York City Neighborhood Level Outdoor Pollution

In partnership with Queens College, the New York City Department of Health conducted the New York City Community Air Survey. During 2008 and 2009, 150 outdoor air-monitoring stations were places throughout New York City to measure ozone, nitrogen oxides, elemental carbon, particulate matter, and sulfur dioxide. UHF level (UHF level = several zip codes) annual average concentrations from this data were made publically available by the New York City Department of Health and Mental Hygiene.[33] These average concentrations were linked to the study subject's home address by zip code.

Local Neighborhood Estimated Variables

The subject's residential school addresses were geo-coded by using Geosupport and LION geocoding services GIS as previously described.[12] For those used in this article, variables were created for the 500-m radius surrounding the child's home. Neighborhood variables included average daily traffic variables (number of vehicles per area), truck density as a marker of diesel combustion byproduct exposure (density of truck routes per measured area), use of #4 and #6 heating oil (count of oil burners by oil burner type per measured area), and access to parks or green space (percent of neighborhood definition that is covered by parks or green spaces).

Sensitivity Analyses Models

The purpose of testing the sensitivity analyses models was to determine whether estimations of exposure to allergens or combustion byproducts were associated with EIW or if adjustment for these exposure variables decreased the effect size of the estimated association between neighborhood asthma prevalence and EIW. As described for the main analyses, PRs were calculated by using a GEE model with UHF used as a cluster variable. Variables conventionally considered as potential confounders or covariates were included in the multivariable model, including gender, race, Hispanic ethnicity, maternal asthma, ETS, neighborhood income, and material hardship. Lung function and waist circumference were not included because inclusion of these variables reduced the sample size. The estimated PR for neighborhood asthma prevalence and EIW in the model that included lung function and waist circumference (PR = 1.09 [1.02–1.16], Table 2) was similar to that estimated without those variables (PR = 1.08 [1.01–1.15], Supplemental Table 3).