



School environmental exposures and risk of exacerbations in pediatric asthmatics - a pilot study

OBJECTIVE

This observational epidemiologic study aims to:

Investigate whether biologic and chemical asthma triggers in the indoor school environment, alone or in combination with home exposures, are associated with short-term increases in lower airway inflammation or decrements in lung function in pediatric asthmatics.

Identify physical school characteristics, policies, and practices that are associated with classroom asthma trigger levels and the health of asthmatic students.

BACKGROUND

Asthma, an inflammatory disease characterized by airway hyperresponsiveness, bronchial constriction, and decreased lung function, ranks as a leading chronic disease of childhood. Symptoms can lead to school absences, reduced activity, diminished quality of life, doctor visits, and hospitalizations. Uncontrolled chronic inflammation may result in irreversible airway remodeling and gradually declining lung function.

Minimizing exposures to environmental triggers, in combination with monitoring, education, and pharmacologic treatment, is a primary means of controlling asthma. Most epidemiologic studies to identify indoor asthma triggers and develop exposure-reduction interventions have focused on the residential environment. Yet children also spend 6-10 hours per weekday in school buildings.

High levels of animal and pest allergens, fungi, and chemicals have been detected in individual schools, as well as inadequate ventilation and humidity. Carpet presence, type of ventilation system, cleaning method, and prevalence of cat owners impact classroom exposure levels. A few studies suggest that school exposures are associated with asthmatic and sick building symptoms, and upper airway inflammation and obstruction. However, such data on health effects of school exposures and potential interventions are limited.



ANTICIPATED IMPACTS

- **Enhanced scientific understanding** of the roles indoor pollutants play in exacerbating asthma.
- **Informed resource-allocation decisions** as to whether efforts to decrease children's asthma trigger exposures should be directed at school, as well as residential, environments.
- **Advanced development and implementation of school-based environmental health programs** through prioritization of proposed school modifications based on their relative effectiveness in reducing asthma triggers or adverse health impacts.
- **Strengthened interdisciplinary partnerships** between health researchers, environmental hygienists, school administrators, teachers, facilities managers, parents, and architects.

SCIENTIFIC APPROACH

Identify and recruit children in grades K - 5th with physician-diagnosed asthma. The cohort will be weighted towards children *not* taking anti-inflammatory controller medications.

Assess and compare asthma trigger presence and levels in participants' classroom and home environments.

- Dust mite*, cockroach*, cat*, and dog* allergens; ergosterol; endotoxin; moisture*; formaldehyde; volatile organic compounds; particulate matter*; and CO₂*. The extent of trigger sampling will depend on funding availability (starred [*] are most likely to be measured).

Identify classroom and school characteristics that are hypothesized to impact trigger levels and asthmatic disease processes.

- Ventilation system type and maintenance; cleaning regimen; wall, floor, ceiling, and furnishings materials (particularly carpet, textiles, and pressed wood); low-emission or "green" products; policies re: animals and eating in classrooms; doormat systems; building site; etc.

Estimate the within-participant changes in three measures of the asthmatic disease process occurring over a weekend (school vs. weekend day) and over winter break (vacation day vs. school day post-vacation).

- Exhaled nitric oxide (eNO): a non-invasive measure of lower airway inflammation
- Peak expiratory flow (PEF): a measure of lung function
- Forced expiratory volume in 1 sec. (FEV1): a measure of lung function

Examine associations between the weekend and vacation changes in eNO, PEF, and FEV1 and the following exposures:

- Classroom asthma triggers, statistically controlling for home exposures.
- Overall asthma trigger exposure variables based on the combined classroom and home trigger levels.
- Classroom and school characteristics, with and without controlling for classroom trigger levels so as to both estimate the overall associations between school characteristics and asthmatic outcomes, and explore the mechanisms behind such associations.