

BUILDING EVIDENCE



FOR HEALTH

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ALLERGENS

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What are they?

Indoor allergens are typically harmless substances we encounter everyday. Common household allergen sources include pet dander, pollen, mold, pest and rodent excrement. Particle containing these allergens commonly settle into carpets, drapes, soft furnishings and other locations where settled dust collects.¹¹ However, when allergens are inhaled or come into contact with eyes, they can trigger an immune response that leads to an allergic reaction. A survey of 851 homes in 75 different locations across the United States found that more than half the homes had a least 6 detectable allergens.²⁶ Pet allergens are ubiquitously distributed, and independent of the presence of animals because loss of pet hair, dander, and body secretions easily distribute small particles that contain allergens and can be carried on clothing and human hair.¹¹ Therefore, even in homes without pets, pet allergen may be present, as well as in hospitals, schools, offices, and public transport.²⁵ However, homes without pets can have allergen concentrations 10-1000 times lower compared to homes with pets.³

Why do we care?

In addition to nasal allergies, which plague 50 million people in the United States alone, and allergic rhinitis, allergens can result in the development and the exacerbation of asthma.¹¹ Asthma, a chronic condition that can result from inflammation of the lung airways, causes coughing, chest tightness, wheezing and shortness of breath (<http://acaai.org/news/facts-statistics/asthma>) and is the fifth most common chronic illness amongst all ages (AAFA, 2017) and the most common chronic illness in children.⁷ Asthma results in 439,000 hospitalizations, 1.8 million emergency room visits, 3,600 deaths annually,¹⁰ 13.8 million missed school days and 14.2 million lost work days for adults,⁷ costing \$56 billion annually.¹ Asthma and allergy symptoms (i.e. sneezing, stuffiness, runny nose, itchiness) are strongly associated with moisture, mold, and house dust mite and cockroach problems, and tobacco smoke.⁸ It is predicted that with global environmental changes, there will be altered spatial and temporal distributions of allergens that could exacerbate pre-existing asthma conditions and increase the risk of developing asthma and other allergic respiratory conditions.²⁰

How does the building contribute to this issue?

Building quality (e.g. cracks in walls/floors/windows, broken plumbing, or exposed wires) can increase or decrease exposure to allergens.¹⁶ For example, in a study involving Boston Public Housing, holes in the wall/ceiling were associated with a six to eleven-fold increase in kitchen cockroach allergen.²² Asthma was less frequently diagnosed in homes that were owned rather than rented,¹⁶ and the authors suggest that this relates to their finding that rented units were more likely to be of poor quality than those that were owned. However, there are other socioeconomic factors that may confound these associations.

Indoor temperature and humidity can contribute to domestic allergen load. Common household arthropod (insect) allergens include those from the microscopic house dust and storage mites, which reproduce and develop well in humid, warm environments. As a person sleeps they can increase bed temperature and humidity due to perspiration and make an optimal microclimate for dust mite survival.²⁵ Exposure to these common household allergens have been associated with increased risk for wheeze, asthma severity, persistent cough and medication use in exposed children.¹¹



In addition, a 2011 World Health Organization report (WHO 2011) showed that homes with indoor dampness, mold, mildew, and dustmites were associated with an increase in childhood asthma. In westernized, urban societies asthma morbidity is worse for children living in households with poor-quality, high crowding, no vehicle for transportation, and lack of amenities.¹² For example, Hughes et al, (2017) examined the 2011 American Housing Survey, and found households with poor quality housing (e.g. cracks in walls/floors/windows, lacking basic amenities, more than 2 people per bedroom) had a 50% higher odds of an asthma-related ED visit in the past year. Additionally, exposure of pregnant mothers to domestic cockroach allergen and high concentrations of non-volatile polycyclic hydrocarbons (a class of chemicals produced from partial combustion of organic matter) were predictive of their children being sensitized to cockroaches at age 5-7 years. This suggests that targeting allergens or combustion sources could be a valuable approach to reducing cockroach sensitization.²³ In developing countries, asthma development and exacerbation are triggered by air pollution, industrialization, construction, as well as limited access to health services and education.⁴

Housing proximity to other neighborhood infrastructure (i.e. supermarkets, restaurants, construction sites, other dilapidated buildings) may influence the amount of mouse or rat allergen present, as may building size (i.e. number of floors) and type of housing (i.e. house, duplex, apartment building).²⁴

Who is most vulnerable to indoor allergens?

Young children, the elderly, genetically predisposed, and low-income individuals are most vulnerable.^{2,3,19,25} For example, Lopez et al. (2015) found that New York City children living in low income, largely minority neighborhoods of East Harlem were nearly 13 times more likely to have asthma related emergency department visits compared to children on the Upper East Side, a nearby affluent neighborhood. This was attributable to high number of environmental asthma triggers including, poorly maintained housing, and presence of mold and pests.¹⁸ Additionally, African American/Black individuals are disproportionately exposed to cockroach allergen and experience allergic sensitization compared to white individuals.²⁷ Individuals exposed to high outdoor air pollution also result in higher asthma rates in children.¹⁵

What can I do?

There are a multitude of different strategies with varying efficacy for reducing allergens in homes. Currently, there is uncertainty and controversy surrounding the best practices for reducing allergen exposure.²¹ Below are examples of the widely researched options:

- To temporarily reduce indoor allergens, wash bedding and drapes in hot water as well as regularly wash pets. Vacuuming soft furnishings (carpets, drapes, seating) with a high efficiency particulate air (HEPA) filter if regular washing is not possible.^{11,13}
- Create barriers for allergens and pests. Encasing mattresses in allergen-impermeable materials (reduce allergen exposure by 89% but it does not completely remove the risk).¹¹ Additionally, caulking and sealing holes and cracks.¹³
- Utilize Integrated Pest Management strategies. A single Integrated Pest Management visit was shown to significantly reduce the number of cockroaches, concentration of cockroach allergen, and pesticide use in the New York City Public Housing compared to regular applications of pesticides.¹⁷
- Prevent accumulation of dust in your homes by removing shoes when entering, using front door mats that capture allergens before you enter, dusting regularly, reducing carpeting throughout the home, and cleaning air filters.¹³
- Control the growth of mold by properly maintaining dehumidifiers, regularly cleaning air conditioning units, and exhaust kitchen and bathroom fumes.^{6,13}
- Reduce or eliminate behaviors that promote asthma and allergies including smoking indoors.²¹



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