
Wanda Phipatanakul, M.D., M.S., FAAAAAI
Associate Professor of Pediatrics
Boston Children’s Hospital
Harvard Medical School
Pediatric Allergy and Immunology
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wanda.phipatanakul@childrens.harvard.edu
Conflicts of Interests

- No relevant conflicts of interest
- NIH funding
OBJECTIVES

At the end of this discussion, participants should be able to:

• Describe home/building based triggers of both allergic and non-allergic triggers of rhinitis and asthma.

• Outline steps in the assessment of a home environment for triggers

• Develop a plan for avoidance of triggers (environmental control) that works
Environmental Control = Remediation
(both allergens and non-allergic triggers)
Who’s Most Likely to Be Affected?

- Rhinitis or asthma with evidence of sensitization & possible exposure
- Exposure assessment starts with a thorough history
  - Absence of report, though, may not be reassuring
  - Some allergens are not visible to the patient (e.g. dust mites)
- Populations for special consideration
  - People residing in communities endemic for a particular allergen
    - UK, Australia for dust mite
    - Baltimore City for mouse
  - People with African ancestry
  - Children
  - People living in poverty
    - Poor housing conditions
Triggers of Airways Disease

- **Allergic**
  - House Dust Mites
  - Domestic Animals
    - Cat
    - Dog
    - Horse
  - Pests
    - Mouse
    - Cockroach
  - Fungi spores
  - Pollen

- **Non-allergic**
  - Cigarette Smoke
  - Combustion by-products
  - Vehicle exhaust
  - Volatile Organic Compounds
  - Ozone
  - Formaldehyde
  - Ergosterols
  - Glucans
Home-based Environmental Intervention

Koch’s Postulates

- impact on well being
- reduced candidate allergens significantly
- reduction in allergens correlated with health improvement

- Most Significant Effects in Reduced Cockroach
- Mouse not evaluated

Figure 2. Mean Maximal Number of Days with Symptoms for Every Two-Week Period before a Follow-up Assessment during the Two Years of the Study. The difference between the groups was significant in both the intervention year (P<0.001) and the follow-up year (P<0.001).

Morgan, NEJM 2004
Principles of Environmental Controls in the Home

• **Source Control**
  – Control or remove the trigger.

• **Indoor Moisture & Humidity**
  – Wet is bad.
  – Control moisture & water incursion, & humidity.
  – 30-50% of all structures in the United States and Canada have damp conditions.

• **Air Ventilation, Circulation, & Filtration**
  – OSHA found >50% of building-related health problems were from poor ventilation.

OSHA-IAQ Invest Manual 1999
Steps to an Environmental Control Plan in the Allergist’s Office

• Detailed medical history determining triggers recognized or perceived by the patient.
  – Important not to dismiss perceived triggers at this stage – you loose your credibility

• Detailed environmental history looking for unrecognized triggers, including potential building issues (ask open ended questions)

• If significant potential building issues surface, a home inspection by a certified *Healthy Homes Specialist* should be considered. (www.healthyhomestraining.org)
EPA Home Visit Assessment Tool
<table>
<thead>
<tr>
<th>General Measures</th>
<th>Specific Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Improve Ventilation</td>
<td>• No Smoking</td>
</tr>
<tr>
<td>• Control humidity</td>
<td>• Mite-proof Encasings</td>
</tr>
<tr>
<td>• Regular maintenance of HVAC, gas appliances,</td>
<td>• Removal of allergen reservoirs e.g. carpeting, upholstered furniture</td>
</tr>
<tr>
<td>fireplaces.</td>
<td>• Reduce animal exposure</td>
</tr>
<tr>
<td>• High efficiency air filtration</td>
<td>• Pest control</td>
</tr>
<tr>
<td>• Vacuum (HEPA, cyclonic, central)</td>
<td>• Minimize use of candles, incense, aerosols, air fresheners, etc.</td>
</tr>
<tr>
<td>• Wear personal respiratory protection (N95 Respirator)</td>
<td></td>
</tr>
</tbody>
</table>
Targeted Avoidance Measures

• Source Control
  – Allergens: Mites, Animals, Pests (Cockroach, Mouse)
  – Combustion by-products: cigarette smoke, candles, etc
  – Sources for VOCs, ozone, etc.
  – Water/Moisture damaged reservoirs for mold growth

• Ventilation/Humidity Control/Filtration
  – Allergens: Mite, Mold, Pollen
  – Indoor Pollutants
  – Reduce incoming mold, pollen, pollutants from outdoors.
  – Vent moisture, indoor pollutants to the outdoors.
  – High efficiency filtration to remove particulates from air
Cockroach/Mice Pest Management

• Integrated pest management preferred
  – Targeted placement of insecticide bait to reduce exposure to potentially toxic pesticides
  – Sealing of cracks and crevices to prevent re-infestation
  – Removal of food and water sources
  – Thorough cleaning of all surfaces including floors, cabinets, appliances
  – Occupant education

• Vacuum with HEPA filters/ Clean surfaces

  Sheehan WJ, Phipatanakul, AAAAI Indoor Committee Rostrum JACI 2010:125; 575-581
Professional IPM & Mouse Allergen

Mus m 1 (mcg/g)

p<.05

Baseline 1 3 5

time (mos)

intervention
control

ICAS: Home IPM & Asthma Morbidity

- N=150/155
  - asthma
  - +SPT
- Rodent module
  - Traps, education, air filters
- Change in BR floor Mus m 1
  - -27% vs. +28%

Pongracic J, Ann Allergy Asthma Immunol 2008
Air Cleaners and Health Coaching Improves Symptoms

**Table 4. Differences in SFDs, Slowed-Activity Days, and Symptom-Free Nights During Past 2 Weeks by Group**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Difference(^a) in SFDs During Past 2 wk, Mean (SD)</th>
<th>(P) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daytime wheeze, cough, chest tightness(^b)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control group</td>
<td>-0.24 (3.0)</td>
<td>.09</td>
</tr>
<tr>
<td>Air cleaner group</td>
<td>1.06 (3.4)</td>
<td></td>
</tr>
<tr>
<td>Air cleaner plus health coach group</td>
<td>1.63 (4.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Slowed-activity days(^b)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control group</td>
<td>0.25 (3.2)</td>
<td>.12</td>
</tr>
<tr>
<td>Air cleaner group</td>
<td>2.24 (5.2)</td>
<td></td>
</tr>
<tr>
<td>Air cleaner plus health coach group</td>
<td>1.32 (5.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Nocturnal wheeze, cough, chest tightness(^b)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control group</td>
<td>-0.03 (4.3)</td>
<td>.34</td>
</tr>
<tr>
<td>Air cleaner group</td>
<td>1.21 (4.5)</td>
<td></td>
</tr>
<tr>
<td>Air cleaner plus health coach group</td>
<td>1.25 (3.9)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: SFDs, symptom-free days.
\(^a\) Indicates mean 6-month concentration minus the baseline concentration.
\(^b\) Analysis of variance was used to compare mean differences in SFDs.

Air Filters and Improved Asthma Symptoms

FIGURE 2
Mean numbers of unscheduled asthma visits in the previous 3 months, reported at quarterly intervals during the trial, according to group assignment, with adjustment for differences in the numbers of unscheduled asthma visits at baseline. The solid line and closed circles indicate the intervention group; the dashed line and open circles, control group.
Changes in health care costs for each intervention compared with baseline over all asthma patients

JACI Jan 2014
Top Ten Tips for Improving Indoor Air Quality and Reducing your Allergen Exposure

1. No smoking inside the home at any time.
2. Measure the indoor humidity and keep it below 50%. Do not use vaporizers or humidifiers. You may need a dehumidifier.
3. Use vent fans in bathrooms and when cooking to remove moisture. Repair all water leaks.
4. Vent gas appliances and fireplaces to the outside and maintained regularly.
5. Keep pets out of the bedroom at ALL times.
6. Remove wall-to-wall carpets from the bedroom if possible.
7. Use a central vacuum, a cyclonic vacuum or a vacuum with a HEPA filter regularly. Remember it takes over 2 hours for the dust to settle back down.
8. Wear a NIOSH N95 particulate respirator when vacuuming, sweeping, or doing yard work to reduce your exposure to fine particulates and allergens.
9. Install a MERV 11 or 12 disposable high efficiency media filter in the furnace and air-conditioning system. Change the filter every 3 months. Leave the fan “on” to create whole house filtration.
10. Use a HEPA Air Cleaner in the bedroom with an adequate CADR (Clean Air Delivery Rate) for the size of the room.
Summary...

- Targeted avoidance measures should be the cornerstone for the treatment of atopic diseases
- Avoidance may play more of a role in altering disease progression rather than thinking of them as a treatment. (e.g. the way we approach smoking cessation)
- Identification of triggers by thorough environmental history and allergen skin testing very helpful.
- Avoid a “shot-gun” approach with avoidance
- Multiple interventions are necessary to see measurable clinical results
Call for More Research

• Environmental control (EC) is feasible, effective, cost-effective, sustainable, and has the potential to benefit multiple people living in the home

• Perception that EC is not effective, however, persists

• Areas to target
  – Understanding dominant allergen in a community
  – Understanding location of exposures
  – Understanding dose-response relationships
  – Consideration of public health approach to augment individual patient management
  – Policy change to cover durable goods and services for EC
  – Other modes of exposure

• Certain patient groups deserve special consideration
  – Children, poor, African ancestry
References Parameters


References: Rostrums

- Sublett JL, Seltzer J Brukhead R, William PB, Wedner HJ, Phipatanakul W; American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee. “Air filters and air cleaners: Rostrum by the American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee.” Journal of Allergy and Clinical Immunology 2010; 125(1):32-38 American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee. “Air filters and air cleaners: Rostrum by the American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee.” Journal of Allergy and Clinical Immunology 2010; 125(1):
- Sheehan WJ, Rangsithienchai PA, Wood RA, Rivard D, Chinratanapisit S, Persanowski MS, Chew GL, Seltzer JM, Matsui EC and Phipatanakul W. “Pest and Allergen Exposure and Abatement in Inner-City Asthma: A Work Group Report of the American Academy of Allergy, Asthma & Immunology Indoor Allergy/Air Pollution Committee.” Journal of Allergy and Clinical Immunology 2010;125(3):575-81. PMCID: PMC2862381