Environmental Assessment and Exposure Reduction of Cockroaches

Wanda Phipatanakul, MD, MS
Associate Professor of Pediatrics
wanda.phipatanakul@childrens.harvard.edu

Harvard Medical School

Session: Immunotherapy Track - Cockroach Immunotherapy: New Insights

December 6, 2014
1:50 PM to 2:05 PM
COI/Disclosures

• NIH Funding-to Institution
Learning Objective

• To Discuss Cockroach Practice Parameters and Key Evidence to date on the importance of cockroach allergen exposure, symptoms, and abatement
Why should an allergist care about cockroaches?
Bla g 2 levels > 1U/g in children’s bed and kitchen dust samples were independently associated with cockroach-specific IgE, adjusting for other covariates (such as asthma).
NHANES- US Cockroach Allergy Prevalence ~20%

N = 9440

Male
Black
South
No Pet
More Pos

Roach ~20%
1/3 children
age 1-5
sensitized

### Mouse/Cockroach Rural Homes


<table>
<thead>
<tr>
<th></th>
<th>Detectable</th>
<th>Above Sensitation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mus m 1</strong></td>
<td>&gt;0.01 mcg/g</td>
<td>&gt;1.6 mcg/g</td>
</tr>
<tr>
<td>any room</td>
<td>93 (97.9%)*</td>
<td>32 (33.7%)*</td>
</tr>
<tr>
<td>bedroom</td>
<td>93 (96.7%)</td>
<td>21 (22.1%)</td>
</tr>
<tr>
<td>kitchen</td>
<td>74 (81.3%)</td>
<td>26 (26.8%)</td>
</tr>
<tr>
<td><strong>Bla g 1</strong></td>
<td>&gt; 0.4 U/g</td>
<td>2 U/g</td>
</tr>
<tr>
<td>any room</td>
<td>62 (65.3%)*</td>
<td>38 (40%)*</td>
</tr>
<tr>
<td>bedroom</td>
<td>41 (43.2%)</td>
<td>15 (15.8%)</td>
</tr>
<tr>
<td>kitchen</td>
<td>53 (58.2%)</td>
<td>36 (39.6%)</td>
</tr>
<tr>
<td><strong>Bla g 2</strong></td>
<td>&gt; 1 U/g</td>
<td>&gt;2 U/g</td>
</tr>
<tr>
<td>Any room</td>
<td>38 (40%)*</td>
<td>35 (36.9%)*</td>
</tr>
<tr>
<td>bedroom</td>
<td>27 (28.4%)</td>
<td>19 (20%)</td>
</tr>
<tr>
<td>kitchen</td>
<td>34 (37.4%)</td>
<td>34 (37.4%)</td>
</tr>
</tbody>
</table>

20% bedrooms > cockroach sensitization threshold
Allergy/Climate in Subtropics

Larenas-Linnemann et al. Clinical and Translational Allergy 2014, 4:20

SAR vs. PAR

Mite  Trees  Grass  Weed  Mold  Cockroach  Cat
A Nationwide Survey of Inhalant Allergens Sensitization and Levels of Indoor Major Allergens in Korea

Hye Jung Park,1,2 Jae-Hyun Lee,1,2 Kyung Hee Park,1,2 Hea Won Ann,3 Moo-Nyun Jin,3 Soo-Young Choi,2 Yong-Won Lee,1,2 Chein-Soo Hong,1,2 Jung-Won Park1,2*

[Bar graph showing SPT and sIgE positivity rates for various allergens.]

Cockroach Sensitization
Rural/Urban Asthma-Africa

Oluwole A, African Health Sciences 2013; 13(1) 144-153
HOME Cockroach Allergen Exposure and Asthma Morbidity in Inner City Children

- **Hospitalizations**: $p=0.001$
- **Unscheduled Medical Visits**: $p<0.001$
- **Change in Care Giver’s Plans**: $p=0.006$

<table>
<thead>
<tr>
<th>Skin Test</th>
<th>Allergen Exposure</th>
<th>No. of Visits in Past Year</th>
<th>Days With Changed Plans in Past Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neg skin test</td>
<td>Low allergen</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Neg skin test</td>
<td>High allergen</td>
<td>0.2</td>
<td>0</td>
</tr>
<tr>
<td>Pos skin test</td>
<td>Low allergen</td>
<td>0.3</td>
<td>0</td>
</tr>
<tr>
<td>Pos skin test</td>
<td>High allergen</td>
<td>0.4</td>
<td>0</td>
</tr>
</tbody>
</table>

* Bla g 1 > 8 U/gram

Cockroach exposure independent of sensitization status and association with hospitalizations for asthma in inner-city children

Table 4. Multivariable Regression Analyses of Children Who Were Hospitalized for Asthma vs Those With No Hospitalization

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI)</th>
<th>Model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blag1 exposure &gt;2 U/g</td>
<td>5.41 (1.14–25.62)</td>
<td>4.20 (1.24–14.17)</td>
<td></td>
</tr>
<tr>
<td>Blag1 exposure &gt;2 U/g and sensitized</td>
<td>0.65 (0.13–3.32)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Oral corticosteroid use (≥1 x daily)</td>
<td>17.65 (1.52–204.75)</td>
<td>15.42 (1.39–171.37)</td>
<td></td>
</tr>
<tr>
<td>Ever admitted to the ICU for asthma</td>
<td>4.69 (1.29–17.01)</td>
<td>5.56 (1.27–16.36)</td>
<td></td>
</tr>
</tbody>
</table>
Now that we have established why allergists care about cockroaches, what do you need to know?
Periplaneta americana
Blattella germanica
Early-life cockroach allergen and polycyclic aromatic hydrocarbon exposures predict cockroach sensitization among inner-city children.
Environmental Changes, Microbiota, and Allergic Diseases

Byoung-Ju Kim,¹ So-Yeon Lee,² Hyo-Bin Kim,³ Eun Lee,⁴,⁵ Soo-Jong Hong⁴,⁵*

## Early Mouse/Cockroach Exposure - What is Going On?

<table>
<thead>
<tr>
<th>Sensitizations</th>
<th>n</th>
<th>Sensitized Percent (no.)</th>
<th>Unadjusted Odds ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any food</td>
<td>383</td>
<td>40% (155)</td>
<td>1.74 (1.14-2.67)</td>
<td>.01</td>
</tr>
<tr>
<td>Any aeroallergen</td>
<td>356</td>
<td>46% (163)</td>
<td>1.58 (1.02-2.46)</td>
<td>.04</td>
</tr>
<tr>
<td>Cat</td>
<td>362</td>
<td>17% (61)</td>
<td>1.78 (1.02-3.12)</td>
<td>.04</td>
</tr>
<tr>
<td>Dog</td>
<td>359</td>
<td>12% (44)</td>
<td>1.91 (1.01-3.60)</td>
<td>.05</td>
</tr>
<tr>
<td>Cockroach</td>
<td>359</td>
<td>14% (52)</td>
<td>1.62 (0.89-2.94)</td>
<td>.11</td>
</tr>
<tr>
<td>Mouse</td>
<td>366</td>
<td>20% (74)</td>
<td>1.58 (0.94-2.66)</td>
<td>.09</td>
</tr>
<tr>
<td>Dust mite</td>
<td>364</td>
<td>11% (41)</td>
<td>2.18 (1.13-4.20)</td>
<td>.02</td>
</tr>
<tr>
<td>(Dermatophagoides farinae)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust mite (Dermatophagoides pteronyssinus)</td>
<td>360</td>
<td>13% (45)</td>
<td>1.48 (0.79-2.80)</td>
<td>.23</td>
</tr>
</tbody>
</table>

*ETS, Environmental tobacco smoke; PSS, Perceived Stress Scale.*

JACI 2014, Lynch, Wood, Gern
Effects of early-life exposure to allergens and bacteria on recurrent wheeze and atopy in urban children

C. Year 1 by Sensitivity

p = 0.001
p < 0.001

B. Taxa of Interest

<table>
<thead>
<tr>
<th>p</th>
<th>0.19</th>
<th>0.01</th>
<th>0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>19</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>10</td>
<td>23</td>
<td>44</td>
<td>29</td>
</tr>
<tr>
<td>21</td>
<td>23</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>48</td>
<td>35</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>

Neither Wheeze Atopic Both

JACI 2014, Lynch, Wood, Gern
Mouse or Cockroach? Will the Real Inner-City Allergen Please Stand Up?

Ahluwalia et al. JACI 2013; 132: 830-5

Adjusted for age, gender, total IgE, and public health insurance
Summary statements

• Keep exposures low to reduce risk of sensitization
• Keep exposure low to reduce risk that sensitized patients will develop disease
• Keep exposure low to reduce risk of asthma morbidity in already sensitized patients
• Patients with suspected atopy and likely cockroach exposure should be test for sensitization
Home-based Environmental Intervention - Long Lasting Events

The Critical View

- Effect size modest
- Some exposures were minimally affected by the intervention (mouse)
- Did reduction in exposures mediate the effects?
- Home-based Mouse Trial-Ongoing
- Consideration of Schools?
- Cost-Effective? $750-1000
- Daily Singulair costs more
IPM

Assess & modify facilitative factors

• Routes of ingress
• Sources of food, water
• Assess infestation
• Location(s) of greatest activity
• Source control:
  • traps
  • + - Pesticide (low toxicity)
• Educate/Clean
Location of Trap
Physical Exclusion
IPM in Baltimore (Asthmatic children)

Figure 3. Change in the proportion of children with daytime asthma symptoms. The proportion was significantly lower at 6, 9, and 12 months in the treatment group (*t* test), and the average difference was significant during the first 9 months (generalized estimating equation).
Summary statements

• Use IPM to prevent and eliminate cockroach infestations
• Reservoirs should be cleaned or removed to prevent additional exposures
• Pesticides should be used judiciously and ideally applied by a professional as part of and overall IPM program.
Because these interventions are not covered by the patient’s insurance, the family is referred to the Healthy Housing Program at the City Health Department because this organization can support the family in instituting these environmental control practices.”
Multicomponent intervention

The Seattle-King County Healthy Homes Project: A Randomized, Controlled Trial of a Community Health Worker Intervention to Decrease Exposure to Indoor Asthma Triggers

James W. Krieger, MD, MPH, Tim K. Takaro, MD, MPH, MS, Lin Song, PhD, and Marcia Weaver, PhD

Community health workers:
- reduced asthma symptom days
- reduced urgent health services
- Improved caregiver quality-of-life score

Review articles:
Multi-faceted interventions

Effectiveness of home-based, multi-trigger, multicomponent interventions with an environmental focus for reducing asthma morbidity

Housing interventions and control of asthma-related indoor biologic agents: a review of the evidence.
Cockroach Practice Parameter Workgroup

- Jay Portnoy, MD, Ginger Chew ScD, Wanda Phipatanakul MD, MS, James Sublett MD co-chair, Kevin Kennedy MPH co-chair, Charles Barnes PhD, David Bernstein MD, Jonathan Bernstein MD, Carl Grimes, Elizabeth Matsui MD, Jeffrey D. Miller MD, J David Miller PhD, James Seltzer MD, P Brock Williams PhD.