Mold Damage in Homes and Atopic Wheezing in Infants
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ABSTRACT

RAISONABLE: Mold is known to cause respiratory symptoms and illnesses, but very few studies have investigated the effect of mold exposure among infants.

METHODS: As part of the Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS), we studied the effect of presence of mild mold damage and exposure to house dust mite in the home on wheezing in infants at age one. The presence of mold was investigated during onsite home evaluation, which included questions on history of water/mold damage, observation of moldy odor, and measurement of the area of the visible water/mold damage. Floor dust samples were taken at the same time for the allergen analysis. The homes were classified into three categories: no water/mold damage (class 0), minor water/mold damage (class 1), and major mold damage (>0.2 m²) (class 2). Skin prick test (SPT) for allergens, milk and egg, and a respiratory symptom questionnaire were administered during clinic visits.

RESULTS: There were 629 infants included in the analysis that had an onsite home evaluation, a symptom questionnaire, and a SPT test. Among the homes, 43% were found to belong to class 0, 50% to class 1, and 7% to class 2. A positive SPT result was observed in 20% of infants with 18% positive to any allergen and 7% positive to milk. Children who lived in mold-damaged homes (class 2) had increased risk of atopic wheezing (wheezing at least twice with SPT+), especially for non-African American (AA) OR (95% CI) = 4.15 (2.4, 7.3) for entire cohort and 7.1 (3.5, 13.9) for non-AA. House dust mite allergen was associated with wheezing and SPT positivity only in AA infants.

CONCLUSION: Mold exposure is associated with wheezing in atopic infants regardless race. However, house dust mite is more likely to be a risk factor in AA infants.

PURPOSE OF THE STUDY

To investigate the relation of mold damage in homes and exposure to house dust mite with persistent wheezing and sensitization to allergens in infants.

METHODS

Study location
- Cincinnati and Northern Kentucky

Study cohort
- 778 eligible families visited in the "Cincinnati Childhood Allergy and Air Pollution Study" (CCAAPS)
- 629 infants analyzed
- At least one parent with SPT+ for allergens (pollen and mold)

Child’s skin prick test
- Clinic visit at the age about 12 months
- Food (milk and egg) and allergens (pollen and mold)

Symptom report
- Persistent wheezing: at least 2 times of wheezing episode
- Atopic persistent wheezing: persistent wheezing and SPT+ for allergen, food, or animal

METHODS (cont’d)

On-site home visit and exposure assessment
- Home visit at the age 6 months
- Questionnaires
  - History of water damage
  - Existence of visible mold
- Exposure assessment
  - Observation of visible water/mold damage inside home
  - Moldy odor
  - Moldy surface material
- Floor dust sampling in the child’s primary activity room
- Analysis of house dust mite allergen (Der f1) by ELISA

Development of mold classification
- Class 0 (no damage): must not have any of the following:
  - Water damage
  - Visible mold
  - Moldy odor
  - Water/mold damage history
- Class 1 (minor damage): must have at least one indication above (visible mold ≤ 0.2 m²)
- Class 2 (major damage): must have visible mold
- Additive weight in the entire room ≤ 0.2 m²
- Combined area of visible mold + water damage on the same surface ≤ 0.2 m²

Statistical analysis
- Spearman correlation: the association between wheezing and SPT positivity and mold class and Der f1
- Multiple logistic regression: the relative risk of mold class and Der f1 on wheezing and SPT positivity

RESULTS

Table 1. Prevalence of wheezing and SPT positivity in infants (629 infants)∗

<table>
<thead>
<tr>
<th>Type</th>
<th>Any persistent wheezing</th>
<th>Asthmatic wheezing</th>
<th>SPT food+</th>
<th>SPT egg+</th>
<th>SPT mold</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>7</td>
<td>25</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

∗ At least three times of wheezing or SPT+.

Table 2. Measured mold damage in homes and house dust mite exposures and their relation to wheezing and SPT positivity for allergens in infants of different races

<table>
<thead>
<tr>
<th>Any persistent wheezing</th>
<th>Asthmatic wheezing</th>
<th>SPT food+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(class 0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(OR)</td>
<td>(95% CI)</td>
<td>(p-value)</td>
</tr>
<tr>
<td>1 (no damage)</td>
<td>1 (no damage)</td>
<td>1 (no damage)</td>
</tr>
<tr>
<td>2.4 (1.9-2.9)</td>
<td>2.0 (1.4-3.0)</td>
<td>1.3 (0.8-2.2)</td>
</tr>
<tr>
<td>3.1 (2.0-5.1)</td>
<td>2.4 (1.4-4.0)</td>
<td>1.8 (1.1-3.0)</td>
</tr>
<tr>
<td>4.1 (2.8-6.3)</td>
<td>3.6 (2.1-6.0)</td>
<td>2.8 (1.7-4.7)</td>
</tr>
</tbody>
</table>

Conclusions

More than half of families in the study had visible mold or water damage.

Mold damage was found to be highly associated with persistent wheezing.

Mold damage was associated with a significant 4-fold risk (OR=4.15) for atopic wheezing.

In African American infants, exposure to house dust mite was significantly associated with risk of wheezing (OR=2.84), atopic wheezing (OR=3.17), and sensitization to allergens (OR=2.26).

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