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2017

Link to publication

Citation for published version (APA):

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Utility of measuring allergen content in house dust samples in a cross-sectional study of respiratory health and atopy in a cohort of immigrant families in poor-quality housing in Malmö, Sweden

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Abstract

Background. Exposure to allergens plays a role in the development of atopic sensitization and influences allergic phenotype. House dust mites (HDM) are a common source of allergens in many parts of the world. The relationship between indoor environment factors such as temperature, moisture/humidity, and ventilation and HDM allergen load is complex.

Methods. Part of a larger study into the health in its social context of an immigrant population living in poor-quality housing in Malmö, Sweden. Families with small children were identified from health care records (child treated in primary care with respiratory illness), and school records (matched for age range). Families were visited in their homes by health care professionals fluent in their language. For 6-12 months, family and individual level health data, including skin-prick-tests for a standard panel of allergens, were analyzed together with environmental exposures (mould, dampness, ETS, crowding and allergen content) in the part of the study presented here. Allergen content was analyzed for house dust mites and cockroach allergens. Der p1, Der f 1, and Bla g 1 from dust samples collected in the affected apartments. Allergen content was measured using sandwich ELISA.

Results. 130 families participated, with usable data for 359 children under the age of 12, 61 older children and 230 parents. The overall exposure to potentially harmful factors was relatively high, the burden of atopy and respiratory diseases was significant. Dust samples were collected in all 130 apartments. Correlations between apartment characteristics, allergen content and health outcomes in this vulnerable population are explored and discussed against the framework of a model explicitly accounting for social determinants of health.

Conclusions. The utility of allergen content measurements in the context of this study was rather limited, as it did not add vital information that could further elucidate pathways and connections between environmental exposures and health outcomes.

BACKGROUND

In 2008, the public in Sweden became aware of the extremely poor housing conditions in certain areas of Powellton, a predominantly immigrant neighborhood in Malmö (county of Skåne, southern Sweden). Upshot had been severely neglected by the proprietors for many years. Apartments in the affected neighborhood, Hongkonggatan, were overcrowded, damp, affected by mould, and infested by cockroaches and other vermin. The main property owner, after massive media attention and subsequent court trial, received an injunction from local authorities to perform extensive renovations on 190 housing units. This provided a unique opportunity to examine whether the health of children living in this neighborhood had been affected by poor indoor environmental conditions. The results of the study were presented at various international conferences and have been published as separate articles. The study approach also considered the social determinants of public health.

MATERIALS AND METHODS

Because the main study design was a prospective intervention study looking at the effect of the housing renovations on respiratory health status of children, children with respiratory symptoms were used for the baseline, identified from records at the local health centres. These children and their siblings along with the parents were invited to participate in the study. In addition, a second set of children were defined from class lists at the local schools, together with their siblings and parents. These families lived in a nearby area, Törnrosen, with buildings of similar age and construction, but with appropriate upkeep.

Table 1: Description of study area (Horgen)

<table>
<thead>
<tr>
<th>Der p1</th>
<th>Der f 1</th>
<th>Bla g 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>n=12 (above 2000 ng/g)</td>
<td>Low</td>
</tr>
<tr>
<td>Low</td>
<td>n=36 (above 2000 ng/g)</td>
<td>Low</td>
</tr>
<tr>
<td>Present</td>
<td>n=12</td>
<td>Present</td>
</tr>
<tr>
<td>Under detection level</td>
<td>n=130</td>
<td>Under detection level</td>
</tr>
<tr>
<td>Detection level</td>
<td>n=124</td>
<td></td>
</tr>
</tbody>
</table>

Subclinical/effective dampness and elevated house dust mite allergen concentrations in dust

- 12 households had measurable quantities of both Der p 1 and Der f 1 allergens in their dust samples.

All households with detection of Der p 1 allergen also had detectable Der f 1 allergen, and in all of these cases Der f 1 concentrations were high or very high.

- All 12 of these households showed detecable signs of mould in the apartment, but were not in the worst category of damaged apartments. There was no statistically significant association between household status “crowded” and presence of both allergens in the dust.

- In general there was some overlap between apartment characteristics and the presence of HDM allergen in dust samples, but more an observable trend rather than sound statistical association.

Cockroach infestation and cockroach allergen in house dust

- According to the questionnaires, 49 households had ever had a presence of cockroaches in the apartment in 20% of which currently, Only 6 households had any measurable corresponding allergen content in their dust samples. In only 2 of the 20 apartments with reported current presence of cockroaches was there any detectable antigen in the dust, and only in 4 of the 48 apartments with reported ever presence of cockroaches was there any detectable allergen in dust.

Allergen in dust samples and health data

- On a family level, presence of measurable allergen content of Der p 1 in dust from the apartment was significantly associated with a higher risk of any family member being sensitized against Der p 1 (p=0.038).

This was also seen for Der f 1 allergen presence and sensitization of any family member (p=0.032).

- Presence of HDM allergen in dust samples was not associated with other health outcomes on a family or individual level.

RESULTS

2.2. Allergen in dust samples and health data

On a family level, presence of measurable allergen content of Der p 1 in dust from the apartment was significantly associated with a higher risk of any family member being sensitized against Der p 1 (p=0.038).

This was also seen for Der f 1 allergen presence and sensitization of any family member (p=0.032).

- Presence of HDM allergen in dust samples was not associated with other health outcomes on a family or individual level.

DISCUSSION

Considering the high number of apartments with reported indoor moisture/dampness problems, it was somewhat surprising to find HDM-antigen below the level of detection in so many instances. When examining the connection between HDM-allergens in dust and health data, there was indeed a signal on the family level. Sensitization as determined not only to dust mites, but also to cockroach allergens. The mechanism of the allergic reaction against dust mites was shown to be rather than an IgE-mediated reactivity which could or could not put the individual at risk for symptoms of allergic disease.

The signal detected in the study was not of a strong and uniform nature. No significant connection between allergen levels in dust samples and meaningful health outcomes could be detected on an individual level.

The striking lack of association between reports of cockroach infestation and detection of the corresponding allergens in dust samples could be due to under reporting errors, or to due to technical issues with the dust collection and test. The environmental and sociocultural conditions of our study may not be entirely unique. A certain degree of transferability of the results to similar climatic and societal conditions in high-income countries of the globe North may be present.

CONCLUSIONS

Collection of dust samples and measurement of allergen concentrations for house dust mites and cockroach did not add discriminable value in our investigation into the health in its social context in immigrant families in Malmö. Results in this context might be better spent in proper documentation of social and environmental factors influencing health during the home visits in which we have little doubt.

The addition of “objectively” measured variables into the evaluation of the social determinants of health could be challenging, as it is often a complex system of potentially harmful and protective factors – attempting to isolate simple components may be tempting, but may not lead to meaningful interventions.

Addressing housing related health variables will be of continued importance as housing in many parts of the world will have to be reconsidered in terms of its climate impact in the very near future.

Acknowledgements: The Horgen study group: Kirstine Jakobsen MD PhD, Division of Occupational and Environmental Medicine, Lund University; Taiki W Tan MD, Division of Occupational and Environmental Medicine, Lund University, Sweden; Anna Öhblin PhD, Division of Occupational and Environmental Medicine, Lund University, Sweden; Sören Sandstrom, PhD, Department of Social Medicine, Skåne University Hospital, Malmö, Sweden; Jan-Erik Persson, PhD, Department of Social Medicine, Skåne University Hospital, Malmö, Sweden.

Funding: This study was funded by the Swedish Research Council (FORNAX) project number 2015-050. This poster presentation was supported through a travel grant from the Lund Medical Society.