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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
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 the language. For n insects, communicators fluent in the language. For n insects, communicators fluent in the language.

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 Malmö, 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, Herbergia, were overcrowded, damp, affected by mould, and infested by cockroaches and other vermin. The main property owner, after mass media attention and subsequent court trial, received an injunction from local authorities to perform extensive renovations on 200 housing units. This provided a unique opportunity to examine whether the health of children living in this neighborhood had been affected by poor indoor environment.

MATERIALS AND METHODS
Because the main study design was a prospective intervention study looking at the effect of the housing renovation on respiratory health in children, children around the age of 5 were selected as study material. Baseline and follow-up visits were performed. Children were included in the study if they were aged 0-13 years at the time of visit with a main doctor on respiratory, allergic, and dermatological symptoms. Usually, the mother was the informant. A standardized visual assessment of multiple areas of all homes was carried out in all apartments, together with multiple sampling of dust for analysis of mites and cockroach allergens.

Methodology
Allergen measurement levels. Airborne allergen levels in dust were measured in dust samples collected from the apartments at several locations, if consent was given by the occupants: the kitchen, the child’s bed and/or a parent’s bed and a carpet in the living room, if present. All samples were analyzed together, to reflect the nature of general exposure in the apartment. The health communicators visiting the home vacuumed the floor, mattress, carpet separately for 5 min each with a dust collects packed in a zip-sealed plastic bag. Copenhagen, Denmark. The lowest level of detection was set at 0.8 mg/L. For measurements of mites, dust was stored at 4°C for at least 2 days to kill possible house dust mites before sending them in batches to the laboratory at Occupational and Environmental Medicine, Lund University, Sweden.

House dust mite (D. pteronyssinus and D. farinae, 1c, 1d, and 1f, respectively, and cockroach allergens (B6 g) concentrations were measured using a Sandwich ELISA methodology using reagents from Immuno Diagnostics (Chesterfield, VA, USA) expressing the allergen level in ng/g dust. The lowest level of detection was set at 0.5 ng/g. A level of 0-2000 ng/g (≥ 2000 ng/g) was det. As corresponding to the level usually measured to be indicative of risk for sensitization and symptoms of asthma.

Family study size
All children from the base-line study, together with parents and siblings regardless of age were invited to skin prick tests against a standard panel of airborne allergens, including house dust mites plus cockroach at a local community center. Tests were carried out by qualified staff nurses according to usual international guidelines.

RESULTS
There was an overall number of 650 participants from 130 families. The place of birth was known for all participants: 85% of all children between 0 and 13 years had been born in Sweden. All children that had been born outside of Sweden entered the country well before their second birthday. All parents had been born outside of Sweden.

Allergen content for dust samples from 130 apartments:

- 12 households had measurable quantities of both Der p 1 and Der f 1 allergens in their dust samples. All households with detection of the ph allergen also had detectable Der f 1 allergen, and in all of these cases Der 1 concentrations were high or very high.
- 12 of these households had either objective or subjective signs of the moisture 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 none of the observed trends is thought to be statistically significant.

Cockroach infestation and cockroach allergen in house dust
- According to the questionnaires, 49 households had ever had a presence of cockroaches in the apartment at 20 or which currently, only 6 households had any measurable corresponding allergen content in their dust samples. Only in 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. The most common allergen, Der 1. The sample was also seen for Der 1. allergen presence and sensitization of any family member (p=0.020).
- Presence of HDM allergen in dust samples was not associated with other health outcomes on a family or individual level.

BUILT ENVIRONMENT

Judith Patricia Goodenough

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 by ELISA was significantly greater in children living in “crowded” homes.

CONCLUSIONS

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