Questionnaire investigation of asthma/allergy symptoms among children and the indoor environment in homes in Sisimiut, Greenland

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SUMMARY

The aim of this project was to investigate the indoor environment and building characteristics in relation to asthma and allergy among Greenlandic children. A cross-sectional questionnaire study involving 229 children in schools and institutions in Sisimiut was performed. The response rate was 23%. Of the children included, 15% had doctor-diagnosed asthma. Rhinitis and eczema within the last 12 months was associated with; visible damp stains in the child’s room; mouldy, earthy, unpleasant and tobacco smell and with suspected dampness in the construction.

Mould spots, suspected dampness in the construction, condensation on kitchen windows and stuffy air were observed significantly more often in houses constructed prior to 1971.

INTRODUCTION

Throughout the developed world the prevalence of asthma and allergies has increased over the last few decades [1]. No investigations have been made concerning the prevalence of asthma in Greenland. However, the reported frequency of hospital admissions due to asthma among Inuits in Greenland has previously been low [2]. The frequency of atopy in Greenland was analysed in 1987 and again in 1998 and an overall increase from 10% to 19% was found [2]. A main risk factor for developing asthma and allergy is genetic heredity. Due to the short time span of the increase, heredity cannot explain the increase during recent decades. Today children spend more than 90% of their time indoors [3] [4], and the indoor environment therefore has a strong influence on their health. Dampness and mould are indoor environmental factors of great importance for health [5] [6]. Today houses are built tighter, the result being a reduced ventilation rate accompanied by more dampness and mould problems indoors. In Sweden, an investigation has been made entitled Dampness in Buildings and Health (DBH), involving 14077 pre-school children. A similar study have been made in Bulgaria (ALLHOME), involving 4479 children [7]. In Sisimiut, an epidemiological cross-sectional questionnaire study including all children in schools and institutions was performed. The aim of this study was to investigate the association between indoor climate and building characteristics and asthma and allergy among Greenlandic children.

METHODS

A questionnaire including 81 questions divided into four parts, was sent to schools and institutions in Sisimiut for distribution to the children. The questionnaire used in the Swedish
DBH study was used as a template and adapted to Greenlandic conditions. The parts of the questionnaire analysed in this article concern the health of the child, and the housing conditions. The statistical programme SPSS was used. For evaluation of a significant association, the Pearson Chi-Square test was used. If frequencies below 5 were present, the Fisher’s test of significance was applied. An association was considered to be significant if the significance level was $P <0.05$.

Two diseases and four symptoms of asthma and allergy were used as evaluation criteria for associations between asthma/allergy and indoor environment. The two diseases were doctor-diagnosed asthma and rhinitis. The four symptoms were; wheezing, dry cough, eczema and non-doctor diagnosed rhinitis within the last 12 months.

RESULTS

In all, 1010 questionnaires were delivered and 229 valid questionnaires were returned. This results in a response rate of 23%. With this relatively low response rate no generalizations of the prevalence of symptoms in Greenland can be made. However the associations between asthma/allergic symptoms and indoor environmental factors are more valid.

Health of the child

In Figure 1 it is seen that eczema was the most frequently occurring symptom among children in Sisimiut.

![Figure 1: Occurrence of asthma/allergy among children in Greenland, Sweden and Bulgaria](image)

Compared to the results from Sweden and Bulgaria, the prevalence of asthma is noticeably higher in Greenland and the prevalence of wheezing is noticeably lower.

Housing conditions of the child

One third of the children have lived in the same residence all their life; of the remaining children most have moved to the present residence within the last three years (2004-2006). Roughly half of the children lived in apartments followed by an almost equal amount of single and attached houses. The most common size of homes was 75-99m2. Most residences were erected during two distinctive year-intervals 1961-70 and 1984-1993. The majority of the families (75%) rented their residence. Exhaust air valves existed in most of the homes.
Only half of the homes had a cooker hood in the kitchen and one third had exhaust in the bathroom. The most frequent heating system was waterborne. The most common type of window was one with two-layer wooden frame. In most homes the flooring material was parquet and the surface material in the child’s room was painted/unpainted wallpaper. 47 (21%) families reported that they had made considerable changes or extensions to their home during the child’s life and in six cases that it was done due to problems with damp and mould in the residence. Visible damp stains were more often seen than visible mould. Visible mould and damp stains occurred considerably more often in bathrooms as opposed to the other rooms in the home. Drying of clothes took place mainly outside the residence but also inside in one third of the homes.

40 families (17%) suspected that they had humidity/mould problems within the floors, walls and ceiling, problems that were not visible from inside the residence.

Significantly more homes constructed before 1971 had visible mould spots inside, especially apartments. The occurrence of condensation on the kitchen windows was slightly more frequent than condensation on the windows in the child’s and parents’ room. A significant association between condensation on windows in the kitchen and the year of construction was found. The possibility of condensation was increased when living in a building constructed before 1971. Stuffy bad air, tobacco smell, and dry air were the most common perceptions regarding the air quality. A significant association was found between condensation and dry air: the more condensation, the greater the number of complaints of dry air. A significant association was also found for stuffy air and houses constructed prior to 1971, as stuffy air was more often perceived in these homes.

**Associations between symptoms and housing conditions**

There were no significant associations between the type of residence and doctor-diagnosed asthma, wheezing, rhinitis and eczema within the last 12 months. A significant association was found between wheezing and houses built after 1993, as wheezing more often occurred here. No attempt to correlate doctor-diagnosed rhinitis and cough within the last 12 months and type of house and year of construction was made due to the low frequencies. There was a significant association between rhinitis, eczema, and visible damp stains in the child’s room (see Table 1), as rhinitis and eczema occurred when visible damp stains were seen. Considering visible mould in all rooms (except bathrooms) the risk of asthma was increased. No significant association existed between visible mould and visible damp stains in the bathroom and doctor-diagnosed asthma, doctor-diagnosed rhinitis, wheezing, dry cough, rhinitis and eczema within the last 12 months.

**Table 1: Associations between reported dampness in the child’s room and asthma/allergy**

<table>
<thead>
<tr>
<th></th>
<th>Visible mould</th>
<th>Visible damp stains</th>
<th>Suspicion of dampness in the construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>yes n=8</td>
<td>no n=203 P-value</td>
<td>yes n=11</td>
</tr>
<tr>
<td><strong>Doctor-diagnosed</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>2</td>
<td>27</td>
<td>0.337</td>
</tr>
<tr>
<td>Rhinitis</td>
<td>0</td>
<td>9</td>
<td>0.680</td>
</tr>
<tr>
<td><strong>Last 12 months</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheezing</td>
<td>1</td>
<td>23</td>
<td>0.497</td>
</tr>
<tr>
<td>Dry cough</td>
<td>2</td>
<td>18</td>
<td>0.191</td>
</tr>
<tr>
<td>Rhinitis</td>
<td>3</td>
<td>24</td>
<td>0.057</td>
</tr>
<tr>
<td>Eczema</td>
<td>0</td>
<td>37</td>
<td>0.148</td>
</tr>
</tbody>
</table>
A significant association between suspected dampness in the construction and rhinitis within the last 12 months existed see (Table 1), as rhinitis occurred when there was a suspicion of dampness. There were significant associations between unpleasant smell, mouldy smell, earthy smell, tobacco smell and rhinitis within the last 12 months (see Table 2). These smells were observed when rhinitis occurred. There were no associations between smoking in the home and doctor-diagnosed asthma, doctor-diagnosed rhinitis, wheezing, dry cough, rhinitis and eczema within the last 12 months.

Table 2: Associations between rhinitis within last 12 months and smells

<table>
<thead>
<tr>
<th>Smell Description</th>
<th>Yes, n=</th>
<th>No, n=</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stuffy bad</td>
<td>47</td>
<td>127</td>
<td>0.312</td>
</tr>
<tr>
<td>Unpleasant smell</td>
<td>14</td>
<td>147</td>
<td>0.042</td>
</tr>
<tr>
<td>Pungent smell</td>
<td>7</td>
<td>147</td>
<td>0.107</td>
</tr>
<tr>
<td>Mouldy smell</td>
<td>19</td>
<td>143</td>
<td>0.000</td>
</tr>
<tr>
<td>Earthy smell</td>
<td>16</td>
<td>142</td>
<td>0.005</td>
</tr>
<tr>
<td>Tobacco smell</td>
<td>40</td>
<td>128</td>
<td>0.005</td>
</tr>
<tr>
<td>Dry air</td>
<td>27</td>
<td>130</td>
<td>0.076</td>
</tr>
</tbody>
</table>

DISCUSSION

The occurrence of doctor-diagnosed asthma in Sisimiut was high, i.e. 15%. If this is true for the population as a whole, it would classify Greenland among countries having a high occurrence of asthma [1]. This would indicate that asthma has increased in Greenland when compared to previous studies of hospital admissions [2]. Comparing the study in Sisimiut to the Swedish DBH study [6] and the Bulgarian ALLHOME study [7], the occurrence of asthma is seemingly high. The occurrence of self-reported wheezing in Sisimiut was 11%, which is lower compared to the Swedish DBH-study and the Bulgarian ALLHOME-study. In another study in five cities (Adelaide, Sydney, West Sussex, Bochum, and Wellington) the prevalence of self-reported wheezing was between 20% and 40% [9]. The response rate to the questionnaire was 23% which means that tendencies can be indicated but generalizations cannot be made. Considering the low response rate, selection bias can be a problem. Families with symptomatic children could be more prone to participate, resulting in a higher prevalence of symptoms. Furthermore, the size of the data set is small and this makes the statistics more sensitive.
In cold climates, visible mould on indoor surfaces is not often found, except in bathrooms, as the humidity is low and the houses are well insulated [6]. The climate in Sisimiut is arctic and the observations of mould were generally low in rooms but considerably higher in bathrooms. These results comply with the climatic conditions. Visible mould was observed slightly less than visible damp stains in the homes. This accords with findings in the Swedish DBH-study [6]. Several people who reported observations of visible mould observed also visible damp stains. Rhinitis and eczema occurred when visible damp stains were observed in the child’s room, and asthma occurred when visible mould in all rooms in the home (except bathrooms) were considered. This indicates that the indoor environment influences the health of the child.

Condensation on the kitchen window was more common in houses built before 1971. The same finding was reported in the Swedish DBH-study [6]. Condensation on the inside of windows is an indication of poor ventilation or poor glazing, and thus high indoor humidity. As the most common type of window was a two-layer glazing, it can be assumed that the type of window is not the primary reason for condensation. The association found may be related to the demands of ventilation strategies in newer houses as the buildings are tighter and ventilation strategies have to be implemented. A significant association between condensation and the perception of dry air was found. This finding has also been reported in the Swedish DBH-study and supports the suspicion that the sensation of dryness is linked to air pollutants, and thus to poor ventilation.

A significant association between the year of construction and wheezing was found. The risk of wheezing increased in houses built after 1993. In a study by Emenius et al. [8] it was found that the building age, or more likely, certain types of building construction, and indoor air humidity were associated with recurrent wheezing.

CONCLUSION

The occurrence of doctor-diagnosed asthma in Sisimiut was high. The likelihood of having had rhinitis within the last 12 months was increased: when visible damp stains were seen in the in child’s room; when mouldy, earthy, unpleasant and tobacco smells were observed, and when the family had a suspicion of dampness in the construction. Significant associations of poor indoor environment were observed in houses constructed prior to 1971 as mould spots, suspicion of dampness in the construction, condensation on kitchen windows and stuffy air were observed.

ACKNOWLEDGEMENT

Thanks to Arne Villumsen for arranging the contact to the persons in Greenland and thanks to Kiril Naydenov for thoughtful comments on the project. Our greatest thanks go to the children and families in Sisimiut who participated in the studies.

REFERENCES

Proceedings of Clima 2007 WellBeing Indoors


