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Indoor air pollutions and respiratory symptoms in a Norwegian community sample

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ABSTRACT

BACKGROUND: Limited data is available on the effect of a poor indoor climate on the respiratory health in adults. No data is available regarding the contribution of indoor exposures to the burden of respiratory symptoms in the population.

METHODS: In 1996/97, a community sample of 3181 adults, aged 26-82, was invited to a survey on indoor climate and respiratory health in Hordaland County, Norway. 2401 subjects participated. Logistic regression was used to examine the relationship between eight markers of indoor exposure, and physician-diagnosed asthma and five respiratory symptoms, after adjustment for sex, age, smoking, educational level, smoking-habits, pack-years and occupational airborne exposure. RESULTS: Mould exposure was associated with all the respiratory symptoms; the adjusted odds ratios (OR) varied from 1.6 (95% confidence interval (CI): 1.0-2.4) for phlegm cough to 2.3 (95% CI: 1.4-3.9) for dyspnoea grade 2. Cat or dog keeping in childhood was associated with dyspnoea grade 2 and attack of dyspnoea, the adjusted OR being 1.3 (1.0-1.7) and 1.4 (1.1-1.8) respectively. Having fitted carpet in the bedroom was negatively associated with three of the five respiratory symptoms. From 3 to 5 % of the frequency of the respiratory symptoms in the study population could be attributed to exposure to visible moulds.

CONCLUSION: Mould exposure is an independent risk factor to several respiratory symptoms in a general population covering a wide age span. Still, mould exposure contributes to a minor degree to the respiratory symptom burden in the population at large.

In the western world, most people spend a significant amount of time indoors (1). At the same time, there has been an increased awareness regarding the possible health effects of poor indoor climate. Building dampness and pet allergens are among the most commonly examined indoor risk factors to airway disease. Many of the studies examining these risk factors have focused on children (2-5). Of the studies examining the relationship between indoor pollutants and indices of airway obstruction in adults (6-11), two have included subjects aged over 50 years (6, 7). Poor socio-economic status may confound the relationship between indoor climate and respiratory disease, as socio-economic status is associated with both the exposure (12, 13) and the outcome variable (14) . Only two of the studies cited have adjusted for socio-economic status (6, 8). Furthermore, no study has taken occupational airborne exposure into account.

Most of the studies on indoor environment in adults have focused on asthma-related symptoms like wheezing and attacks of dyspnoea. The present study expands on that, by including symptoms indicative of COPD, such as phlegm cough, chronic cough and dyspnoea on exertion.

From a health planner's perspective, it is valuable to know the proportion of a disease that might be attributed to a specific exposure. To our knowledge, no community study has examined the population attributable risk of an indoor air pollutant on respiratory disease. The objective of this community study, covering a wide age span, was to examine the relationship between self-reported indicators of a poor indoor climate and respiratory symptoms, adjusted for socio-economic status. Furthermore, we wanted to assess how this relationship varied with sex, age, smoking and occupational airborne exposure, and finally to assess the proportion of the respiratory symptom burden in the community that can be attributed to indoor air pollutants.

METHODS

Study population

The study sample was part of the second phase participants in the Hordaland County Cohort Study, which is a randomly sampled, general population study on respiratory health in Western Norway. The first phase was conducted in 1985 (15) with 3786 responders, and the second phase was conducted between September 1996 and May 1997 (16).

In the first phase, 3370 subject from the random selected sample participated. Before the second phase, 189 had died, leaving 3181 subject eligible to follow-up. In 1996/97, the 3181 subjects, aged 26-81, received a letter explaining the survey together with a mailed questionnaire, a paid reply-envelope, and an invitation to participate in an examination at the Department of Thoracic Medicine, Haukeland University Hospital. The sampling procedure and data collection, both in 1985 and 1996/97, have been described previously in detail (15, 16). After a maximum of two mailed reminder letters and one telephone reminder, 2819 (88.6%) subjects had returned the questionnaire, and 2401 (74.5%) subjects attended the examination.

Questionnaires

While attending the examination, the subjects were also asked to complete a questionnaire with 20 questions regarding their housing and indoor climate. The analyses in this paper are based on the exposures reported while at the examination and the outcomes reported in the mailed questionnaire.

The questionnaire on indoor climate has the same questions as the questionnaire used in the European Community Respiratory Health Survey (17). The questions on respiratory symptoms and asthma have previously been validated against lung function and bronchial reactivity (18), and compared with the British Medical Research Council questionnaire on chronic bronchitis (19).

The exact wording of the questions regarding indoor climate, respiratory symptoms and asthma, is given in the appendix.

Statistical analysis

Chi-square tests were used to compare the prevalences of exposures between women and men, as well as comparing the prevalences of symptoms and asthma among those exposed and unexposed. Logistic regression analysis was used to estimate the odds ratios for the five respiratory symptoms and physician-diagnosed asthma.

In the logistic regression analyses we have adjusted for age, sex, educational level, smoking habits, pack-years, occupational airborne exposure and all the other indoor exposure variables in all models except for mould and water damage. Due to co- linearity between exposure to moulds and water damage the odds ratio for the effect of moulds was calculated without water damage in the model and vice versa.

Smoking habits were categorized as never, ex, or current smoking. Pack-years were defined as the number of cigarettes smoked per day divided by 20, and then multiplied by numbers of years smoked. Socio-economic status was assessed in terms of educational level, which was categorized in three categories; primary, secondary, or university, based on the highest level of education obtained (14). Occupational airborne exposure was defined as self-reported exposure to dust or fumes in the workplace (20).

We applied the method of fractional polynomials to decide whether to model age as a categorical or continuous variable (21, 22). As the assumption of linearity of the logit did not hold for age as a continuous variable in the modelling of some of the outcomes, age was treated as a categorical variable with three categories.

All first order interactions between significant indoor climate exposure variables and the confounders age, sex, smoking or educational level were investigated for each model.

For the interaction analyses, a significance level of 0.01 was used.

The adjusted attributable fractions (AF) of the indoor exposure variables moulds and cat and dog in childhood on the five respiratory symptoms and asthma were calculated.

The statistical analyses were performed with SPSS version 11.5 and Stata 8.0.

RESULTS

The distribution of smoking status and educational level for different age groups and for men and women, and the prevalence of the indoor exposure variables, are given in table 1. Significantly more men than women reported having had a workplace with much dust or gas in the air, and significantly more women than men reported having kept a cat in childhood. Dog keeping in childhood was more often stated by the youngest (41%) compared to the oldest (37%) age group. and by current smokers (43%) compared to never smokers (34%). The frequency of reporting mould exposure and water damage decreased with increasing age, being four times as common in the youngest as in the oldest age group. Mould exposure was related to increasing educational level, the exposure being reported three times as often in those with university than those with primary education.

Fitted carpets in the bedroom and in the living room were reported more often by the oldest than youngest age group. by current (40%) than never smokers (34%), and by those with secondary (40%) compared to university education (33%). The other relationships between the exposures and demographic variables did not reach statistical significance.

Table 1
The distribution of background variables and indoor exposures by sex and age

	Women	Men		Age groups			
				26-40	41-60	61-82	
	n=1246 n (%)	n=1155 n (%)		n=1711 n (%)	n=1832 n (%)	n=1448 n (%)	
Educational level							
Prim	247 (20,1)	197 (17,3)		93 (12,3)	124 (12,5)	227 (36,7)	*
Sek	713 (58,2)	660 (57,2)		435 (57,4)	608 (61,4)	330 (53,3)	
Uni	266 (21,7)	284 (24,9)		230 (30,3)	258 (26,1)	62 (10,0)	
Smoking status			*				
Current	389 (31,2)	402 (34,8)		326 (42,9)	415 (41,8)	188 (29,7)	*
Ex	286 (23,0)	380 (32,9)		78 (10,3)	233 (23,5)	171 (27,1)	
Never	571 (45,8)	373 (32,3)		356 (46,8)	345 (34,7)	273 (43,2)	
Occupational exposure							
Yes	381 (30,6)	714(61,8)		238 (31,2)	305 (30,6)	157 (24,5)	*
Mould exposure			*				
Just earlier	65 (5,2)	51 (4,4)		39 (5,1)	54 (5,4)	23 (3,6)	*
Earlier and last year	54 (4,3)	53 (4,6)		55 (7,2)	42 (4,2)	10 (1,6)	
Water damage							
Just earlier	94 (7,5)	101 (8,7)		71 (9,3)	86 (8,6)	38 (5,9)	*
Earlier and last year	42 (3,4)	52 (4,5)		49 (6,4)	34 (3,4)	11 (1,7)	
Fitted carpets							
Bedroom	464 (37,2)	436 (37,7)		236 (30,9)	419 (42,0)	245 (38,2)	*
Living room	189 (15,2)	184 (15,9)		107 (14,0)	143 (14,3)	123 (19,2)	*
Cat							
In adulthood	222 (17,8)	234 (20,3)		162 (21,2)	238 (23,9)	56 (8,7)	*
In childhood	688 (55,2)	582 (50,4)		405 (53,1)	512 (51,4)	353 (55,1)	
Dog			*				
In adulthood	170 (13,6)	168 (14,5)		112 (14,7)	183 (18,4)	43 (6,7)	*
In childhood	461 (37,0)	437 (37,8)		316 (41,4)	345 (34,6)	237 (37,0)	*

* $p < 0.05$. (Significant difference between sexes or age groups).

Table 2 shows the prevalences for the five respiratory symptoms and asthma related to the eight different indoor exposure variables. There was a higher prevalence of all symptoms among those exposed to moulds compared to those not exposed, statistically significant only for the symptoms phlegm cough, attacks of dyspnoea and wheezing.

Among those who reported fitted carpets in their bedroom there was a lower prevalence of all symptoms compared to those who did not have fitted carpets in their bedroom. This was statistically significant for the symptoms phlegm cough, chronic cough and attacks of dyspnoea. Subjects reporting having a cat or a dog in childhood had a higher prevalence of all

the respiratory symptoms compared to those who did not have cats or dogs in childhood (table 2).

Table 2
Prevalences of the five respiratory symptoms and physician-diagnosed asthma among those exposed and not exposed.

	Phlegm cough	Chronic cough	Dyspnoea grade 2	Attacks of dyspnoea	Wheezing	Asthma
Moulds						
Never	23,6	12,3	16,4	14,7	22,0	6,1
Just earlier	31,0	13,8	20,7	22,4	29,3	7,8
Earlier and last year	31,8 *	17,8	21,5	20,6 *	39,3 **	7,5
Waterdamage						
Never	23,8	12,4	16,5	15,2	22,6	6,2
Just earlier	27,2	14,4	19,0	15,4	27,2	6,7
Earlier and last year	29,8	14,9	19,1	19,1	27,7	6,4
Fitted carpets in bedroom						
Yes	20,7 **	10,9 *	16,9	13,1 *	21,7	5,7
No	26,4	13,7	16,8	16,7	24,1	6,5
Fitted carpets in livingroom						
Yes	22,3	12,1	19,8	13,4	19,8	4,3
No	24,7	12,7	16,3	15,7	23,8	6,6
Cat in adulthood						
Yes	25,7	12,9	15,6	14,7	24,3	4,6
No	24,0	12,5	17,1	15,5	22,9	6,6
Cat in childhood						
Yes	26,1 *	13,1	18,3 *	17,6 **	24,3	6,3
No	22,2	12,0	15,1	12,7	21,9	6,1
Dog in adulthood						
Yes	26,6	13,3	17,2	18,9 *	25,7	5,6
No	23,9	12,5	16,8	14,7	22,7	6,3
Dog in childhood						
Yes	27,1 *	14,4 *	19,2 *	16,1	24,8	5,2
No	22,6	11,6	15,4	14,8	22,2	6,8
TOTAL	24,3	12,6	16,8	15,3	23,2	6,2

* $p<0.05$ ** $p<0.01$

The results from the multivariate analyses are shown in table 3. There was an increased risk of having any respiratory symptom among subjects with known exposure to moulds, after adjustment for age, sex, educational level, smoking habits, pack years, occupational airborne exposure and all other indoor exposure variables. Although not reaching statistical significance, the OR for having asthma was likewise increased in subjects reporting mould exposure.

For chronic cough, dyspnoea grade 2 and wheezing, the association was only significant if the exposure had also been within the last 12 months. Having fitted carpets in the bedroom was negatively associated with phlegm cough, chronic cough and attacks of dyspnoea. Those who reported having a cat or dog in childhood had an increased risk of attacks of dyspnoea and dyspnoea grade 2 respectively, after adjustment for all other variables. None of the eight indoor exposure variables examined showed a significant association with physician-diagnosed asthma.

Table 3
The adjusted * odds ratios with 95 % confidence interval (CI) for the respiratory symptoms and asthma.

	Plegm cough		**Chronic cough**		**Dyspnoea grade 2**		**Attacks of dyspnoea**		**Wheezing**		**Asthma**	
	OR	95 % CI	**OR**	95 % CI	**OR**	95 % CI	**OR**	95 % CI	**OR**	95 % CI	**OR**	95 % CI
Mould**												
Never												
Just earlier	1.6	(1.01,2.38)	1.2	(0.71,2.19)	1.5	(0.92,2.47)	1.7	(1.06,2.72)	1.5	(0.99,2.34)	1.4	(0.68,2.85)
Earlier and last year	1.7	(1.08,2.64)	2.0	(1.17,2.48)	2.3	(1.35,3.85)	1.5	(0.91,2,59)	2.3	(1.46,3.47)	1.5	(0.69,3.47)
Waterdamage**												
Never												
Just earlier	1.2	(0.84,1.72)	1.2	(0.74,1.86)	1.4	(0.91,2.10)	1.1	(0.74,1.74)	1.3	(0.92,1.86)	1.4	(0.78,2.62)
Earlier and last year	1.2	(0.74,2.01)	1.2	(0.61,2.19)	1.2	(0.63,2.15)	1.2	(0.65,2.07)	1.0	(0.61,1.69)	1.2	(0.49,2.85)
Fitted carpets in bedroom												
Yes	0.7	(0.55,0.85)	0.7	(0.53,0.93)	0.9	(0,71,1.94)	0.7	(0.56,0.94)	0.9	(0.69,1.06)	0.9	0.62,1.32)
No												
Fitted carpets in livingroom												
Yes	1.0	(0.73,1.32)	1.1	(0.75,1.58)	1.3	(0.94,1.78)	0.9	(0.63,1.27)	0.9	(0.64,1.16)	0.6	(0.36,1.10)
No												
Cat in adulthood												
Yes	1.1	(0.82,1.37)	1.1	(0.78,1.50)	1.2	(0.88,1.63)	0.9	(0.65,1.20)	1.0	(0.77,1.28)	0.8	(0.46,1.24)
No												
Cat in childhood												
Yes	1.2	(0.99,1.51)	1.0	(0.76,1.32)	1.0	(0.80,1.33)	1.4	(1.11,1.83)	1.1	(0.87,1.33)	1.2	(0.81,1.69)
No												
Dog in adulthood												
Yes	1.1	(0.81,1.44)	1.0	(0.67,1.42)	1.2	(0.84,1.68)	1.4	(1.01,1.93)	1.0	(0.78,1.38)	0.9	(0.55,1.61)
No												
Dog in childhood												
Yes	1.1	(0.90,1.37)	1.2	(0.93,1.61)	1.3	(1.0,1.65)	0.9	(0.72,1.19)	1.0	(0.82,1.25)	0.8	(0.52,1.13)
No												

* Adjusted for sex, age, smoking status, educational level,pack years and occupational dust or fumes exposure.
** The ORs for mould and waterdamage is calculated without waterdamage and mould in the model respectively. For all the other exposures all the exposure variables is kept in the model, also mould and waterdamage.

Of all first order interactions tested, only the interaction between sex and having fitted carpets in the bedroom for the symptom chronic cough proved statistically significant ($p < 0.01$). A negative association between fitted carpets in the bedroom and having chronic cough was

observed only in men, the odds ratios (95 % confidence interval) being 0.4 (0.3, 0.6) for men and 1.1 (0.8, 1.6) for women.

The adjusted AF's of previous mould exposure for the respiratory symptoms and physician diagnosed asthma ranged from 3.4 % for phlegm cough to 4.7 % for wheezing (table 4). Also the adjusted AF for pet keeping in childhood is shown in table 4. For dyspnoea grade 2, dog in childhood represented an adjusted AF of 7.4%. Cats in childhood represented an adjusted AF of 15.3 % for attacks of dyspnoea. The adjusted AF of smoking is shown for comparison, and varied between 1.9 % for dyspnoea grade 2 to 30.1 % for wheezing (table 4).

Table 4
The adjusted * attributable fraction (AF)** of four indoor exposure variables and smoking for five respiratory symptoms.

Respiratory	**Moulds**		**Cat in childhood**		**Dog in childhood**		**Smoking**	
symptoms	AF %	95 % CI	AF %	95 % CI	AF %	95 % CI	AF %	95 % CI
Phlegm cough	3.4	1.0,5.9	7.6	-0.7,15.1	2.9	-3.2,8.6	21.9	12.7,30.2
Chronic cough	3.9	0.0,7.6	0.3	-12.9,11.9	6.6	-3.0,15.2	19.1	4.9,31.3
Dyspnoea grade 2	4.5	1.3,7.5	1.7	-9.5,11.7	7.4	-0.3,14.5	1.9	-9.8,12.3
Attacks of dyspnoea	4.1	0.6,7.5	15.3	4.2,25.1	-	-	19.8	7.5,30.5
Wheezing	4.7	2.0,7.2	3.1	-5.2,10.8	0.3	-5.9,6.2	30.1	20.8,38.3

*All models were adjusted for age, sex, educational level, smoking-habits, pack-years, occupational airborne exposure, and all the other exposure variables. For moulds the model was not adjusted for waterdamage.
** Also refferred to as population attributable risk (PAR)

DISCUSSION

Subjects reporting moulds in their homes ever or within the recent 12 months had an increased risk for all respiratory symptoms examined, after adjustment for sex, age, smoking and educational level. A dog owned in childhood or adulthood was independently associated with dyspnoea grade 2 (childhood), and attacks of dyspnoea (adulthood). Neither of these associations varied by sex, age or educational level. From 3 to 5 % of the frequency of the respiratory symptoms in the study population could be attributed to exposure to visible moulds, after adjustment for all co-variables.

The strength of the current study is that it is a randomly sampled community study, with a wide age span, and a high response rate. The responders and non-responders did not differ significantly with respect to sex, age and smoking status (23).

However, some methodological aspects must be considered. First, the respiratory symptoms and the indoor climate variables were self-reported. Subjects with symptoms could over-report indoor exposure, leading to a false positive exposure-disease relationship. However, the participants completed the respiratory symptom questionnaire before learning about the indoor environment questionnaire, reducing the likelihood for this bias. Conversely, subjects with respiratory symptoms could over-report indoor pollution. However, a study by Williamsson et al (24) showed that both occupants with and without respiratory symptoms tended to report less dampness in their homes as compared to the dampness observed by outside inspectors.

Secondly, the cross-sectional design of the analyses cannot control for a selection bias caused by symptomatic subjects moving from houses with a poor indoor climate. This would tend to underestimate an exposure-disease relationship.

The frequency of self-reporting indoor exposures in our subjects younger than 44 years of age was approximately of the same magnitude as previously reported from the Nordic countries (6, 7, 10, 25, 26). To our knowledge, the present study is the first to present community-based data on the distribution of these exposures in the elderly. For all the indoor exposures, even those describing lifetime events, the prevalence fell with increasing age. This is probably due to a tendency of older people to forget previous exposures. Another explanation could be that younger people know more about the potential hazards of moulds and/or are more willing to report them then elderly people. The age trend in frequency of reported moulds persisted after adjusting for the number of years lived in the dwelling.

In the current study, we assessed a wider range of symptoms than previous studies. For all symptoms examined, reporting of visible moulds was a risk factor, whereas the exposure to cats or dogs in childhood, gave a mixed picture. Having fitted carpets in the bedrooms were associated with a decrease in risk. These results could reflect the relative ease with which subjects can withdraw from the exposures. Presumably, it is easier to throw out carpets than ones pets or to eradicate moulds. If so, then the effect of having carpets would be more under-estimated than either the effect of pets or moulds.

Self-reported water damage was not associated with any of the respiratory symptoms or asthma. This finding has also been reported in several other studies (10, 11, 26, 27). Water damage in itself is unlikely to be a causal factor for asthma or respiratory symptoms, but is a known risk factor for mould growth. Thus, this finding could be the result of a mingling of subjects with some risk (water damage and mould growth) with subjects with no risk (only water damage, no moulds). The clinical point in this would be that only subjects that actually report moulds should be considered at significant risk.

The finding that mould exposure was associated with higher risk of respiratory symptoms is in line with the results of other studies (6, 8-11, 26), of which only two adjusted for socio-economic status (6, 8). Our findings persisted also after taking this potential confounder, as well as occupational airborne exposure, into account.

Residual confounding by smoking was a concern, particularly with symptoms like phlegm cough and chronic cough. Thus, adjustment for smoking was made both in terms of smoking habits (current-, ex-, and never-smoking) and pack-years smoked. Furthermore, conducting the analyses among only never-smokers produced the same trends in the estimated effects, but with a widening of the confidence intervals to the point of non-significance.

Exposure to visible moulds, having fitted carpets or pets can be thought of as markers of allergens, namely moulds, dust mites, and feline proteins. Having visible moulds in the house

is almost certain to mean an increased exposure to mould spores, which could trigger an allergic response from the airways. However, visible moulds could also be a sign of increased house dampness, which may cause increased levels of air-borne bacteria, dust mites, and other microbial volatile organic compounds (MVOC) in the dwelling. The major compounds of fungal cells are glucans, which are shown to cause respiratory symptoms (28) and bronchial hyper responsiveness (1). Bjornsson et al (29) found higher levels of air born bacteria and house dust mite in houses of subjects with asthma symptoms. Some respiratory symptoms have also been found to be associated with higher levels of carbon dioxide, formaldehyde and total concentration of MVOC in the indoor air (30). The mechanisms are not clear at present, and possibly not similar between the different exposures.

A wide range of studies on pet keeping in childhood have not been able to ascertain whether pet keeping increases the risk for disease or not (31-34). Indeed, several studies have suggested a protective effect of pet ownership on allergic disease (34, 35). The results from the large European Community Respiratory Health Survey were recently presented by Svanes et al (34). Pooling results from several countries, having a dog in child- or adulthood were associated with a marginal increase in risk for having wheeze with and without cold. Overall, cat ownership was not a risk factor, for either wheeze or hay-fever in childhood or in adulthood (34). Svanes et al used serum-IgE as a marker of atopy. Interestingly, whereas cat ownership in atopic subjects was associated with an increased risk for wheeze, the opposite was true for dog-ownership which was associated with an increased risk only in non-atopic subjects (34). If indeed there is an association between pet ownership and respiratory disease, the mechanism is likely different between dogs and cats.

In the present study, no protective effect of pet ownership was found. Subjects reporting having had a cat in childhood had an increased risk for two out of five symptoms examined, symptoms not examined in the ECRHS. When stratifying the analyses by reported hay-fever,

we found no overt changes in the relationship between any of the exposures to the symptoms. There was no interaction between hay-fever and the exposures on the symptoms.

It is possible that recall bias in the elderly blurred a relationship between pet exposure in childhood and the symptoms. However, re-analyses of the data after excluding subjects above 45 years of age did not alter the magnitude of the associations. Finally, we had no data on duration and degree of exposure, nor at what time during childhood the pet was kept. A better exposure characterisation is likely to improve the validity of the analyses. Exposure in early childhood may have a protective effect as to asthma, while later exposure in childhood may have an opposite effect (31, 34).

In this study it was found that having fitted carpets in bedrooms was associated with a lower risk of respiratory symptoms. This was also found by Zock et al (11). The most likely explanation is that symptomatic subjects had removed the carpets before they answered the questionnaire. (36)

The attributable fraction (AF) can be interpreted as the proportion of the symptom load that would theoretically be eliminated if the exposure in question had not occurred. To our knowledge, this is the first study to estimate the burden of symptoms in the general population due to indoor air pollutants. The estimates are strongly dependent on the prevalence of the exposures in the population. Only about 9 % of the current study population reported exposure to moulds. Thus, if mould exposure is under-reported, the adjusted AF could be under-estimated. It is also important to note that the effect of preventing one exposure in the situation where several exposures are involved will depend on the order of which the exposures are prevented. However, the figures give some perspective of the relative importance of moulds as compared to smoking.

In conclusion, this study observed that exposure to moulds is an independent risk factor to several respiratory symptoms in a general population covering a wide age span. The current

advice to eradicate moulds and fitted carpets when possible is probably sound, whereas solid advice on pet ownership cannot be obtained from this study or the literature at present.

APPENDIX

The wording of the indoor factors related questions was:

Has there ever been mould or mildew on any surface, other than food inside your home? (yes, no, do not know) *If yes, they were also asked to respond to this question:*

Has there been mould or mildew on any surfaces inside your home in the last 12 months? (yes, no)

Has there ever been any water damage to the building or its contents? (yes, no, do not know)

If yes, they were also asked to respond to this question:

Has there been any water damage in the last 12 months? (yes, no)

Are there fitted carpets in the room most used at home during the day? (yes, no)

Are there fitted carpets in your bedroom? (yes, no)

When you were a child did you have a cat as a pet? (yes, no)

When you were a child did you have a dog as a pet? (yes, no)

Do you have a cat now? (yes, no)

Do you have a dog now? (yes, no)

The wording of the respiratory symptoms related questions were as follows;

Do you have phlegm when coughing? (yes, no)

Do you have a cough for 3 mounts or more altogether during a year? (yes, no)

Are you breathless when you climb two flights of stairs at an ordinary pace? (yes, no)

Do you ever have attacks of breathlessness? (yes, no)

Have you ever had wheezing in your chest for the last 12 months? (yes, no)

Have you ever been treated by a doctor or been hospitalised for asthma?

(yes, no, do not know)

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