

# Atopic Disease among Adults in Northern Russia, an Area with Heavy Air Pollution

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**The cumulative incidence of atopic disease among adults was assessed in the heavily polluted Russian town Nikel on the Kola peninsula. The study was conducted in spring 1994 using a self-administered questionnaire. A total of 3,368 (93.6%) of the 3,600 subjects returned a completed questionnaire. Information about atopic diseases, smoking habits and living conditions in the family was also obtained. A cumulative incidence of atopic diseases of 11% was reported in 377 adults. This was significantly more frequent in women (12.7%) than in men (9.7%). Smoking habits differed from other western countries, as 53% of males and only 10% of females smoked. Indoor damp was reported by 13% and the keeping of dogs and cats by 52%. Our study indicates that atopic diseases is less frequent among adults in a heavily polluted Arctic Russian town than in western industrialized countries. Key words: allergic rhinoconjunctivitis; atopic dermatitis; asthma; domestic pets; prevalence; tobacco smoking.**

(Accepted June 24, 1999.)

Acta Derm Venereol 1999; 79: 448–450.

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Surveys from several western countries have indicated an increase in the prevalence of atopic disease among children and young adults (1–4). A high prevalence of allergy has been reported in Swedish medical students (5) and in the Norwegian population (6).

The causes of the apparent increase in the prevalence of atopic disease remain unclear. Inherited constitution, as expressed by the tendency to familial clustering, is one of the main background factors for atopic disease (3, 7). The incidence of a hereditary disease will not change greatly in a period of just a few generations (8), hence indoor and outdoor environmental factors, nutrition, lifestyle and living conditions are, to some extent, thought to share the responsibility for the increased prevalence of atopic disease in western industrialized countries (1–5).

Since little is known about the prevalence of atopic disease among adults in Russia, we aimed to investigate the prevalence of atopic disease in Nikel, a town on the Kola peninsula, which is heavily polluted by airborne sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) and heavy metals, such as nickel, copper, arsenic and poisonous aluminium compounds (9). Furthermore, we looked for environmental factors that may influence the prevalence of atopic diseases. The analyses were based on retrospective information from a questionnaire study of schoolchildren and their parents.

## MATERIAL AND METHODS

Nikel is situated on the Kola Peninsula close to the Norwegian border and is built up around the nickel-refining industry. The town centre is densely populated, with 23,000 inhabitants, and the Nikel refinery is situated in the northern part of the town.

This study was conducted in spring 1994, when a self-administered questionnaire was distributed to 3,600 parents of schoolchildren aged 8–17 years from all of the six schools in the town centre of Nikel. A total of 3,368 (93.6%) returned a completed questionnaire (10). They were asked about symptoms of previous and/or present asthma, allergic rhinoconjunctivitis (AR), atopic dermatitis and urticaria in the whole family. Furthermore, information was sought regarding smoking habits in the family, keeping of pets, housing and living conditions.

The epidemiological term “cumulative incidence” was used for past and/or present symptoms of atopic diseases. We have restricted atopic diseases to include the three main atopic manifestations atopic dermatitis, asthma and AR.

Atopic dermatitis was diagnosed if people had past and/or present symptoms of pruritic, chronically relapsing (inflammatory) skin disease lasting several weeks with typical distribution, i.e. to the face, side of neck and flexural lesions. Asthma was diagnosed if people confirmed previous and/or present symptoms of asthma or recurring attacks of wheezing, coughing or heavy breathing due to external factors, such as animal dander, pollen, house dust or food. AR was defined as episodic rhinorrhea associated with nasal stuffiness and sneezing in response to known or strongly suspected allergen(s) and often accompanied by itching and lacrimation. Symptoms of urticaria have, in this study, been defined as one or more episodes of transient erythema and swelling of the skin with or without pruritus.

The statistical analyses were performed using the statistical package SAS and Epi info. Differences between groups were assessed using the  $\chi^2$  test. The relative risk (RR) and a confidence interval (CI) of 95% are also indicated and if the 95% CI does not include 1.0 the results are regarded as significant at  $p < 0.05$  (4).

## RESULTS

The cumulative incidence of atopic diseases among Russian adults is shown in Table I. One or more episodes of urticaria occurred in 221 adults (6.6%), and more frequently in women (8.7%) than in men (4.4%) ( $p < 0.0001$ ).

Smoking at home was reported by 55% of the families. According to the questionnaires, 53% of males and only 10% of females smoked. Damp patches on walls and/or windows (and other signs of damp) were present in 13% of the homes, and domestic animals in 52%. With regard to pets, 23% of the families kept dogs and 27% cats. Few reported daily contact with horses (including horse-riding), however, 9% kept birds. Carpeted floors were common in most homes (83%). Nearly all houses were built after the Second World War. Interestingly, half of the people lived in homes with less than 33 m<sup>2</sup> of floor area, and only 4% had more than 55 m<sup>2</sup>. Moreover, in Nikel almost everyone (97%) lived in blocks of flats, where each flat generally comprised a kitchen, a living-room and a bedroom. Oil heating systems were installed in 26% of the homes and electric heating and wood burning were used in 16% and 3% of the homes, respectively. However, the majority of homes used coal, gas and other heating systems (55%).

The relationship between atopic diseases and environmental risk factors is given in Table II. There was a statistically

Table I. Cumulative incidence of atopic diseases among adults in Nikel, Russia, in relation to sex ( $n=3,368$ )

Atopic disease	Women <i>n</i> (%)	Men <i>n</i> (%)	Total <i>n</i> (%)
Atopic dermatitis	109 (6.5)	89 (5.3)	198 (5.9)
Allergic rhinoconjunctivitis	121 (7.2) <sup>a</sup>	69 (4.1)	190 (5.6)
Asthma	92 (5.5)	72 (4.3)	164 (4.9)
Total atopic diseases	214 (12.7) <sup>b</sup>	163 (9.7)	377 (11.2)

<sup>a</sup>  $p < 0.0005$  compared with men.

<sup>b</sup>  $p < 0.005$  compared with men.

significant association between carpeted floors and atopic dermatitis, between carpeted floors and AR and between indoor smoking and eczema. No correlation with other risk factors, such as damp, animal dander and smoking, was found.

## DISCUSSION

The results of this study suggest a lower frequency of atopic diseases among adults in a heavily polluted Russian town than the 21–46% recently reported in Western Europe (3–6, 11, 12). Questionnaire-based studies always have inherent limitations with respect to exactness. Thus, recall bias can lead to misclassification and possible over- or under-reporting of symptoms in the population studied.

In a recent study in Sør-Varanger community in northern Norway, an area close to the Russian border, the prevalence of atopic dermatitis was found to be three times higher (15.9%) than that found in this study (3). The same study design and questionnaire formula were used in these two studies. Nevertheless, our figures for atopic dermatitis are comparable with some North European studies (11, 13), but are 2–3 times lower than those found in Finnish adolescents and conscripts (11, 14), Swedish medical students (5), and adults in the south-west of Norway (6).

The frequency of asthma in Scandinavia and Europe was at a level similar to that found in the present study (2, 6, 11), but higher than that found in Norwegian Lapps (2.8%) (13). On the other hand, a prevalence 2–3 times higher has been reported in schoolchildren in Scandinavia (1, 3, 4, 15) and in Scotland (2) (9–20% and 9–20%, respectively). Furthermore,

in recent North European studies levels of AR and urticaria are twice as high as those found in Nikel (4, 6, 11, 14), however, our figures compare well with those from a Swedish study (16).

The International Study of Asthma and Allergies in children (ISAAC) has recently carried out standardized international comparisons of the prevalence of atopic diseases among children aged 13–14 years in 155 collaborating centres in 56 countries throughout the world (17). They found worldwide variation in the prevalence rate, i.e. 20-fold for asthma, 30-fold for AR and 60-fold for atopic dermatitis. The prevalence rate found among schoolchildren in Uzbekistan was 5–10%, 2–5% and 2% for AR, atopic dermatitis and asthma, respectively. This is further evidence to support the lower prevalence of atopic diseases found among schoolchildren in what was previously East Europe (17, 19). Thus, our results are consistent with the results of a recent study among adults in two cities in West and East Germany (20).

Allergens from domestic mites and moulds do not seem to be a major problem in arctic regions (21). This may explain why we did not find any association between damp and atopic manifestations, although indoor damp was reported 3–4 times more frequently than in two recent comparable studies in northern (4) and southern (15) Norway. Exposure to animals and pollens was widespread in Nikel, in fact comparable with studies in Sweden (16, 18) and Norway (4, 15). These findings indicate that most people were, in one way or another, exposed to animal dander either by keeping animals at home or by indirect contact with furred pets. Thus, the absence of a relationship between direct exposure and atopic symptoms may be due to a ubiquitous presence of these allergens, causing continuous exposure (4, 21).

The border area between Russia and Norway is polluted by Russian smelting industries in Nikel and Zapoljarnij on the Kola peninsula. During the 1980s extremely high emissions of SO<sub>2</sub> and heavy metals, such as nickel, copper and arsenic, were measured (9). For a considerable length of time high levels of SO<sub>2</sub>, NO<sub>x</sub> and particulate matter in the air have been associated with bronchial hyper-reactivity and asthma (20, 22) as well as with coughs and respiratory infections (19). This study and other recent studies (18, 19, 22) suggest, however, that air pollution is not a strong determinant for the development of allergic diseases, but is associated with

Table II. Relative risk (RR) of contracting atopic diseases according to environmental factors. P-values and a confidence interval (CI) of 95% are also indicated

Environmental factor	Atopic disease	RR	95% CI	<i>p</i>
Carpets	Eczema	2.05	1.19–3.53	0.008
	Asthma	1.72	0.97–3.06	n.s.
	allergic rhinoconjunctivitis	1.89	1.09–3.28	0.02
Damp	Eczema	0.32	0.17–0.60	n.s.
	Asthma	0.32	0.16–0.65	n.s.
	allergic rhinoconjunctivitis	0.35	0.19–0.66	n.s.
Indoor smoking	Eczema	2.42	1.24–4.71	0.007
	Asthma	0.84	0.48–1.47	n.s.
	allergic rhinoconjunctivitis	0.69	0.40–1.17	n.s.
Animal dander	Eczema	0.93	0.56–1.56	n.s.
	Asthma	1.0	0.56–1.77	n.s.
	allergic rhinoconjunctivitis	0.96	0.57–1.62	n.s.

bronchitis, unspecific respiratory symptoms and decrements in the pulmonary function.

The number of men smoking exceeded that reported in western countries. Interestingly, very few women said that they smoked, making the total average number of smokers in the family comparable with that reported in Scandinavia (3, 15) and Italy (23). Passive as well as active smoking increase serum IgE levels (4), bronchial responsiveness and asthma (6, 23). This provides further evidence to the negative effects of smoking and to the fact that smoking may be one of the most important irritant risk factors for eliciting atopic symptoms in the airways and in the skin (4, 23). The reasons for the lower prevalence of atopic diseases in a polluted, Arctic Russian town are thus unknown.

It appears that domestic factors characteristic of Russian living conditions may influence the process of developing allergy, i.e. indoor climate, ventilation, building materials and other housing conditions as well as lifestyle may differ substantially from those in Western Europe. Thus, the reason for the increased risk of developing atopic diseases in western society has to be searched for in these factors.

#### ACKNOWLEDGEMENT

The authors thank Dr Jon Øyvind Odland for skilful assistance.

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