

Atopic diseases among adults in Sør-Varanger community, northern Norway

An epidemiological study in an arctic area influenced by Russian industrial pollution

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Abstract. – **Background:** Atopic diseases are common in western industrialized countries and their prevalence appears to be increasing. The prevalence seems to be higher in the cold, northerly regions of Europe.

Aim: The aim of the study was to assess the prevalence of atopic diseases among adults in Sør-Varanger community, northern Norway, an arctic area at 70° latitude north influenced by industrial pollution from smelting plants on the Kola peninsula.

Patients and Methods: The parents of all 575 schoolchildren aged 7-12 years in Sør-Varanger community (northern Norway) received a four page questionnaire concerning home environment and symptoms of allergy. A total of 1102 adults filled in and returned the questionnaire.

Results: 25.2% of the adults reported past and/or present symptoms (prevalence) of atopic diseases, whereas 38.7% of the children reported atopic symptoms. The prevalence of eczema occurred in 15.9%, followed by allergic rhinoconjunctivitis (10.3%) and asthma (5.6%), however, a significant difference between sexes was only found for eczema ($p < 0.0005$). Women smoked more frequently (45.6%) than men (39.0%). Keeping of furred pets occurred in 54.3% and dampness in 3.6% of the homes.

Conclusion: This study indicates that the frequency of atopic diseases among adults is only two thirds of that reported in schoolchildren. Thus, the increased prevalence of atopic diseases over one generation could point towards factors associated with western lifestyle and living conditions (allergens and adjuvant factors).

Key Words:

Adult, Allergic rhinoconjunctivitis, Asthma, Atopic diseases, Dampness, Domestic animals, Eczema, Tobacco smoke.

Introduction

Allergy and allergy like symptoms seem to have become more prevalent in the western world and prevalence rates of up to 46% have been reported in some selected age groups¹⁻³. Epidemiological studies of the prevalence and changes with time in different population groups are therefore important and are prerequisites for analysis of risk factors. Atopic dermatitis, allergic rhinoconjunctivitis and asthma as well as certain forms of gastrointestinal allergy and urticaria are usually classified as atopic diseases^{2,3,5-7}.

The cause of allergy seems to be an interaction between inherited constitution, climate and environmental factors³⁻⁹. Changes in lifestyle, diet and exposure to environmental factors (including allergens and adjuvant factors) have been interpreted as major causes of the supposed increased prevalence of atopy³⁻¹⁰. A recent Swedish study demonstrated that the prevalence of atopic diseases increases the further north you go and that the major risk factor was bad indoor climate⁴.

The present study forms part of a comprehensive investigation of schoolchildren and adults as well as indoor environmental conditions in homes and schools in the community of Sør-Varanger, northern Norway.

The aim of this retrospective questionnaire study was to determine the prevalence of atopic diseases among adults in an arctic area at 70° latitude north close to a polluted Russian region. Moreover, some risk factors for the development of atopic diseases are discussed.

Material and Methods

This study is part of a comprehensive study among schoolchildren and adults carried out between 1991 and 1993 in the community of Sør-Varanger⁵⁻⁸. The community is situated in northern Norway close to the Russian border at 70° north and consists of an urban population of 4770 and a rural municipality of 5040. The parents of all the 575 schoolchildren aged 7-12 years in Sør-Varanger community received a four page questionnaire. From these 1150 selected adults 1102 (96%) took part in the survey. The whole family were asked about symptoms of present and/or past eczema, asthma and allergic rhinoconjunctivitis. Other parameters to be considered were keeping of and reactions to pets, smoking habits in the family and housing and living conditions. The features of atopic diseases were explained in broad terms in an accompanying letter.

The air pollution found in this area is mainly caused by emissions from Russian nickel smelting plants in the cities of Nikel and Zapoljarnij located 10 km and 40 km from the Norwegian border respectively. The annual average emission of SO₂ from these nickel smelting plants is about 300,000 ton. The air pollution in Sør-Varanger is dominated by episodes linked to unfavourable wind conditions. During these episodes the concentrations of SO₂ have exceeded international guideline values by a factor of ten at distances of up to 30 km from the two smelting plants. Moreover, deposition of the heavy metals nickel, copper and arsenic have been found to be 10 to 20 times higher in the border areas than (at background stations) in southern Norway (Birkenes), e.g. nickel depositions of 3 mg/m² or more have been measured annually in two thirds of this area¹¹.

In this study we have restricted atopic diseases to include the three main atopic manifestations eczema, asthma and allergic rhinoconjunctivitis.

Asthma was diagnosed if the child confirmed previous and/or present asthma or recurring attacks of wheezing, coughing or heavy breathing due to external factors such as animal dander, pollen, house dust or food. Allergic rhinoconjunctivitis was defined as episodic rhinorrhea associated with nasal stuffiness and sneezing in response to known

or strongly suspected allergen(s) and often accompanied by lacrimation. Eczema was diagnosed if people had previous and/or present symptoms of pruritic, chronically relapsing (inflammatory) skin disease lasting for weeks with typical distribution, i.e. to the face, side of neck and flexural lesions. Urticaria was defined as one or more episodes of transient erythema and swelling of the skin with or without pruritus.

In this study prevalence is defined as the total proportion of adults with past and/or present symptoms.

The data were manually computed and processed with the statistical package SAS and Epi info. The statistical significance of group differences was evaluated using the Chi-square test.

The study was approved by the Ethical Committee of Tromsø University (Health Region V, Norway).

Results

Information about atopic diseases was obtained from 1102 adults in the community of Sør-Varanger which represent 15% of the adult population. Past and/or present symptoms of eczema, asthma and allergic rhinoconjunctivitis were reported by 278 adults (25.2%), significantly more frequent in women (30.3%) than in men (20.1%) ($p < 0.0005$). All atopic diseases occurred more frequently in women than in men but the difference was only significant for eczema ($p < 0.0001$). Overall, eczema was reported by 15.9% and in addition 5.6% and 10.3% reported past and/or present symptoms of asthma and allergic rhinoconjunctivitis respectively (Table I).

One or more episodes of urticaria was reported in 62 cases (5.6%) and was significantly more frequent in women (7.6%) than in men (3.6%) ($p < 0.005$). The cumulative incidence of atopic diseases among 551 schoolchildren (285 boys and 266 girls) in Sør-Varanger community was 38.7% (213/551) (including urticaria 45.2%). Furthermore, atopy was found to be more common in girls with the difference being related to eczema ($p < 0.05$). Corresponding figures for eczema, allergic rhinoconjunctivitis and asthma were 23.6%, 20.6% and 12.3% respectively.

Table 1. Frequency of atopic diseases among adult in Sør-Varanger community in relation to sex (n = 1102).

	Number of adults	Men %	Women %	Total %
Eczema	175	9.6	22.1 ^a	15.9
Allergic rhinoconjunctivitis	114	9.5	13.1	10.3
Ashma	62	5.1	6.2	5.6
Total atopic diseases	278	20.1	30.3 ^b	25.2

^ap < 0.0001; ^bp < 0.0005.

In Figure 1 the number of adult smokers in the population surveyed appears to be higher than the average for the country (telephone survey), particularly female smokers (45.6%). Keeping of domestic animals was reported in 54.3% without a significant difference between atopics and non-atopics. Homes with carpets and down quilts accounted for 21.2% and 14.7% respectively. A tendency to have damp patches on walls and/or windows (and other signs of dampness) was reported in 3.6% of the homes, however, as with carpets and down quilts there was no significant association with the atopic group.

Discussion

The diagnostic criteria for atopic diseases often present problems in population surveys^{3,12,14,15}. Because of the lack of a suitable definition it is difficult to obtain accurate information about the prevalence of atopy. Moreover, the accuracy of figures obtained from a questionnaire depends on the precision of the questionnaire, the standard of knowledge of the investigated population and their willingness and conscientiousness in replying. Factors such as a change in the medical definition of the different atopic diseases, especially asthma and eczema, a change in

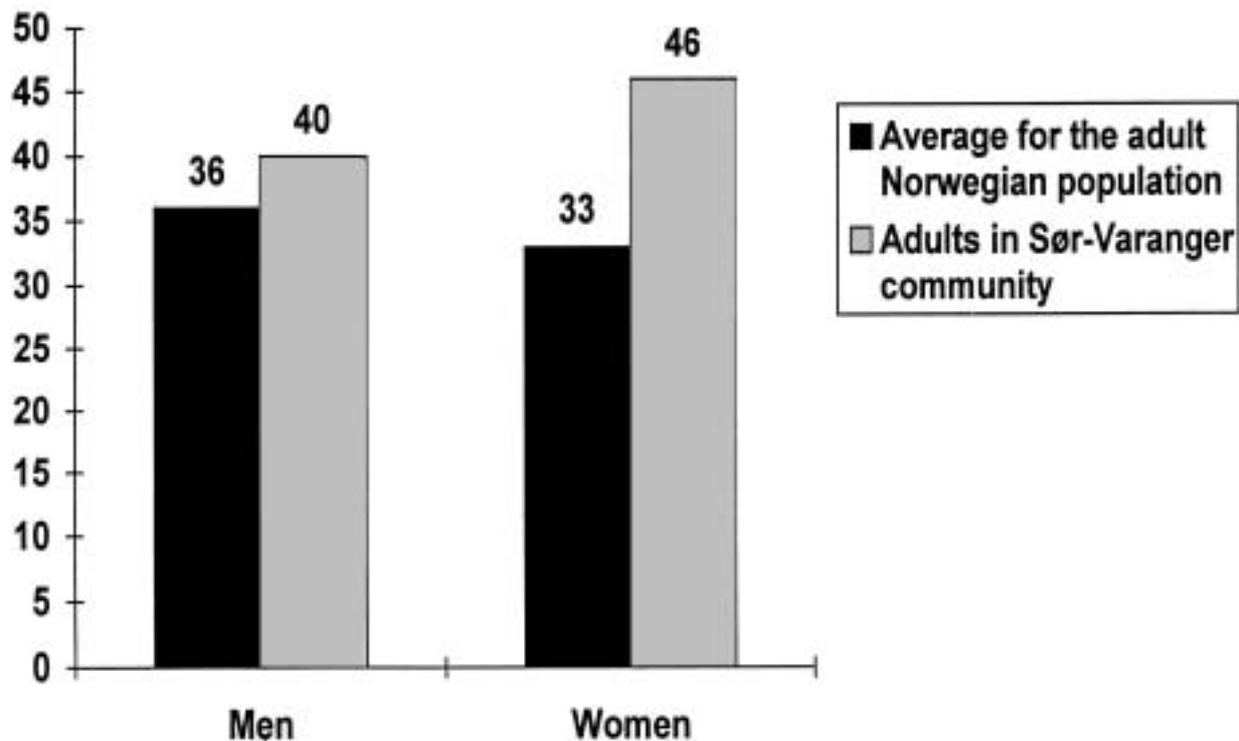


Figure 1. Smoking habits in the Norwegian population as a whole and in adults in Sør-Varanger community.

the acceptability of and attitude towards people with eczema, more attention to relatively minor symptoms and the standard of knowledge of those completing the questionnaires might all have a bearing on the apparently increased prevalence of allergic diseases. Selection bias and volunteer effects may also influence the frequency of the disease in a population based study^{3,12,16}. In the present study we found the frequency of atopic diseases to be 25%, which is (much) lower than that found in a recent adult study in southwest Norway (37%)¹, among medical students in Sweden (46%)³ and in Finnish conscripts (38%)² and adults (47%)¹⁷, but comparable with a recent German study (23%)¹⁸. However, our figures are higher than those recorded in adult Norwegian Lapps (5.5%)¹⁵ and in some other adult studies in Scandinavia^{19,20}.

We do believe that serious over/under-reporting is unlikely since high sensitivity and specificity are found between self-reported diagnosis and a diagnosis based on a physician's clinical examination^{1,21}. However, eczema appears to have poor specificity, indicating that people tend to include other skin disorders such as urticaria, seborrhoeic eczema, contact dermatitis and other dermatoses. Females, in particular, have a high prevalence of contact eczema (e.g. nickel), which may have led to some false (positive) cases of atopic eczema²². Nevertheless, an overestimation of 20% has been observed for a positive answer in relation to atopic dermatitis²³. On the other hand, people with eczema often have their onset in infancy and with early remission. Thus, episodes of eczema in infancy can, in some cases, have been misunderstood by general practitioners or even forgotten.

The high prevalence of eczema among females, which was more than twice that among males, may be due to the inclusion of dermatoses other than atopic eczema (e.g. contact eczema). Nevertheless, our figures for eczema in adults are in agreement with some Scandinavian studies^{1,2,16}, but much higher than those found by others^{3,15,18,19}. Urticaria, which may be encumbered with great uncertainty and have several other causes than atopy, was comparable with studies in Hordaland county¹ and in Sweden¹⁹. However, Finnish studies have re-

ported a two or even three times higher prevalence of urticaria in the general population^{2,17}.

With respect to the occurrence of asthma the present study was comparable with other north European studies^{1,16-20}, but figures were higher than those found in Norwegian Lapps¹⁵. Reports from Scandinavia and Germany indicate a prevalence of allergic rhinoconjunctivitis higher than that found in Sør-Varanger community^{2,16-18}, however, our figures are comparable with some other studies^{1,20}.

Regional variations in the frequency of atopic diseases may be attributed to a multitude of factors such as ethnic differences, inclusion criteria and study design, climate, other environmental factors etc^{1-3,5-10}. In this part of northern Norway there are very few Lapps and few people from other ethnic groups. There are, however, no striking differences, e.g. with respect to HLA-patterns, between the study group and the Norwegian population as a whole²⁴. Furthermore, there is no evidence of consistent influence by the HLA-system on atopic diseases²⁵. We believe that the discrepancy in the prevalence of atopy between different parts of northern Europe may largely be due to different study designs, climates and local environmental conditions^{5-10,13,19,21,26}. Åberg et al^{4,19} reported a 25% higher prevalence of atopic diseases in schoolchildren in northern Sweden than in the southern part of the country, although the outdoor air pollution is lower in the north. Interestingly, equal figures have also been found in two recent comparable studies of schoolchildren (i.e. using the same questionnaire formulas, age group and year of investigation and data processing) in the south and in the north of Norway^{5,21}. Factors such as a cold and dry subarctic climate and associated living conditions seem to be related to an increased prevalence of atopic diseases the further north you go. Consideration must also be given to how the indoor environment is influenced by the outdoor temperature, i.e. chemical pollution from new building materials and allergens remaining indoors due to the efficient insulation applied in colder climates in order to save energy. However, allergy to domestic mites and mould, which tend to concentrate in humid indoor climates, does not seem to be a major problem in the

Sør-Varanger community^{8,27,28}. Likewise, the pollen exposure time is shorter and the pollen counts lower most days during the pollen season (Bolle R. and Ramfjord H, personal communication). Moreover, sensitization to pollen in schoolchildren in this area is equal to that found in Sweden²⁶. Furthermore, keeping of domestic animals (54.3%) is similar to that reported in other Scandinavian studies^{2,19,21}.

There is probably no outdoor air as polluted as the air in a room where people are smoking^{9,29}. In our study smoking, especially in females, was more common than in any other part of the country (National Council on Tobacco and Health, Oslo, Norway, personal communication). Despite health education and good public medical services in this area, people here have a lifestyle which is different to that found in the rest of the country. Numerous epidemiological studies have found an association between exposure to tobacco smoke and recurrent wheezing, bronchial hyperreactivity and the diagnosis of asthma as well as skin diseases³⁰. Moreover, we recently found that children whose parents smoked had significantly increased serum IgE levels compared with children of non-smokers, but without a correlation between skin sensitivity and parental smoking⁷. This provides further evidence to the fact that smoking influences our immune system and may act as an adjuvant factor in eliciting sensitization and atopy^{7,9,29,30}. Hopefully, planners, policy makers and medical practitioners will now join forces and propose an action plan to eradicate smoking, which is an unacceptable and needless health risk.

In conclusion, this study indicates that the frequency of atopic diseases among adults is only two thirds of that reported in schoolchildren in northern Norway. Thus, the geographically related increase in atopic diseases over recent decades must be due to factors present mainly during childhood. The pathogenesis of atopic sensitization and the development of allergy is still unexplained. Enhanced understanding of features of atopic diseases such as provocative factors and predictors of disease will ideally lead to more effective preventive and therapeutic measures, ultimately improving the prognosis of atopic diseases.

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