

# Atopic diseases in Sami and Norse schoolchildren living in northern Norway

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Among children in the western world, atopic diseases are a major cause of morbidity. However, several prevalence studies have indicated that the frequency of these diseases displays both geographic and ethnic variations. In 1995, we conducted a questionnaire-based, cross-sectional survey in northern Norway. Atopic diseases among 8676 schoolchildren, aged 7–13 years, including 491 children with Sami ethnicity, were studied. The role of ethnicity (Sami/white Caucasian) was determined by comparing the reported atopic disease rate in each of the respective groups. In the areas under investigation (the cumulative incidence, the point prevalence of asthma and allergic rhinoconjunctivitis and the cumulative incidence of atopic dermatitis), the Sami children scored higher than the white Caucasian Norwegian children. The relative risks (RR) in Sami children were: current asthma RR = 2.01 [95% confidence interval (CI) 1.48–2.73]; current allergic rhinoconjunctivitis RR = 1.51 (95% CI 1.14–1.99); lifetime atopic dermatitis RR = 1.39 (95% CI 1.18–1.63). We thus conclude that there is an association between Sami ethnicity and asthma and allergy among schoolchildren in northern Norway.

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Owing to the high prevalence of atopic diseases (bronchial asthma, allergic rhinoconjunctivitis and atopic dermatitis) in children, several epidemiological studies have been performed to obtain a better understanding of their complexity (1–3). Ascertaining demographic information such as geographic and ethnic distribution is essential. Interactions between atopic traits and genetic and environmental risk factors can thus be elicited.

This work presents a cross-sectional, questionnaire-based study of children of Sami and Norse (white Caucasian) ethnicity in northern Norway. Study parameters were the atopic diseases: asthma, allergic rhinoconjunctivitis and atopic dermatitis. The study objective was to compare the prevalence of atopic diseases among children of different ethnicity living within the same geographic boundaries.

## Materials and methods

In 1995, a questionnaire dealing with atopic diseases in childhood was distributed to school-

children aged 7–13 in the counties of Nordland, Troms and Finnmark in northern Norway. The primary schools included were randomly chosen within each county. The local school nurse distributed the questionnaires and an accompanying letter, with a description (symptoms and signs) of the diseases under investigation, to the schoolchildren and their parents. The questionnaire targeted the symptoms of bronchial asthma, allergic rhinoconjunctivitis and atopic dermatitis. Questions about urticaria and adverse reactions to food were also included. Furthermore, information about atopic disease in close relatives, residence, housing, indoor/outdoor environment and ethnicity was collected. The present study was a 10 year follow-up of a study conducted in northern Norway in 1985 and the questionnaires used in both surveys were almost identical.

Of the 9950 schoolchildren selected, 8682 subjects (87.3%) returned a completed questionnaire. Six questionnaires lacked information about gender or age and these were deleted from the study. The questionnaire was answered

by the child's mother in 78.5% of cases and by the father in 12.3%, by both mother and father in 5.0%, by the child in 2.9% and by others in 1.3%.

#### Definitions

There were 491 children (5.9%) with two or more grandparents who had Sami as their native language, and who were defined as being of Sami ethnicity. In 404 children (4.7%) this question was left unanswered. In accordance with previous Norwegian studies where a similar questionnaire was employed (4,5), asthma was recorded if there was an affirmative answer to either one or both of the questions 'Has the child ever had asthma?'/ 'Does the child get a wheeze, periods with cough or attacks with shortness of breath (asthma) caused by external factors?'. Atopic dermatitis was recorded in the cases of an itchy eruption lasting for more than four weeks combined with (i) lesions in face, elbow- or kneeflexures or (ii) high degree of itching and lesions elsewhere. The term 'atopy' in this article refers to children recorded with one or more of the diseases asthma, allergic rhinoconjunctivitis or atopic dermatitis.

#### Validity of the asthma questionnaire

The same questionnaire was previously used to assess atopic diseases among schoolchildren in Telemark county, Norway (4). A clinical follow-up study showed that the sensitivity and the specificity of the asthma questionnaire was high. It was concluded that the questionnaire was a useful epidemiological tool.

#### Reliability of the asthma questionnaire

In 1996, a reliability study was conducted among 152 of the respondents from Nordland county. The study comprised 54 cases in a restricted geographic area, with episodes of asthma the last 12 months in the 1995 survey. The 98 controls were chosen as follows. For each case, two controls were randomly selected. These were the two pupils in the same grade and of the same gender as the case, appearing closest before and after in the alphabetical order of the grade. All were paid a home visit, at which time samples were taken to investigate the indoor climate. Additionally, an asthma questionnaire identical to that used in the 1995 survey was filled in during the home visit. To estimate the reliability of our asthma questionnaire, the results from the follow-up survey were compared with those from the 1995 study by calculating the Kappa coefficient (6). Among the children recorded with

asthma in the 1995 study, parents reported no asthma in the child in 6.5% of cases in the 1996 study. Among the controls, 2.2% reported a history of asthma a year later. The reliability test yielded a Kappa coefficient of 0.92.

The present survey was based on informed consent from the parents. Approval was obtained from The Norwegian Data Inspectorate and The Ethical Committee in North-Norway. All statistics were computed by SAS software package (7).

#### Results

Both the cumulative incidence of asthma according to our definition and the prevalence in the last 12 months were higher in Sami than in Norse children (Table 1). The differences were found both for the single question of asthma and for asthma symptoms. By adding children with symptoms to children with an affirmative answer to the question of asthma, the frequency of children with asthma according to our definition increased markedly in both study populations. However, the frequency of children with lifetime or current asthma defined by symptoms only did not differ between the Sami and Norse (data not shown).

The cumulative incidence of allergic rhinoconjunctivitis, atopic dermatitis and atopy was higher in Sami children. This was also the case when looking at the prevalence of symptoms in the last 12 months of allergic rhinoconjunctivitis and atopy (Table 2).

Table 3 presents the associations between the living conditions and ethnicity. The greatest ethnic difference in atopic disease was found for the question 'Has the child had asthma in the last 12 months?'. Consequently, the associations between living conditions and an affirmative answer to this question are included in Table 3. Only indoor dampness during winter and a wall-to-wall carpet in the child's bedroom were associated to both ethnicity and current asthma. When the association between ethnicity and current asthma was adjusted by these two risk factors, the relative risk (RR) Sami/Norse decreased to 2.12 [95% confidence interval (CI) 1.48–3.05].

#### Discussion

In this cross-sectional, questionnaire-based study among Sami and Norse schoolchildren in Northern Norway we found higher frequencies of parent-reported atopic diseases in children of Sami than of Norse ethnicity. The difference was

Table 1. Atopic diseases in Sami and Norse schoolchildren living in northern Norway. Cumulative incidence and symptoms in the last 12 months of asthma among Sami and Norse children with relative risk (RR) Sami/Norse adjusted by age and gender with 95% confidence interval (95% CI) of RR

|                                                                                                                          | Sami<br>% | Norse<br>% | Sami/Norse<br>RR | 95% CI      |
|--------------------------------------------------------------------------------------------------------------------------|-----------|------------|------------------|-------------|
| Has the child ever had asthma?                                                                                           | 13.6      | 8.2        | 1.69             | (1.33–2.15) |
| Does the child get a wheeze, periods with cough or attacks with shortness of breath (asthma) caused by external factors? | 16.1      | 10.2       | 1.61             | (1.29–2.01) |
| Asthma by definition: cumulative incidence                                                                               | 19.1      | 12.3       | 1.57             | (1.29–1.92) |
| Has the child had asthma in the last 12 months?                                                                          | 6.7       | 2.8        | 2.40             | (1.70–3.41) |
| Does the child get a wheeze, periods with cough or attacks with shortness of breath (asthma) caused by external factors? |           |            |                  |             |
| Occurrence in the last 12 months                                                                                         | 5.5       | 3.6        | 1.57             | (1.07–2.30) |
| Asthma by definition: symptoms in the last 12 months                                                                     | 9.0       | 4.6        | 2.01             | (1.48–2.73) |

greatest concerning asthma in the last 12 months with a more than twofold increased risk among the children of Sami origin.

There are obvious limitations to a questionnaire-based survey in diagnosing bronchial asthma and allergy. Ideally, the diagnosis of these diseases should be made in a clinical examination by an experienced doctor. A detailed clinical history and lung-function test, skin-prick test, blood specimen sampling for serum immunoglobulin E (IgE) and radio-allergo-sorbent test (RAST) should all be investigated. When diagnosing asthma by questionnaire in epidemiological surveys, it is shown that the question 'Have you ever had asthma' is remarkably specific, although markedly insensitive (1). In order to increase the sensitivity of our asthma questionnaire, we consequently added questions concerning symptoms. The accuracy of parent reports was investigated in a survey by comparing parents' responses to a self-administered questionnaire with information extracted from pediatricians' records (8). For asthma in the last year the percentage with good agreement was 91%. It was concluded that parent reports are generally acceptable for most research purposes. The reliability test of our asthma question in the

reliability study showed a high degree of agreement. We would therefore argue that misinterpretation of the asthma question by the respondents was insignificant. The description of hay fever in the questionnaire and the accompanying letter was unambiguous and a consequent high degree of sensitivity and specificity can thus be expected. Although with some minor alterations, the same questionnaire was employed to assess atopic dermatitis among schoolchildren in the community of Sør-Varanger in northern Norway (5). In a follow-up study, the clinical examination by an experienced dermatologist uncovered a considerably higher frequency of atopic dermatitis than that estimated in the questionnaire study (9). Consequently, the frequency of atopic dermatitis detected in our survey is most likely an underestimate.

The ethnic minority termed Sami is ill-defined. In Norway there is a Sami Parliament elected by people registered as Sami, mainly defined by language. The Sami and white Caucasians immigrated to the northern parts of Scandinavia from different origins and in different historical periods. Until today, the Sami have traditionally been divided in two categories: those living permanently by the seaside, and the

Table 2. Atopic diseases in Sami and Norse schoolchildren living in northern Norway. Cumulative incidence and symptoms for the last 12 months of allergic rhinoconjunctivitis/atopic dermatitis/atopy among Sami and Norse children with relative risk (RR) Sami/Norse adjusted by age and gender with 95% confidence interval (95% CI) of RR

|                                                          | Sami<br>% | Norse<br>% | Sami/Norse<br>RR | 95% CI      |
|----------------------------------------------------------|-----------|------------|------------------|-------------|
| Allergic rhinoconjunctivitis: cumulative incidence       | 32.6      | 21.6       | 1.52             | (1.32–1.76) |
| Allergic rhinoconjunctivitis: symptoms in last 12 months | 10.5      | 7.0        | 1.51             | (1.14–1.99) |
| Atopic dermatitis: cumulative incidence                  | 26.7      | 19.2       | 1.39             | (1.18–1.63) |
| Atopic dermatitis: symptoms in last 12 months            | 6.7       | 5.1        | 1.29             | (0.91–1.83) |
| Atopy: cumulative incidence                              | 49.4      | 38.8       | 1.28             | (1.15–1.42) |
| Atopy: symptoms in last 12 months                        | 17.1      | 13.2       | 1.30             | (1.06–1.61) |

Table 3. Associations between living conditions and ethnicity/current asthma

|                                                                   | Sami<br>n = 491 | Norse<br>n = 7781 | p-value* | Response to 'Has the child had asthma<br>in the last 12 months?'<br>p-value** |
|-------------------------------------------------------------------|-----------------|-------------------|----------|-------------------------------------------------------------------------------|
| Number of siblings (mean $\pm$ SD)                                | 2.0 $\pm$ 1.4   | 1.8 $\pm$ 1.2     | 0.001    | 0.86                                                                          |
| Building year of house (19–) (mean $\pm$ SD; years)               | 75 $\pm$ 15     | 73 $\pm$ 18       | 0.006    | 0.42                                                                          |
| Area of house (square meters) (mean $\pm$ SD)                     | 127 $\pm$ 65    | 139 $\pm$ 71      | 0.001    | 0.87                                                                          |
| Indoor dampness during winter (%)                                 | 6.7             | 3.0               | 0.001    | 0.001                                                                         |
| Heating the household with firewood (%)                           | 78.4            | 73.9              | 0.027    | 0.25                                                                          |
| Heating the household with oil heater (%)                         | 15.9            | 12.3              | 0.021    | 0.89                                                                          |
| How many do usually sleep in the child's bedroom? (mean $\pm$ SD) | 1.3 $\pm$ 0.6   | 1.2 $\pm$ 0.5     | 0.001    | 0.56                                                                          |
| Is there a wall-to-wall carpet in the child's bedroom? (%)        | 10.0            | 25.9              | 0.001    | 0.001                                                                         |
| Does someone in the family smoke? (%)                             | 56.6            | 51.6              | 0.035    | 0.70                                                                          |
| Does the family keep animals? (%)                                 | 54.6            | 51.6              | 0.20     | 0.001                                                                         |
| Does the family keep cats/dogs? (%)                               | 46.2            | 41.9              | 0.059    | 0.001                                                                         |
| Does the family keep reindeer? (%)                                | 7.7             | 0                 | 0.001    | 0.99                                                                          |

\*For continuous variables p-value from anova, for categorized variables p-value from chi-square. \*\*Associations analyzed by logistic regression.

nomads who keep reindeer. These stereotypes are today minorities as the majority of the Sami are integrated in the modern Norwegian society. However, there are today no official statistics available concerning ethnicity in Norway. Our multi-ethnic study population comprised a socio-economic comparable population that encouraged an investigation of ethnic differences in the prevalence of asthma and allergy.

In a study of atopic diseases among Norwegian Lapps by reviewing medical records, Falk found the frequency of total atopic diseases among individuals under 20 years to be comparable with other studies (10). We are not aware of other studies comparing the prevalence of asthma and allergy in Sami and white Caucasians. Several studies have explored the relationship of ethnicity with prevalence of asthma and atopy in children (11–15). A study of Inuit primary schoolchildren living in far-northern Quebec concluded that asthma and atopy were uncommon in this population (11). A prevalence study of asthma symptoms among adolescents by ethnicity in the Wellington region, New Zealand, concluded that there are, at most, minor differences in asthma prevalence between Maori and non-Maori children (12). A study conducted in four rural Australian Aboriginal communities concluded that asthma in Aboriginal children was almost non-existent (13). For a study of childhood asthma among Puerto Rican Hispanics, 9 276 mothers were interviewed to ascertain whether they had asthmatic children younger than 18 years of age and asking about genetic risk factors for asthma (14). Hispanic and African-American ethnicity were found to be independent risk factors for asthma in 7 776 children. Ethnic differences in the prevalence of asthma were

studied in a socio-economically homogenous, middle-class, multi-ethnic population of schoolchildren in Southfield, Michigan, USA (15). The study confirmed the hypothesis that differences in biological factors between black and white people play a role in asthma risk.

Adjusting the associations between ethnicity and current asthma by differences in living conditions only implied minor alterations in the relative risks. Hence, the present study does not explain the ethnic differences uncovered in asthma and allergy prevalence. A clinical case-control study controlling environmental risk factors is thus necessary to draw further conclusions concerning associations between ethnicity and atopic diseases in northern Norway.

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