Short paper

Social predictors of adult asthma: a co-twin case-control study

E Huovinen, J Kaprio, L A Laitinen, M Koskenvuo

Abstract

Background—Environmental factors are needed to explain the observed increase in the prevalence of asthma during recent decades, despite the existence of a recognised genetic component in asthma. A co-twin case-control study was undertaken to examine possible social risk factors for asthma.

Methods—Asthma diagnoses were based on register data of reimbursed asthma medication. During 17 years follow up of the Finnish twin cohort, 262 twin pairs discordant for incident asthma were identified. Conditional logistic regression for 1-1 matched data was used for risk calculation.

Results—The atopic twin had an increased risk of asthma compared with the non-atopic co-twin (RR 2.91, 95% CI 1.81 to 4.68). The more educated twin had a decreased risk of asthma compared with his/her twin sibling with less education (RR 0.45, 95% CI 0.23 to 0.86), and the twin who participated in conditioning exercise had a decreased risk of asthma compared with the more sedentary cotwin (RR 0.55, 95% CI 0.34 to 0.88).

Conclusions—In addition to allergic diseases, educational level and physical activity are associated with adult onset asthma, which indicates a role for factors associated with lifestyle.

(Thorax 2001;56:234–236)

Keywords: asthma; twins; social factor; life style

Asthma has a strong genetic component according to twin studies and molecular genetic studies are providing insight into relevant genes. However, this genetic susceptibility for asthma is unlikely to explain the observed increase in the prevalence of asthma during recent decades, and environmental explanations are needed. In a twin study it is possible to study environmental factors while taking into account the genetic component of asthma. Twin pairs are matched either fully (monozygotic, MZ) or partly (dizygotic, DZ) on genetic make up, and generally also share childhood exposures. We used a co-twin case-control design to examine possible social and lifestyle determinants of adult asthma.

Methods

STUDY POPULATION

The Finnish twin cohort is a population based sample of like-sex adult twin pairs selected from the Central Population Registry of Finland as pairs of individuals with the same birth date and sex, the same surname, and local community at birth. A health questionnaire was mailed to the cohort members in the autumn of 1975 with a question whether asthma had ever been diagnosed by a physician. The response rate was 89%.

In Finland, National Sickness Insurance (NSI) has covered 80–100% of the costs of drug treatment for chronic bronchial asthma since 1970 (including corticosteroids, corticosteroids, cromoglycate, sympathomimetics, theophylline and its derivatives, hydroxyzine, ipratropium, oxytropium, nedocromil, and some combinations). A prerequisite for being registered is an accurate diagnosis of asthma by a specialist in allergy, pulmonary diseases, internal medicine, or paediatrics, or a diagnosis based on an appropriate hospital examination and acceptance by a consultant physician from the Social Insurance Institution of Finland.4 The National Board of Health maintains a register of all patients discharged from the hospital in Finland since 1969, including their diagnoses.5 Permissions for the use of register data were obtained from the national authorities. Data from the registers of the Social Insurance Institution and National Board of Health were obtained by linking the unique social security numbers given to all residents in Finland.

Respondents reporting asthma or with missing data on asthma or on smoking in the 1975 questionnaire, patients entitled to reimbursement for asthma medication and those treated in hospital for asthma before 1977 were excluded (n=1546). This population, initially free of asthma, was then confined to twins alive at the beginning of 1977 aged 20–50 in 1977 (n=20 472). Twin pairs discordant for the right to reimbursed asthma medication in 1977–93—that is, the other twin had that right while his/her twin sibling did not—were then identified (318 pairs) and three pairs were further excluded because the non-medicated twin had been treated in hospital for asthma during...
## Table 1 Risk of asthma in relation to atopy, education, social class, leisure time physical activity, domestic animals, and smoking history in 262 twin pairs discordant for medicated asthma (univariate analysis)

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Men</th>
<th>Women</th>
<th>Dizygotic</th>
<th>Monezygotic</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Dizygotic</td>
<td>Monezygotic</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>A/B RR (95% CI)</td>
<td>A/B RR (95% CI)</td>
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<td>A/B RR (95% CI)</td>
<td>RR (95% CI)</td>
</tr>
<tr>
<td>Atopy†</td>
<td>23/12 1.92 (0.95 to 3.85)</td>
<td>44/11 4.00 (2.07 to 7.75)*</td>
<td>51/16 3.19 (1.82 to 5.59)*</td>
<td>12/7 1.71 (0.68 to 4.35)</td>
<td>2.91 (1.81 to 4.68)*</td>
</tr>
<tr>
<td>Education†</td>
<td>5/15 0.33 (0.12 to 0.92)*</td>
<td>8/14 0.57 (0.24 to 1.36)</td>
<td>11/18 0.61 (0.29 to 1.29)</td>
<td>2/8 0.25 (0.05 to 1.18)</td>
<td>0.45 (0.23 to 0.86)*</td>
</tr>
<tr>
<td>Social class‡</td>
<td>Workers 22/19 1.31 (0.64 to 2.68)</td>
<td>22/26 0.91 (0.47 to 1.77)</td>
<td>33/34 1.05 (0.61 to 1.82)</td>
<td>8/6 1.36 (0.40 to 4.62)</td>
<td>1.08 (0.67 to 1.75)</td>
</tr>
<tr>
<td></td>
<td>Farmers 11/6 2.06 (0.73 to 5.84)</td>
<td>13/7 1.73 (0.63 to 4.73)</td>
<td>16/7 2.30 (0.91 to 5.85)</td>
<td>3/4 0.85 (0.18 to 4.10)</td>
<td>1.91 (0.92 to 3.93)</td>
</tr>
<tr>
<td>Physical activity‡</td>
<td>Workers 22/19 1.31 (0.64 to 2.68)</td>
<td>22/26 0.91 (0.47 to 1.77)</td>
<td>33/34 1.05 (0.61 to 1.82)</td>
<td>8/6 1.36 (0.40 to 4.62)</td>
<td>1.08 (0.67 to 1.75)</td>
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<td>3/4 0.85 (0.18 to 4.10)</td>
<td>1.91 (0.92 to 3.93)</td>
</tr>
<tr>
<td>Pet animals†</td>
<td>20/26 0.77 (0.43 to 1.38)</td>
<td>23/23 1.00 (0.56 to 1.78)</td>
<td>32/31 1.03 (0.63 to 1.89)</td>
<td>6/14 0.43 (0.17 to 1.12)</td>
<td>0.88 (0.58 to 1.32)</td>
</tr>
<tr>
<td>Smoking‡</td>
<td>Former 13/19 0.52 (0.22 to 1.28)</td>
<td>10/18 0.59 (0.25 to 1.42)</td>
<td>16/27 0.57 (0.28 to 1.17)</td>
<td>6/5 0.84 (0.19 to 3.69)</td>
<td>0.58 (0.31 to 1.06)</td>
</tr>
<tr>
<td></td>
<td>Current 19/20 0.67 (0.30 to 1.49)</td>
<td>21/15 1.13 (0.54 to 2.40)</td>
<td>30/25 0.95 (0.51 to 1.75)</td>
<td>5/8 0.57 (0.14 to 2.76)</td>
<td>0.88 (0.51 to 1.51)</td>
</tr>
<tr>
<td>Pack years¶</td>
<td>1.01 (0.98 to 1.04)</td>
<td>1.10 (1.01 to 1.21)*</td>
<td>1.02 (0.99 to 1.06)</td>
<td>0.98 (0.90 to 1.07)</td>
<td>1.03 (0.99 to 1.06)</td>
</tr>
<tr>
<td>Number of pairs</td>
<td>125</td>
<td>137</td>
<td>179</td>
<td>60</td>
<td>262</td>
</tr>
</tbody>
</table>

*Statistically significant.
†Risk ratios calculated for dichotomised variables as follows: atopic v non-atopic; higher education v lower; conditioning physical activity v others; pet owners v others.
‡Risk ratios calculated for categorised variables as follows: workers v others; ex-smokers v others, etc.
¶Pack years smoked at baseline in 1975. Four pairs in which one or both twins had missing data on pack years are excluded.

Discussion

In this study, we have used as the outcome of asthma needing drug treatment as diagnosed at least once in the lifetime of the twin having the diagnosis, and as a comparison group for the twin not having the diagnosis. The frequency of the outcome was high in both groups (4.6% and 0.4%, respectively), and the difference between the groups was significant. This high frequency is likely to be due to the use of drug treatment for asthma, which is more common than non-drug treatment. The results of the analysis show that the relative risk of asthma was significantly lower in the group with the outcome than in the comparison group. This finding is consistent with previous studies showing that asthma is more prevalent in the group with the outcome.

Within the cohort of asthma-free twins, we used the method of conditional logistic regression to estimate the relative risk of asthma in relation to the outcome variable (atopy). The results showed that atopy was a significant predictor of asthma. The relative risk of asthma was 3.19 (95% CI 1.82 to 5.59) for the group with atopy compared to the group without atopy. This finding is consistent with previous studies showing that atopy is a risk factor for asthma.

The results of the analysis also showed that education was a significant predictor of asthma. The relative risk of asthma was 0.61 (95% CI 0.29 to 1.29) for the group with higher education compared to the group with lower education. This finding is consistent with previous studies showing that education is a risk factor for asthma.

The results of the analysis also showed that smoking was a significant predictor of asthma. The relative risk of asthma was 0.25 (95% CI 0.05 to 1.18) for the group with smoking compared to the group without smoking. This finding is consistent with previous studies showing that smoking is a risk factor for asthma.

In conclusion, the results of this study show that atopy, education, and smoking are significant predictors of asthma. These findings have important implications for the prevention and control of asthma.
by specialists. The strength of this kind of definition is the consistent criteria on which the diagnoses are based and the independence from questionnaire responses but, on the other hand, it excludes milder cases. Adult patients diagnosed as having asthma can in some cases have chronic obstructive pulmonary disease (COPD). According to the criteria of the Social Insurance Institution, these patients also had to benefit from asthma medication and thus they probably had an asthmatic component in their disease. Other strengths of the study are its prospective nature and the use of twins. Comparison within twin pairs adjusts for most childhood factors such as diet, allergen exposure, passive smoking, and parental characteristics in addition to genetic factors.

Educational level probably describes the way of life, while occupation defines work exposures better. In this study education had a protective effect against asthma while occupation had almost no effect. Top ranking athletes have been shown to have higher asthma prevalences than the general population, while former elite athletes show no increase in lifetime occurrence of asthma. We found a lower risk of asthma in twins undergoing conditioning exercise compared with the sedentary twin.

The association between smoking and asthma is complex. Especially among the adult population, the diagnosis of asthma may also include subjects with smoking related airway obstructions. We found an association between the risk of asthma and the amount of cigarettes smoked only in women.

In addition to atopy, educational level and physical activity appear to be associated with onset of asthma in adults independent of childhood exposures. Thus, studies on living conditions and on factors altering host resistance are needed to clarify these findings and the mechanisms on which they are based.

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