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The prevalence of asthmatic respiratory symptoms among adults in Estonian and Swedish university cities

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The prevalence of atopy and related diseases is lower among children in Eastern European countries than in countries with a market economy. Such comparisons have not been made in adults. The European Community Respiratory Health Survey (ECRHS) postal questionnaire was mailed to random samples of 3000 inhabitants in Tartu, Estonia, and 3600 in Uppsala, Sweden, between the ages of 20 and 44 years. Asthmatic symptoms (wheeze with breathlessness occurring in the absence of colds) were less prevalent in Tartu (4.6% vs 6.8%, $P<0.001$), as were attacks of asthma (1.9% vs 3.3%, $P<0.01$), current asthma medication (0.7% vs 4.9%), and allergic rhinitis (17.8% vs 22.2%, $P<0.001$). Age was inversely related to allergic rhinitis in Uppsala ($P<0.05$), but not in Tartu. Nocturnal respiratory symptoms (wakening with chest tightness or being woken by an attack of breathlessness or an attack of cough) were more prevalent in Tartu ($P<0.001$), and their prevalence increased with age ($P<0.05$) in Tartu, but not in Uppsala. Symptoms of asthma and hay fever were less common but other respiratory problems more common in Tartu than in Uppsala. The difference in the prevalence of hay fever diminished with age, supporting the notion that the increasing prevalence of allergy among children and young adults in Western Europe is caused by a cohort effect.

Key words: allergic disease; atopy; bronchial asthma; epidemiology.

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A worldwide increase, as well as large regional differences, in the prevalence of atopy and related diseases, has been reported in recent years (1–8). Recent studies have also revealed a lower prevalence of asthma, hay fever, and atopic sensitization among children in the previously socialist countries of Eastern Europe than in countries with a market economy. In a German study, the prevalence of hay fever in Leipzig in the former East Germany was only 1/3 of that in Munich in the former West Germany (9). Similarly, the prevalence of at least one positive skin prick test was much lower in Estonia and Poland than in Sweden (10, 11). However, two of the most significant risk factors for allergy, i.e., atopic heredity and exposure to tobacco smoke, appeared to be similar in the three countries. There was an inverse relationship between crowded living and allergic sensitization, supporting a previous observation of an inverse relationship between the number of siblings and sensitization to allergens (12).

There are several indications that allergy is triggered by the conditions of early life under which the primary sensitization takes place (14). Accordingly, an increasing prevalence in older children and young adults would represent a cohort effect. This hypothesis would be supported by diminishing differences in the prevalence of allergic diseases with age between populations with large differences in the prevalence of allergic diseases among children. The aim of this study was to compare the prevalence of respiratory symptoms, asthma, and allergic rhinitis among adults in Tartu, Estonia, and in Uppsala, Sweden, in relation to age, sex, and smoking history.

Material and methods

Study areas and subjects

According to the protocol of the European Community Respiratory Health Survey (ECRHS)

(15, 16), two areas were compared, i.e., Tartu, Estonia, and Uppsala, Sweden. Both are university cities (population 110 000 and 167 000, respectively) with little industry. They are located at a similar latitude and have a similar climate. The track of development of the countries parted 50 years ago, and the study group in Tartu has been living in a socialist economy from birth. In 1993, the mean monthly salary was $80 in Tartu and $2612 in Uppsala, and the purchasing power of the salary for the internal market was five times higher in Sweden than in Estonia. The living area per inhabitant was 12 m^2 in Tartu, as compared to 40 m^2 in Uppsala. In Tartu, 63% of people used gas stoves for cooking, as compared to less than 1% in Uppsala.

Random samples of 3000 subjects in Tartu and 3600 in Uppsala aged 20–44 years, with equal numbers from either sex, were taken from the census rolls. To avoid linguistic problems, only people of Estonian nationality were selected in Tartu. The study was approved by the respective local ethics committees.

Study design and methods

The ECRHS modified version of the International Union Against Tuberculosis and Lung Disease (IUATLD) questionnaire (16, 17) was used. It included seven questions commonly related to the diagnosis of asthma. The questions referred to the 12-month prevalence with the exception of the question, "Do you have any nasal allergies including hay fever?" Questions on smoking history were added both in Uppsala and Tartu (Table 1). The questionnaire was translated from English into Estonian and Swedish and retranslated into English. The Estonian questionnaire was also translated into Swedish for comparison.

The questionnaire was mailed in December 1990 in Uppsala and in December 1993 in Tartu, together with a letter of explanation and a stamped reply envelope. Two additional questionnaires were sent to nonresponders. Positive answers to both question (Q)1.1 and Q1.2, i.e., wheeze with breathlessness occurring in the absence of colds, were considered to represent "asthmatic symptoms" (AS). Subjects with an affirmative answers to Q5 (attacks of asthma) or Q6 (asthma medication) were classified as having "asthma-related disorder" (AD). These combinations were used earlier in a Swedish evaluation of the questionnaire (18).

Statistical analysis

The statistical analysis was performed on a Mackintosh ICI computer with the Statistica 4.0 software package (State Soft, Inc., Tulsa, OK, USA). The chi-square test was used to analyze differences between groups. Odds ratios (OR) with 95% confidence intervals (CI) were determined. Logistic regression analysis was performed in order to estimate adjusted OR when taking into account several variables. The confounding variables were age, sex, and current smoking. Two-tailed tests were used. A P value under 0.05 was regarded as statistically significant.

Table 1. Reported airway symptoms, medication, and smoking habits in different age groups (chi-square-trend test was used to test for influence of age [$*P<0.05$, $**P<0.01$, $***P<0.001$] and difference between centers [$+=P<0.05$, $++=P<0.01$, $+++=P<0.001$])

Question (Q) no.		20–24 %	25–29 %	30–34 %	35–39 %	40–44 %	Total %
1)	Wheezing or whistling						
	Tartu	26.5	22.9	25.8	30.2	29.0	26.5+++
	Uppsala	18.2	18.6	18.6	20.1	18.6	19.0
1.1)	Breathlessness while wheezing						
	Tartu	7.5	6.0	6.8	7.9	11.4	7.7+++
	Uppsala	10.5	10.6	10.7	10.2	9.7	10.3
1.2)	Wheeze without cold						
	Tartu	12.9	12.1	12.1	14.6	12.3	12.8
	Uppsala	10.6	12.5	11.4	11.4	11.0	11.4
2)	Waking with chest tightness						
	Tartu	11.1	11.6	13.9	14.4	19.7**	13.6+++
	Uppsala	8.5	8.7	9.6	11.0	10.6	9.7
3)	Woken by attack of breathlessness						
	Tartu	5.7	6.8	8.3	9.9	10.7*	7.9+++
	Uppsala	3.3	4.7	5.7	5.6	5.7	5.0
4)	Woken by attack of cough						
	Tartu	38.0	40.8	45.1	46.3	42.8*	42.0+++
	Uppsala	22.7	23.4	27.8	28.6	24.7	25.4
5)	Attacks of asthma						
	Tartu	1.9	1.6	1.3	1.5	2.7	1.9++
	Uppsala	3.8	2.7	3.7	4.0	2.5	3.3
6)	Current asthma medication						
	Tartu	0.8	0.9	0.4	0.5	0.6	0.7+++
	Uppsala	6.3	5.1	4.4	4.0	4.6	4.9
7)	Nasal allergies						
	Tartu	16.6	17.1	17.4	20.3	18.7	17.8+++
	Uppsala	23.6	23.5	23.6	22.3	18.2	22.2
8)	Current smokers						
	Tartu	41.5	48.0	49.0	52.5	39.3***	45.9+++
	Uppsala	31.1	31.6	35.2	40.0	31.6**	33.8
9)	Ex-smokers						
	Tartu	7.3	11.1	14.6	16.6	15.7***	12.1++
	Uppsala	3.4	9.9	15.7	18.8	26.5***	14.9
	Asthma-related symptoms (1.1+1.2)						
	Tartu	4.6	4.0	3.5	4.7	6.2	4.6+++
	Uppsala	6.7	7.7	7.2	5.9	6.2	6.8
	Asthma-related disorder (5 or 6)						
	Tartu	2.1	1.8	1.3	2.0	2.7	2.0+++
	Uppsala	7.7	5.6	5.6	5.8	5.2	5.9

Results

The response rate was 87.3% in Uppsala and 83.0% in Tartu ($P<0.001$). Women responded more often

(89.6% vs. 85.1%, $P<0.001$ in Uppsala; 84.5% vs. 79.2%, $P<0.001$ in Tartu) and also earlier than men. Thus, the proportions of men among early (<4 weeks) and late (>8 weeks) responders were 46.1% and 52.2% ($P<0.05$) in Tartu, and 47.4% and 55.6% ($P<0.05$) in Uppsala. Current smoking was more common among the late responders than among early responders (54.8% vs 41.1% in Tartu, $P<0.001$, and 49.3% vs 30.8% in Uppsala, $P<0.001$). In Uppsala, but not in Tartu, a higher rate of nocturnal symptoms was recorded among the late responders (Q2: 9.6% vs 15.2%, $P<0.05$; Q3: 4.6% vs 9.3%, $P<0.05$). Twenty-five percent of the nonresponders in Uppsala were randomly chosen for a telephone survey (18). The prevalence of symptoms was similar among those who could be reached and those who had answered the questionnaire. A similar analysis was not feasible in Tartu, because of the low number of private telephones.

The prevalence of symptoms, medication, and smoking habits in the two areas is shown in Table 1. Self-reported asthma, as well as AS, AD, and allergic rhinitis were less prevalent in Tartu than in Uppsala. Allergic rhinitis defined as an affirmative answer to the question, "Do you have any nasal allergies including hay fever?", was also less prevalent in Tartu than in Uppsala (Table 1). The prevalence of "wheezing" was higher and "wheezing with breathlessness" lower in Tartu than in Uppsala, while the prevalence of "wheeze without a cold" was similar. In Tartu, but not in Uppsala, "wheezing" and "wheeze without a cold" were more common among men than women (Table 2). All nocturnal symptoms (i.e., Q2, Q3, and Q4) were more prevalent in Tartu. More women both in Tartu and Uppsala reported "being woken by attacks of coughing". In Tartu, the prevalence of "waking with chest tightness" was higher in women. There were no significant trends in age distribution of any symptoms associated with wheezing. However, there was a significant increase in all nocturnal symptoms with age in Tartu, but not in Uppsala.

Asthma medication was reported seven times more often in Uppsala. Of those who reported attacks of asthma, 30.4% were taking medication in Tartu and 68% in Uppsala ($P<0.001$). Only 9.3% of people with AS were taking asthma medication in Tartu, as compared to 37% in Uppsala ($P<0.001$).

There were more current smokers and fewer who had stopped smoking in Tartu than in Uppsala. In both cities, there was a significant trend to increased age among persons who had ever smoked, the highest numbers being among the 35–39-year-olds (Table 1). There were no sex differences in smoking habits in Uppsala, while men were more common, among both current and previous smokers, in Tartu (Table 2).

The results of the logistic regression analyses are shown in Table 3. Increasing age was an independent risk factor for nocturnal symptoms in Tartu (Fig. 1) and was also inversely related to allergic rhinitis in Uppsala (OR 0.9, $P<0.05$), but not in Tartu (Fig. 2). Female sex was a risk factor for nocturnal cough both in Tartu and Uppsala and for nocturnal chest tightness and nocturnal breathlessness in Tartu. Current smoking was associated with wheezing and all nocturnal symptoms except for nocturnal chest tightness in Tartu. There was a strong relationship between reported allergic rhinitis and prevalence of all the other reported symptoms both in Uppsala and in Tartu. Living in Tartu was an independent risk factor for reporting nocturnal symptoms and wheezing and was inversely related to breathlessness while wheezing, AS, and AD.

Table 2. Reported airway symptoms, and smoking habits by sex in Tartu and Uppsala (*$P<0.05$, **$P<0.01$, ***$P<0.001$)

		Tartu		Uppsala	
		F %	M %	F %	M %
1)	Wheezing or whistling	24.0**	29.1	19.1	18.8
1.2)	Wheeze without cold	10.1***	15.7	10.5	12.4
2)	Waking with chest tightness	16.4***	10.5	9.2	10.2
4)	Woken by attack of cough	44.2**	39.4	31.4***	19.0
8)	Current smokers	34.3***	58.4	34.2	33.5
9)	Ex-smokers	10.1**	14.3	14.3	15.5

Discussion

The prevalence of symptoms suggesting current asthma (AS and AD) and hay fever was lower and the prevalence of nocturnal respiratory symptoms was higher in Tartu than in Uppsala despite similar geography and climate. These findings in an adult population agree with recent similar comparisons between children in previously socialist countries and countries in Western Europe (9–14). As awareness of asthma may differ between the populations, the prevalence of self-reported attacks of asthma and medication against asthma could not be used to compare the prevalence of asthma. However, the lower prevalence of wheeze with breathlessness occurring in the absence of respiratory infections and at the same time less asthma treatment indicates that asthma is less prevalent in Tartu than in Uppsala. The lower prevalence of wheezing with breathlessness, but not wheeze without a cold in Tartu, while all nocturnal symptoms

Table 3. Risk factors for respiratory symptoms and asthma medication after adjustment for age, sex, and smoking. In comparison of prevalences between centers, Uppsala was used as reference (OR 1.0) (*$P<0.05$, **$P<0.01$, ***$P<0.001$)

		Age OR (CI)	Female sex OR (CI)	Current smoking OR (CI)	Allergic rhinitis OR (CI)	Living in Tartu OR (CI)
1)	Wheezing or whistling					
	Tartu	1.0 (0.9–1.1)	1.0 (0.8–1.2)	2.9*** (2.4–3.5)	2.1*** (1.6–2.6)	1.4***(1.2–1.6)
	Uppsala	1.0 (0.9–1.1)	1.0 (0.8–1.2)	2.7*** (2.2–3.2)	3.4*** (2.7–4.1)	
1.1)	Breathless while wheezing					
	Tartu	1.1 (1.0–1.2)	1.1 (0.8–1.5)	1.8*** (1.3–2.5)	3.6*** (2.6–4.9)	0.7*** (0.6–0.8)
	Uppsala	1.0 (0.9–1.1)	1.0 (0.8–1.2)	1.9*** (1.5–2.4)	3.9*** (3.1–5.0)	
1.2)	Wheeze without cold					
	Tartu	1.0 (0.9–1.1)	0.8 (0.6–1.0)	3.9*** (2.9–5.1)	2.6*** (2.0–3.5)	1.0 (0.8–1.2)
	Uppsala	1.0 (0.9–1.1)	0.8 (0.7–1.0)	2.5*** (2.0–3.1)	4.5*** (3.5–5.7)	
2)	Waking with chest tightness					
	Tartu	1.2*** (1.1–1.3)	1.8*** (1.4–2.3)	1.3 (1.0–1.6)	3.2*** (2.5–4.2)	1.5***(1.2–1.7)
	Uppsala	1.1 (0.9–1.2)	1.0 (0.8–1.3)	1.7*** (1.4–2.2)	3.2*** (2.4–4.1)	
3)	Woken by attack of breathlessness					
	Tartu	1.2** (1.1–1.3)	1.5* (1.1–2.0)	1.6** (1.2–2.2)	2.4*** (1.7–3.4)	1.6***(1.3–2.0)
	Uppsala	1.1 (1.0–1.3)	0.9 (0.6–1.2)	1.5* (1.1–2.0)	3.1*** (2.2–4.3)	
4)	Woken by attack of cough					
	Tartu	1.1* (1.0–1.1)	1.5*** (1.2–2.8)	2.2*** (1.9–2.6)	1.9*** (1.6–2.4)	2.1***(1.8–2.3)
	Uppsala	1.0 (0.9–1.1)	2.0*** (1.7–2.3)	1.7*** (1.4–2.0)	1.9*** (1.6–2.3)	
5)	Attacks of asthma					
	Tartu	1.0 (0.9–1.1)	1.0 (0.5–1.8)	1.3 (0.7–2.4)	6.5*** (3.6–12.0)	0.5***(0.4–0.7)
	Uppsala	1.0 (0.8–1.1)	1.0 (0.7–1.5)	1.4 (0.9–2.0)	10.0*** (6.4–15.6)	
6)	Current asthma medication					
	Tartu	0.9 (0.6–1.3)	1.6 (0.6–4.5)	1.0 (0.4–2.9)	8.2*** (3.0–22.7)	0.1***(0.1–0.2)
	Uppsala	0.9 (0.8–1.0)	1.1 (0.8–1.5)	1.1 (0.8–1.6)	13.4*** (9.1–19.9)	
	Asthma-related symptoms (1.1 + 1.2)					
	Tartu	1.1 (0.9–1.2)	1.1 (0.7–1.6)	2.6*** (1.7–4.0)	3.7*** (2.5–5.6)	0.6***(0.5–0.8)
	Uppsala	0.9 (0.9–1.1)	0.8 (0.6–1.0)	1.7*** (1.3–2.3)	5.4*** (4.0–7.3)	
	Asthma-related disorder (5 or 6)					
	Tartu	1.0 (0.8–1.3)	1.1 (0.6–1.9)	1.4 (0.8–2.5)	6.2*** (3.4–11.1)	0.3***(0.2–0.4)
	Uppsala	0.9 (0.8–1.0)	1.1 (0.8–1.4)	1.2 (0.9–1.7)	12.4*** (8.8–17.5)	

were more prevalent, could at least partly be a reflection of less effective antiasthmatic treatment in Tartu than in Uppsala.

The prevalence of allergic rhinitis was higher and decreased with age in Uppsala. A similar age-dependent trend has been observed in all the three Swedish ECRHS study sites (18). There was not even a trend toward a similar cohort effect in Tartu. It is unlikely that this difference was due to differences in understanding of the questions or awareness of allergic rhinitis/hay fever. If it had been, one would have expected more people with nonallergic rhinitis in Tartu to answer the question affirmatively than in Uppsala, as awareness of "allergy" is probably higher in Sweden than in Estonia.

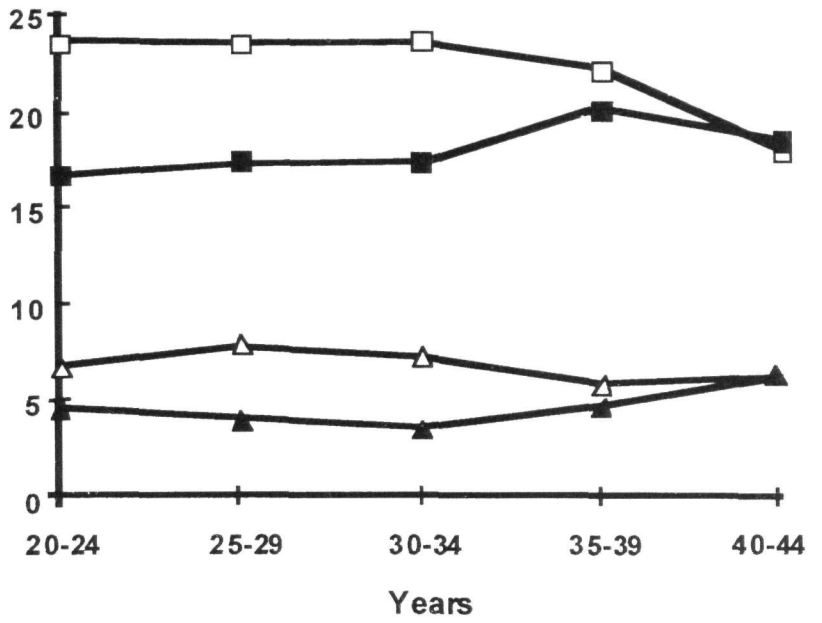


Fig. 1. Reported nasal allergies (squares) and asthma related symptoms (triangles) in different age groups in Tartu (closed symbols) and in Uppsala (open symbols).

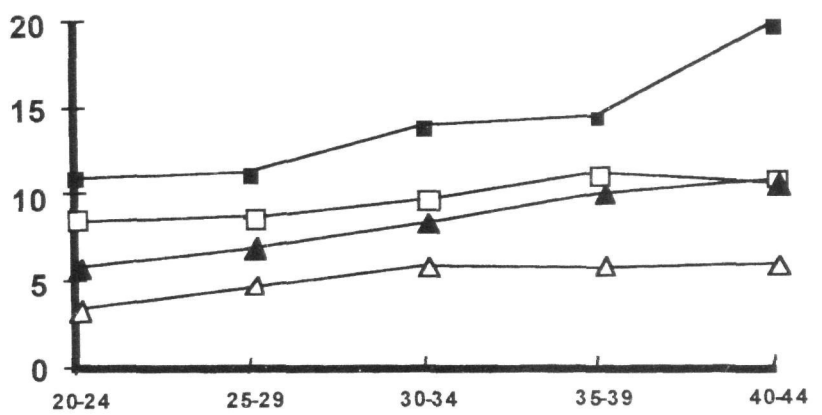


Fig. 2. Reported "'waking with chest tightness" (Q2) (squares) and "woken by attack of breathlessness" (Q3) (triangles) in different age groups in Tartu (closed symbols) and in Uppsala (open symbols).

The decreasing difference in the prevalence of allergic rhinitis with age could support recent suggestions that sensitization early in life has a lifelong effect on allergy manifestations (14). The living conditions in the first years after World War II were probably more similar in Estonia and Sweden than they became later. Thus, the 40-year-old people in Tartu and Uppsala would have had a more similar background during their early childhood than did the younger age groups.

The differences in age distribution of self-reported asthma followed a similar pattern. This, as well as the results of logistic analyses showing a stronger relation between self-reported allergic rhinitis and AD in Uppsala, may indicate that allergy is a more important risk factor for asthma among adults in Sweden than in Estonia. This suggestion is supported by recent findings from comparative studies of schoolchildren in East and West Germany (9) and in Estonia (Vasar et al., submitted). In the former study, 69% of children with current asthma in West Germany were atopic, as compared to only 40% in East Germany. The corresponding figures for Swedish and Estonian children were 60% and 25%, respectively.

In conclusion, symptoms of asthma and hay fever were less common in Estonia than in Sweden, although respiratory problems in general were more common. The differences in the prevalence of symptoms likely to be caused by allergy diminished with age. This may support the notion that the increasing prevalence of allergy among children and young adults in Western Europe is caused by a cohort effect, the causes of which may date back to changes beginning in the mid-1950s.

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