

Original article

Asthma in relation to personality traits, life satisfaction, and stress: a prospective study among 11 000 adults

Background: While patients' personality has been thought to affect allergic diseases, the association of asthma and psychological factors is still debated. Stress is believed to predispose to asthma, but no clear evidence of causality has been found. We have studied the role of psychological factors in prevalent as well as in incident asthma cases among the adult population.

Methods: A total of 11 540 adults initially aged 18–45 years responded to three questionnaires in 1975, 1981, and 1990, respectively. The association of psychological factors (including extroversion and neuroticism scales, subjective stress, and life satisfaction) and prevalent asthma was studied, as well as the predisposing effect of these factors on the risk of adult onset asthma. Logistic regression was used for risk calculations.

Results: Low life satisfaction was associated with asthma prevalence (age- and sex-adjusted OR = 2.27: 1.04–4.93 for prevalent asthma among those with low life satisfaction compared to those with high life satisfaction), as was neuroticism (age and sex-adjusted OR = 1.78: 1.12–2.84 for those with a high neuroticism score compared to those with a low score). A high extroversion score was significantly associated with the risk of adult onset asthma among women (age-adjusted OR = 2.72: 1.44–5.12 for new asthma among those with high score compared to those with a low extroversion score).

Conclusions: No specific personality type is associated with adult onset asthma, but there is a significant sex difference in the effect of psychological factors in asthma risk. A high extroversion score is a strong predictor of incident asthma among women. Prevalent asthma decreases life satisfaction and is associated with a high neuroticism score.

E. Huovinen¹, J. Kaprio¹,
M. Koskenvuo²

¹Department of Public Health, University of Helsinki, Helsinki, and Department of Public Health and General Practice, University of Oulu, Oulu; ²Department of Public Health, University of Turku, Turku, Finland

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Jaakko Kaprio, Professor of Public Health
Department of Public Health
PO Box 41 (Mannerheimintie 172)
FIN-00014 University of Helsinki
Helsinki
Finland

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The psychological characteristics of asthmatic patients have been studied (1). No specific personality profile of asthmatic subjects has been found (2, 3), although there is evidence of an association between atopic illness and depression (4). Quality of life in asthma patients seems to be impaired both in younger (5) and in elderly people (6). An association between respiratory and psychiatric symptoms has also been found among healthy subjects without respiratory disease (7).

The association of stress and asthma has been studied previously, but a causal link between stress and asthma has not been established (8, 9). There are some retrospective studies reporting an association between onset of asthma and stressful life events (10, 11), as well as a prospective study showing an increased risk of asthma attacks among children who had experienced negative life events recently (12).

Still, it is questionable to what extent stress and other psychological factors may influence asthma. It is also necessary to distinguish the effects of asthma on

patients' psychological condition from the role of psychological factors in the genesis of asthma. We did a prevalence study to estimate the relation between asthma and psychological factors and an incidence study to examine the role of stress, life satisfaction, and personality traits in the development of asthma in adulthood in a large, population-based sample.

Material and methods

Study population

This study is based on data from the older part of the Finnish Twin Cohort compiled in 1974 (13). The first questionnaire was mailed in 1975 to selected same-sex pairs, born before 1958 with both members alive in 1967 (response rate was 89%, yielding 31 110 responses). A follow-up questionnaire was mailed in 1981 to the living twin individuals in the cohort (response rate 84%) and in 1990 to those twins born between 1930 and 1957, with both twins in a pair known to be alive ($n=17\,876$ individuals, 8938 pairs, response rate 77%). Twins responding to all three questionnaires were included in this

study ($n = 11\,540$). The question on asthma was identical in all three questionnaires: "Have you ever been told by a doctor that you have or have had asthma?"

Predictive variables and covariables

Stress. The experienced stress was measured in the 1975, 1981, and 1990 questionnaires by four self-report statements of stress in daily activities (14–16). The statements were the following:

- 1) In general, I am unusually tense and nervous.
- 2) There is a great deal of stress connected with my daily activities.
- 3) At the end of day, I am mentally and physically completely exhausted.
- 4) My daily activities are extremely trying and stressful.

The response alternatives (very true, true, not very true, and not at all) were scored 1–4, with the sum score ranging from 4 to 16 (increasing score indicates decreasing stress). Correlation coefficients of scale items and total score distributions have been described elsewhere (14).

Life satisfaction. Life satisfaction was measured in the 1975, 1981, and 1990 questionnaires on Allardt's four-item scale on levels of interest, happiness, easiness, and loneliness of life (14, 17). The item responses were scored on a scale of 1–5 in terms of intensity (e.g., 1=very interesting, 2=fairly interesting, 3=cannot say, 4=fairly boring, 5=very boring). The life satisfaction score was calculated as the overall sum of the four items (possible range 4–20, increasing score indicates decreasing life satisfaction). If the response was missing for at least three items, the total score was regarded as "missing data"; otherwise, one or two items missing data were each scored as 3 (14, 17).

Extroversion and neuroticism. Extroversion and neuroticism were measured in the 1975 and 1981 questionnaires with the abbreviated Eysenck Personality Inventory (EPI) (18), which includes nine items for the assessment of extroversion and nine items for neuroticism (19, 20). The subjects were asked to mark the items in a "yes/no" format in terms of how well they described their acts and feelings. The extroversion and neuroticism scores were then calculated as the overall sum of nine items (possible range 0–9).

Confounding variables. The questionnaires asked whether prolonged bronchitis or emphysema had ever been diagnosed by a physician. In addition, current symptoms of chronic bronchitis and dyspnea were assessed by a mailed questionnaire adaptation of the London School of Hygiene respiratory questionnaire (21). Respondents were considered free of respiratory symptoms if they had none of the aforementioned respiratory symptoms or diagnoses in 1975 or 1981. Whether respondents had a diagnosis of allergic rhinitis (including hay fever) was also asked, and respondents reporting allergic rhinitis/hay fever in the 1975 or 1981 questionnaire were considered to have hay fever.

Respondents were classified as nonsmokers, or occasional, former, or current smokers in each questionnaire. In this study, subjects were divided into three groups: those reporting current smoking in the 1975 and 1981 questionnaires, those reporting no smoking in these questionnaires, and those with changing smoking habits. Social class was defined by years of education and physical activity at work (that reported in 1981 if available; otherwise, that reported in 1975) and classified into three categories (upper, middle, and lower). The upper class consisted of those with at least a high school diploma (12–13 years) and sedentary work. The lower class consisted of those with a primary school (6–7 years) or less education

and work involving at least standing and walking. For respondents with missing data in physical activity in both questionnaires, education alone was used to define social class (Table 1).

Data analysis

Prevalence study. The prevalence study was done to estimate the relation between asthma and psychological factors. The cumulative asthma prevalence in 1981 was estimated among the study population, excluding subjects with missing data on asthma in both the 1975 and 1981 questionnaires ($n = 11\,533$). Subjects reporting asthma in either 1975 or 1981, or in both questionnaires were considered to have prevalent asthma.

A subset without symptoms of chronic obstructive pulmonary disease (COPD) was also defined ($n = 10\,764$). Subjects were excluded if they reported cough and phlegm production for at least 3 months a year or severe dyspnea (becoming short of breath when standing, as during dressing and washing or when walking 150 m at their own speed on level ground) or emphysema in either the 1975 or 1981 questionnaire.

The incidence study. The incidence study was used to estimate the effect of psychological factors on the risk of new asthma. A population initially free of asthma ($n = 10\,615$) was drawn from the study population, including subjects reporting no asthma in either 1975 or 1981, and with no missing data on the asthma question in any of the three questionnaires (1975, 1981, or 1990). The incidence of new asthma diagnoses during 1982–90 was based on the 1990 questionnaire answers. A subset free of symptoms of COPD (as explained above) in 1975, 1981, and in the 1990 questionnaire was also defined ($n = 9\,714$).

Classification of predictive variables. For reported stress, life satisfaction, and extroversion and neuroticism in 1975 and 1981, mean scores were used for those with available data in both years (1975 and 1981), while for those with missing data in either year the sum score of the other year was used. Responders with missing data in both questionnaires were excluded from the analysis.

The scales of each variable were then divided into three groups as follows:

- high levels of stress (4–8 points), some stress (9–15 points), and little stress (16 points), experienced daily
- satisfied (4–6 points), slightly dissatisfied (7–11), and very dissatisfied (12–20)
- low (0–2 points), moderate (3–6 points), and high (7–9 points) levels of extroversion
- low (0–2 points), medium (3–6 points), and high (7–9 points) levels of neuroticism.

In addition to this, scores were used as continuous variables.

Statistical methods. Odds ratios (OR) for asthma prevalence and new asthma were assessed by logistic regression for the three groups of each psychological variable. In addition to initial age (age at 1982 as continuous variable), four possible confounding variables (smoking, social class, presence of respiratory symptoms, and hay fever) were included in logistic regression models. Wald's chi-square test was used to calculate the trend between groups. All statistical analyses were made with the SAS software program.

Results

The prevalence of asthma was 1.6% for men and

Table 1. Distribution of possible confounding variables, odds ratios (OR) for incident asthma, and proportions of psychological factors by these confounding variables among 4826 men and 5789 women free of asthma in 1982

	%	New asthma		Proportion (%) of*			
		OR	95% CI	sda	ls	ext	neu
Men							
Age in 1982							
25–34	47	1.00		3	9	18	8
35–44	35	1.84	1.13–3.01	4	7	18	8
45–52	17	1.57	0.85–2.92	6	12	18	11
Smoking							
Never in 1975 or 1981	34	1.00		2	7	15	6
Other	38	1.06	0.63–1.79	4	8	19	9
Current in 1975 and 1981	28	1.13	0.64–1.97	5	13	21	11
Hay fever							
No	90	1.00		4	9	18	8
Yes	10	3.48	2.11–5.73	5	8	19	11
Respiratory symptoms/disease							
No	62	1.00		2	7	18	5
Yes	38	2.14	1.37–3.33	7	12	19	14
Social class							
Lower	28	1.00		5	11	16	10
Middle	62	0.83	0.51–1.34	4	8	19	8
Upper	10	0.79	0.34–1.83	2	8	20	5
Women							
Age in 1982							
25–34	52	1.00		3	9	15	15
35–44	32	1.52	0.96–2.40	5	9	15	13
45–52	16	1.87	1.10–3.17	5	9	14	12
Smoking							
Never in 1975 or 1981	56	1.00		4	8	12	11
Other	27	1.12	0.69–1.83	3	8	18	14
Current in 1975 and 1981	17	1.24	0.71–2.18	6	14	20	21
Hay fever							
No	89	1.00		4	9	15	13
Yes	11	5.78	3.81–8.76	6	12	18	16
Respiratory symptoms/disease							
No	44	1.00		2	6	18	7
Yes	56	3.04	1.85–4.99	6	12	13	19
Social class							
Lower	26	1.00		6	10	13	16
Middle	65	0.77	0.50–1.20	3	9	15	13
Upper	10	0.60	0.25–1.47	2	8	19	9

* Proportions of subjects in highest stress group (sda), lowest life satisfaction group (ls), highest extroversion group (ext), and highest neuroticism group (neu) by distribution of confounding variables among subjects reporting these variables.

1.7% for women, and the cumulative incidence in 1982–90 was 1.7% for both. Among the COPD-free subset, asthma prevalence was 1.2% for both sexes; and incidence was 1.3% for men and 1.1% for women.

Prevalence study

Low life satisfaction was associated with increased asthma prevalence among both men and women (age- and sex-adjusted OR = 1.85:1.07–3.18 for the most dissatisfied compared to the most satisfied). This was seen also when the life satisfaction score was used as a continuous variable (age-adjusted OR = 1.10: 1.01–1.20 for men and 1.11:1.03–1.20 for women).

This association was stronger among women, and there was a significant trend between the groups of high, moderate, and low life satisfaction (Table 2).

Asthma was also associated with high levels of neuroticism (age- and sex-adjusted OR = 1.78: 1.12–2.84 for those with a high neuroticism score compared to those with a low score). This association was significant in grouped data among men (Table 2) and among women when the neuroticism score was used as a continuous variable (OR = 1.12:1.02–1.23). Smoking habits and social class explained practically none of these associations. Adjusting for respiratory symptoms and hay fever instead had a clear effect (Table 2). In particular, adjusting for respiratory symptoms weakened the association between life

Table 2. Relation of asthma prevalence and subjective stress, life satisfaction, extroversion, and neuroticism among 5203 men and 6330 women (prevalence study)

	Subjects	Cases	Age-adjusted		Adjusted ¹	
			OR	95% CI	OR	95% CI
<i>Men</i>						
Stress						
None	497	12	1.00		1.00	
Some	4428	65	0.61	0.33–1.13	0.45	0.23–0.87
Much	206	5	0.92	0.32–2.65	0.42	0.14–1.28
Test for trend ²			<i>P</i> = 0.43			
Life satisfaction						
High	680	13	1.00	1.00		1.00
Moderate	4041	56	0.71	0.39–1.31	0.71	0.38–1.34
Low	482	14	1.48	0.69–3.19	1.14	0.51–2.56
Test for trend ²			<i>P</i> = 0.37			
Neuroticism						
Low	1412	21	1.00		1.00	
Medium	3282	46	0.96	0.57–1.61	0.70	0.41–1.21
High	465	15	2.14	1.09–4.19*	1.00	0.49–2.05
Test for trend ²			<i>P</i> = 0.088			
Extroversion						
Low	1129	19	1.00		1.00	
Medium	3104	50	1.01	0.59–1.73	1.22	0.70–2.12
High	931	13	0.87	0.43–1.78	0.99	0.47–2.06
Test for trend ²			<i>P</i> = 0.74			
<i>Women</i>						
Stress						
None	729	7	1.00		1.00	
Some	5212	89	1.88	0.87–4.07	1.38	0.63–3.04
Much	267	6	2.33	0.78–6.99	1.11	0.36–3.43
Test for trend ²			<i>P</i> = 0.089			
Life satisfaction						
High	960	11	1.00		1.00	
Moderate	4773	80	1.40	0.74–2.64	1.30	0.68–2.49
Low	596	16	2.27	1.04–4.93*	1.61	0.72–3.57
Test for trend ²			<i>P</i> = 0.037			
Neuroticism						
Low	1064	17	1.00		1.00	
Medium	4309	66	1.00	0.58–1.71	0.80	0.46–1.39
High	891	21	1.56	0.82–2.99	0.88	0.45–1.72
Test for trend ²			<i>P</i> = 0.17			
Extroversion						
Low	1748	24	1.00		1.00	
Medium	3580	60	1.27	0.79–2.05	1.15	0.70–1.88
High	944	19	1.53	0.83–2.82	1.35	0.72–2.53
Test for trend ²			<i>P</i> = 0.16			

¹ Adjusted for age, respiratory symptoms, and diseases and for hay fever.

² Wald's test for trend in logistic regression.

Subjects with missing data on stress (72 men and 122 women), life satisfaction (one woman), extroversion (39 men and 58 women), and neuroticism (44 men and 66 women) are not included in the analysis of variable in question.

satisfaction and asthma prevalence as well as that between neuroticism and asthma. Among the subset free of COPD, low life satisfaction continued to be associated with asthma among women (age-adjusted OR=2.47:1.05–5.83 for the most dissatisfied compared to the most satisfied). The association of neuroticism and asthma was not significant among this subset (age- and sex-adjusted OR=1.41:0.78–2.54 for those with a high neuroticism score compared to those with a low score).

Asthma prevalence was not associated with extro-

version and stress among men; among women, these associations were nonsignificant although suggestive of an association.

Incidence study

The age- and sex-adjusted OR for those with a high extroversion score compared to those with a low score was significant (OR=1.86:1.16–2.96). Women with a high extroversion score had an almost three times higher risk of incident asthma than women with a low

Table 3. Stress, life satisfaction, extroversion, and neuroticism as predictors of new asthma (incidence study)

	Subjects	Cases	Age-adjusted		Adjusted ¹		
			OR	95% CI	OR	95% CI	
<i>Men</i>							
Stress							
None	460	6	1.00		1.00		
Some	4136	70	1.31	0.56–3.03	1.15	0.49–2.67	
Much	179	5	2.03	0.61–6.76	1.42	0.42–4.81	
Test for trend ²			<i>P</i> =0.27				
Life satisfaction							
High	623	11	1.00		1.00		
Moderate	3776	61	0.90	0.47–1.73	0.89	0.46–1.71	
Low	427	10	1.31	0.55–3.12	1.17	0.49–2.80	
Test for trend ²			<i>P</i> =0.60				
Neuroticism							
Low	1328	20	1.00		1.00		
Medium	3063	48	1.06	0.63–1.80	0.91	0.53–1.55	
High	410	12	1.96	0.95–4.04	1.36	0.64–2.87	
Test for trend ²			<i>P</i> =0.15				
Extroversion							
Low	1040	17	1.00		1.00		
Medium	2888	48	1.06	0.61–1.86	1.10	0.63–1.94	
High	874	16	1.16	0.58–2.32	1.18	0.59–2.36	
Test for trend ²			<i>P</i> =0.67				
<i>Women</i>							
Stress							
None	677	12	1.00		1.00		
Some	4812	77	0.97	0.52–1.79	0.76	0.41–1.43	
Much	228	5	1.22	0.42–3.50	0.70	0.24–2.07	
Test for trend ²			<i>P</i> =0.85				
Life satisfaction							
High	897	19	1.00		1.00		
Moderate	4376	68	0.68	0.41–1.14	0.64	0.38–1.08	
Low	515	10	0.86	0.40–1.87	0.65	0.29–1.42	
Test for trend ²			<i>P</i> =0.47				
Neuroticism							
Low	988	20	1.00		1.00		
Medium	3977	61	0.80	0.48–1.33	0.65	0.38–1.09	
High	779	14	0.96	0.48–1.91	0.60	0.29–1.21	
Test for trend ²			<i>P</i> =0.80				
Extroversion							
Low	1610	17	1.00		1.00		
Medium	3276	56	1.72	1.00–2.98	1.67	0.96–2.90	
High	866	23	2.72	1.44–5.12*	2.69	1.42–5.12*	
Test for trend ²			<i>P</i> =0.0018				

¹ Adjusted for age, respiratory symptoms, and diseases and for hay fever.

² Wald's test for trend in logistic regression.

Subjects with missing data on stress (51 men and 72 women), life satisfaction (one woman), extroversion (24 men and 37 women), and neuroticism (25 men and 45 women) were not included in analysis of variable in question.

extroversion score (Table 3), but extroversion was not a significant predictor of asthma among men. After adjustment for hay fever, the effect was weakened, but still significant (OR=2.50:1.32–4.74 for women with a high extroversion score). Adjusting for respiratory symptoms instead gave strength to the predisposing effect of extroversion (OR=2.99:1.58–5.64). This effect of extroversion on new asthma was significant also when the extroversion score was used as a continuous variable (age-adjusted OR=1.14:1.04–1.24 for new asthma among women), and it was seen also

among the subset without symptoms of COPD (age-adjusted OR=2.51:1.13–5.56 for women with a high extroversion score compared to those with a low score).

Incident asthma was nearly two times higher (OR=1.96:0.95–4.04) among men with a high neuroticism score than among the low score group, but this effect was somewhat weakened when adjusted for respiratory symptoms (adjusted OR=1.46:0.69–3.08) and for hay fever (adjusted OR=1.77:0.85–3.67), while smoking and social class had no effect. Among the subset free of COPD, the age-adjusted OR was 1.73

(95% CI:0.74–4.05) among men with a high neuroticism score compared to the low score group. Neuroticism was not associated with incident asthma among women.

Life satisfaction did not predict asthma, and the effect of stress was also nonsignificant (Table 3).

Discussion

The main finding of this study was the strong association between extroversion and incident asthma among women. The difference between men and women in the personality traits associated with asthma was also interesting. Low life satisfaction was associated with prevalent asthma, but not with incident cases.

The asthma diagnoses of the present study are based on the subjects' own reports of doctor-diagnosed asthma. Thus, personality might affect both the reporting of the disease and the seeking of treatment. It is also important to distinguish the effects of asthma on patients' psychological conditions from the possible personality features predicting asthma. An association between respiratory and psychiatric symptoms is found also among healthy subjects without respiratory disease (22). The advantage of a prospective study is the ability to control for the effect of early symptoms or manifestations of asthma on the reporting of psychological factors. Changes in the diagnostic criteria of asthma over time may also be a problem in studies with a long follow-up time. However, a previous study based on the Finnish Twin Cohort found no significant difference in incidences of adult-onset asthma between 1982–90 and 1976–1981 (21). In the present study, we used in all questionnaires an asthma question that has been found to have a high validity (23). In addition, for incidence estimation, analysis of the initially asthma-free population was based on data from two questionnaires.

The Eysenck Personality Inventory used in this study measures the psychosocial status of a subject in two major dimensions: the degree of neuroticism, also termed the "stable-unstable" dimension, and the degree of extroverted behavior (18). Genetic and experiential effects are involved in personality development, and both are modulated by age and sex (19). However, in the present study, the intraindividual levels of extroversion and neuroticism were relatively stable in the two questionnaires 6 years apart. To control the variation of measures used over time, we used a mean score of two measurements if available.

Previous studies have not shown any specific personality profile in asthmatic patients, while emotional sensitivity (3) and anxiety (24) have been suggested. In the present study, the risk of developing asthma in adulthood was increased among women

with a high extroversion level. In contrast, the association with prevalent asthma and extroversion was not significant. Thus, it is possible that asthma itself can modify one's personality. In addition to the possible personality-dependent reporting and treatment-seeking differences discussed above, extrovert women might have a different lifestyle from that of the more introvert ones. The association of smoking and adult onset asthma is not clear. We did not find any effect of smoking on asthma risk with the relatively crude classification used in the present study. However, a high extroversion score was most common among current smokers. The number of cigarettes smoked and the age when smoking began may also be associated with extroversion, thereby partly explaining the increased risk seen in extrovert women. Personality might also affect one's choice of profession and residential environment, and in that way predispose extrovert persons to asthma.

Men with a high neuroticism score had an almost twofold higher risk of asthma than those with a low score. As discussed above, personality might have an effect on one's inclination to seek treatment, and partly contribute to the additional number of new asthma diagnoses among men with a high neuroticism score. This may also partly explain the sex difference seen in the present study.

The life satisfaction scale used in this study is an index of global satisfaction with the current life situation. Low life satisfaction was strongly associated with prevalent asthma. This effect was seen also among women without symptoms of COPD, which are known to worsen the quality of life. Controlling also for moderate respiratory symptoms instead explained the low life satisfaction of asthma patients. Thus, it is interesting that also asthmatic women without severe symptoms felt themselves significantly dissatisfied with their lives. However, it should be remembered that the asthma prevalence of the present study is based on diagnoses done before 1982. The treatment of asthma has improved significantly over recent decades, and asthma patients probably now find their lives more satisfactory.

The high correlation between life satisfaction and the score of the Beck Depression Inventory indicates that life satisfaction also measures aspects of depressive symptomatology (17), as does the neuroticism score. Janson et al. have found an association between reported respiratory symptoms and psychological status, but no evidence that persons with diagnosed asthma had more anxiety or depression than those without asthma (7). Michel (3) also suggests that atopic patients, instead of being typically depressive, are characterized by an increased emotional sensitivity. Another study, based on the 1990 questionnaire of the Finnish Twin Cohort, found an association between atopic illness and depression (4). In addition to low life

satisfaction, neuroticism was also associated with prevalent asthma in the present study, thus indicating an association between asthma and depressive symptoms.

In the present study, the subjects' own experience of daily stress was used to assess the amount of stress. The face validity of this kind of measure of stress is supported by earlier studies of the Finnish Twin Cohort, in which it has predicted mental disorders (16) and peptic ulcer (15). We did not find any significant risk effect of stress on incident asthma, and the slightly increased risk found among stressed men decreased when adjusted for respiratory symptoms.

We conclude that the effect of psychological factors is different among men and women. Personality might

affect the reporting of asthma, and this may explain part of the sex differences seen in the present results. Prevalent asthma decreases life satisfaction and increases neuroticism, thus lending further support to the possible association between asthma and depression. A high extroversion score was a strong predictor of incident asthma among women. Thus, factors associated with the extrovert personality should be studied further to find possible risk factors of adult asthma.

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