

Original article

Validation of a new questionnaire on asthma, allergic rhinitis, and conjunctivitis in young adults

Background: Epidemiologic data on asthma and allergies among adults are mainly based on questionnaires: this study validates the questions on asthma, allergic rhinitis, and conjunctivitis of a new Finnish questionnaire.

Methods: To validate questions used in a country-wide study among university students aged 18–25 years, we examined 150 subjects who had ever reported asthma or wheezing, and 140 without asthma symptoms. Questions were validated in relation to current diseases including

- 1) symptoms detected during the preceding year at the physician's interview
- 2) objective measurements, such as methacholine challenge, skin prick tests, and specific IgE.

Data were adjusted for original proportions of “asthmatics” and “nonasthmatics” in the questionnaire study.

Results: Questions on “reported asthma” and “doctor-diagnosed asthma” had good positive predictive value (PPV) and specificity in diagnosing current asthma. The question on “attacks of shortness of breath with wheezing”, and especially the question on “cough with wheezing” were most sensitive. Questions on “allergic nasal symptoms” and “allergic eye symptoms” that were “related to pollen or animals” were sensitive, but a further question on doctor's diagnosis yielded higher specificity and PPV.

Conclusions: Diagnosis-based questions were found suitable for risk-factor studies, because of their good specificity and PPV, and symptom-based questions for screening, because they were highest in sensitivity.

**M. Kilpeläinen¹, E. O. Terho¹,
H. Helenius², M. Koskenvuo³**

¹Department of Pulmonary Diseases and Clinical Allergology, University of Turku, Turku; ²Department of Biostatistics, University of Turku, Turku; ³Department of Public Health, University of Turku, Turku, Finland

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Dr Maritta Kilpeläinen
Department of Pulmonary Diseases and Clinical Allergology
Turku University Central Hospital
Kiinamyllynkatu 4-8
FIN-20520 Turku
Finland

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Our present knowledge of prevalence and risk factors for asthma and atopic disorders among adults is based mainly on questionnaire data. Questions on asthma rely on either self-reported asthma or doctor-diagnosed asthma, or on a combination of typical symptoms, such as wheezing or episodic shortness of breath. Written questionnaires on asthma and asthma-like symptoms have been available since the 1960s (1–5); more recently, in the 1990s, a video-assisted questionnaire was developed (6) and used widely among children in the International Survey of Asthma and Allergies in Childhood (ISAAC) (7).

The first questions on allergic rhinitis relied on self-report of “hay fever” (8, 9); later, questions on triggering factors, such as pollen, dust, and animals, were developed (4, 10). A symptom question on “sneezing or a runny or blocked nose” apart from “a cold or flu” was introduced in a community survey of

rhinitis in London (UK) (11) and further used in the ISAAC study (7, 11). Questions on “itchy, watery eyes” have usually been included in the nasal symptom questions (7, 11, 12). In a screening questionnaire for atopy, subjects were asked about allergies to specific allergens, such as house-dust mite and pets (13).

The Tuohilampi questionnaire (14) was developed by Finnish experts for population studies of respiratory, eye, and skin allergies, and also for screening allergic patients. It includes 12 sections: asthma, cough and chronic bronchitis, allergic alveolitis, respiratory infections, rhinitis, pharyngeal and laryngeal symptoms, eye symptoms, contact dermatitis, atopy, smoking, and sick building syndrome.

The aim of the present study was to validate a new questionnaire used in a study among 10 667 first-year university students aged 18–25 years. Similar criteria to those used in clinical practice to confirm the diagnosis

were used. The present work provides data on the seldom reported validation of allergic rhinitis, and especially allergic conjunctivitis.

Material and methods

Subjects

A postal questionnaire study on asthma and atopic diseases was carried out among all first-year Finnish university students aged 18–25 years in winter 1995–6. A total of 10 667 (75.0%) students responded, 61.0% of them women and 39.0% men. The response rate was higher among women than among men: 82.2% and 66.5%, respectively.

Sampling of the subjects for the clinical investigation is shown in Fig. 1. For practical reasons, the clinical sample was chosen from the three universities of Turku, a city located on the southwestern coast of Finland. Two random samples were invited to examinations:

- 1) 195 (out of 236) students who had ever reported shortness of breath with wheezing or asthma
- 2) a sex-matched sample of a larger number (218 out of 1395) of subjects with negative responses to these questions (Fig. 1).

The percentage of positive responses to the two questions on asthma and/or wheezing used in the sampling was found to be equal (14.5% vs 14.6%) among those studying in Turku and among questionnaire respondents in the other universities.

A total of 296 students (71.6%) took part in the clinical examination in winter 1996–7. The participation rate was 77.9% among students with history of asthma or wheezing ("asthmatics") and 66.1% among those without ("nonasthmatics") (Fig. 1). The percentages of female participants were 68.0 and 62.0, respectively. Five subjects were excluded because they lacked a methacholine challenge, and one because of onset of asthma symptoms after filling in the questionnaire. Thus, the final study population consisted of 290 subjects, 150 with a positive response to the asthma and/or wheezing question and 140 with a negative response, the latter including 79 subjects without any report of respiratory, eye, or skin symptoms. The same randomized groups were analyzed in the validation of allergic rhinitis and conjunctivitis. Weighted data to adjust for proportions in questionnaire study were calculated (see statistical methods).

Questionnaire

The questions of the Tuohilampi questionnaire on asthma are presented in Appendix 1, and those on rhinitis and conjunctivitis in Appendix 2.

Clinical examination

A chest physician (M. Ki.) examined and interviewed all subjects without knowing the questionnaire responses.

Lung-function tests

All subjects underwent flow-volume spirometry and a bronchodilation test. Subjects with FEV₁ greater than 60% of the normal value also underwent the methacholine challenge test on a different occasion. Anti-inflammatory medication for asthma was allowed, but subjects were told not to take β -agonist medication for 12 h before the test. The bronchodilation test was carried out according to the international recommendation (15) with a standard spirometer (Vitalograph Compact®). An increase of 15% in FEV₁, 15 min after inhalation of 0.4 mg of salbutamol, was regarded as a positive response. The methacholine challenge test was carried out by the dosimeter nebulization method (16). The provocative dose causing a

20% fall (PD₂₀) in FEV₁ was determined on a logarithmic scale, and the test was regarded as positive if PD₂₀ FEV₁ was equal to or below the cumulative dose of 2.9 mg of methacholine.

Skin prick tests

The allergen panel included standardized antigens of birch, timothy grass, and mugwort pollens; *Cladosporium herbarum*; *Aspergillus fumigatus*; *Pityrosporum ovale*; cat, dog, and horse epithelium; and house-dust mite *Dermatophagoides pteronyssinus* (Soluprick®, Allergologisk Laboratorium, Copenhagen, Denmark) and latex (Stallergenes®, France). The food allergens tested were kiwi fruit, egg ovalbumin, and celery by the prick-prick method, and wheat in 10% saline suspension (17). Histamine chloride 10 mg/ml was used as a positive control and diluent solution as a negative control. Antihistamine medication was withheld 5 days prior to testing. The same nurse carried out the tests in duplicate, on the volar side of both forearms. The mean of the two wheals tested with the same antigen was calculated, and mean diameters of at least 3 mm were regarded as positive (18).

Specific IgE

The pharmacia CAP System® (Pharmacia-Upjohn, Sweden) was used to assay IgE antibodies against common airborne allergens (cat, dog, horse, birch, timothy grass, mugwort, *D. pteronyssinus*, and *Cladosporium* antigens) and food allergens (milk, wheat, soybean, egg ovalbumin, codfish, and peanut) (Phadiatop Combi®) (19, 20). The test value greater than 0.35 kU/l was regarded as positive.

Criteria of validation

Current asthma. The criteria were as follows:

- 1) symptoms suggestive of asthma (wheezing, shortness of breath, and typical triggers of symptoms) during the preceding year at interview by the chest physician
- 2) and at least one of the following:
 - PD₂₀ FEV₁ < 2.9 mg in methacholine challenge
 - and/or FEV₁ < reference value minus 1.96 SD
 - and/or FEV₁% (FEV₁/FVC) < reference value minus 1.96 SD
 - and/or FEV₁ showing a rise of 15% after bronchodilation.

Current allergic rhinitis. The criteria were as follows:

- 1) symptoms of allergic rhinitis during the preceding year at interview by the chest physician
- 2) and at least one wheal reaction with a mean diameter of > 3 mm in skin prick tests and/or a specific IgE test (Phadiatop Combi®) > 0.35 kU.

Current allergic conjunctivitis. The criteria were as follows:

- 1) allergic eye symptoms during the preceding year at interview by the chest physician
- 2) and objective criteria of sensitization (same criteria as for allergic rhinitis; see above).

Statistical analysis

Of subjects in the clinical study, 51.7% (150/290) had a positive questionnaire response on asthma or wheezing questions, and the corresponding number in the postal questionnaire survey was 14.5% (236/1395) (Fig. 1). Because of unequal sampling, the 2 × 2 tables for the two groups, "asthmatics" and "nonasthmatics", were constructed separately, and inverse sampling fractions were used as weightings (for asthmatics 236/150 and for nonasthmatics 1395/140).

After combination of the tables, positive predictive value, specificity, and sensitivity of the diagnostic questions on asthma, allergic rhinitis, and conjunctivitis were calculated against criteria of current diseases.

The ethics committee of the University of Turku approved the study. Informed consent was obtained from all the clinical study participants.

Results

Subjects who had ever had asthma or shortness of breath with wheezing ("asthmatics"), and those without these symptoms ("nonasthmatics") were equal as regards age, sex, and smoking status (Table 1). The groups differed significantly with respect to skin prick test result, a positive serum specific IgE for common allergens, and bronchial hyperreactivity (Table 1).

Among lifetime "asthmatics", 48.7% of the subjects fulfilled criteria of current asthma. Among "nonasthmatics", the criteria of current asthma were fulfilled in 4.3% (6/140) (Table 2). Current allergic rhinitis and conjunctivitis were more prevalent in the group of asthmatics.

Validity of questions on asthma, attacks of shortness of breath with wheezing, and cough with wheezing

The questions on asthma and asthma-like symptoms are shown in Appendix 1. The specificity of questions on reported asthma diagnosis (question 3a), as well as on doctor-diagnosed asthma during the lifetime (3a and b), was high, 0.98 and 0.99, respectively, and these questions also had the highest positive predictive values (PPV); 0.76 and 0.82, respectively (Table 3).

The symptom question "attacks of shortness of breath with wheezing" (question 2a) had good specificity but lower PPV than the diagnosis-based questions. By the addition of the further definitions "breathing normal between the attacks" (question 2b) and "not only in relation to respiratory infection" (question 4), better specificity and PPV were achieved (Table 3).

On the contrary, the symptom question on "cough with wheezing" (question 1a) was rather unspecific (specificity 0.72), and only 25% of positive respondents fulfilled current asthma criteria (PPV 0.25). This question, however, was the most sensitive of all questions (sensitivity 0.76). When a further question on "symptoms also at times when you did not have a cold" (question 1b) was included, specificity and PPV increased, but sensitivity was lost (Table 3). The sensitivity of this question combination was comparable to the question on "shortness of breath with wheezing" (sensitivity 0.45) (Table 3), and the combination question with the further addition "breathing normal between the attacks" (sensitivity 0.43) (Table 3).

Table 1. Characteristics of subjects in clinical study. Group "asthmatics" based on positive questionnaire response on asthma or wheezing during lifetime, and group "nonasthmatics" without these symptoms

Characteristic	Reported asthma and/or wheezing during lifetime <i>n</i> = 150		No reported asthma or wheezing* during lifetime <i>n</i> = 140		<i>P</i> value
	Mean (range) years 21.5 (19.3–26.5)		Mean (range) years 21.5 (18.7–26.6)		
Age	%	(<i>n</i> / <i>N</i>)	%	(<i>n</i> / <i>N</i>)	
Sex					
M	32.0	48/150	37.9	53/140	NS
F	68.0	102/150	62.1	87/140	NS
Smoking					
Never	71.3	107/150	75.5	105/139	NS
Ex-smoker†	1.3	2/150	1.4	2/139	NS
Current occasional smoker	14.0	21/150	9.4	13/139	NS
Current daily smoker	13.3	20/150	13.7	19/139	NS
Parental asthma	19.5	29/149	11.4	16/140	NS
Parental atopic disorder	51.0	76/149	36.4	51/140	0.013
Skin prick test >3 mm	68.7	103/150	42.1	59/140	0.001
Positive specific IgE‡	73.0	108/148	47.9	67/140	0.001
Bronchial hyperreactivity§	36.0	54/150	7.9	11/140	0.001

* Attacks of shortness of breath with wheezing.

† Quitted daily smoking at least 6 months before interview.

‡ Phadiatop Combi® (inhalant or food allergens) >0.35 kU/l. Two subjects missed blood tests.

§ Methacholine PD₂₀ <2.9 mg.

Validity of questions on allergic rhinitis and conjunctivitis

Diagnostic questions on rhinitis and conjunctivitis are shown in Appendix 2. The question on "hay fever" or "other allergic nasal symptoms (sneezing, itchy, runny nose) from, e.g., pollen and animals" (question 2a) yielded the best sensitivity, and high PPV and specificity (Table 4). Comparable results were achieved by the question on "allergic eye symptoms (watering, itching,

Table 2. Current asthma, allergic rhinitis, and allergic conjunctivitis in clinical examination in groups of "asthmatics" and "nonasthmatics" defined according to questionnaire responses

Clinical examination	Questionnaire response			
	Reported asthma and/or wheezing* during lifetime <i>n</i> = 150		No reported asthma or wheezing* during lifetime <i>n</i> = 140	
	%	<i>n</i>	%	<i>n</i>
Current asthma†	48.7	73	4.3	6
Current allergic rhinitis‡	60.8	90#	25.7	36
Current allergic conjunctivitis§	58.1	86#	22.9	32

* Attacks of shortness of breath with wheezing.

† Symptoms suggestive of asthma at interview by chest physician and methacholine PD₂₀ of <2.9 mg and/or FEV₁ <reference value minus 1.96 SD and/or FEV₁/FVC <reference value minus 1.96 SD.

‡ Symptoms suggestive of nasal allergy at interview and skin prick test of >3 mm and/or Phadiatop Combi® >0.35 kU/l.

§ Symptoms suggestive of allergic eye symptoms at interview and skin prick test of >3 mm and/or Phadiatop Combi® >0.35 kU/l.

Two subjects excluded due to missing blood tests.

Table 3. Validity of questions on lifetime asthma and asthma-like symptoms in relation to confirmed current asthma* in young adults. Validity measures adjusted for proportions of asthma and nonasthma groups in original questionnaire study. Detailed questions in Appendix 1

Questionnaire item	Positive predictive value†	Specificity	Sensitivity
Doctor-diagnosed asthma	0.82	0.99	0.36
Reported asthma	0.76	0.98	0.40
Cough with wheezing apart from respiratory infection	0.56	0.96	0.44
Attacks of shortness of breath with wheezing, breathing normal between attacks, apart from respiratory infection	0.48	0.95	0.39
Attacks of shortness of breath with wheezing, breathing normal between attacks	0.45	0.94	0.43
Attacks of shortness of breath with wheezing	0.42	0.93	0.45
Cough with wheezing	0.25	0.72	0.76

* Symptoms suggestive of asthma at interview by chest physician and methacholine PD₂₀ of <2.9 mg and/or FEV₁ <reference value minus 1.96 SD and/or FEV₁/FVC <reference value minus 1.96 SD.

† True positives divided by all positives.

redness of the eyes) from, e.g., pollen and animals” (question 4a) (Table 4). The addition of further questions on doctor’s diagnosis (questions 2b or 4b) (Table 4) improved PPV and specificity, *but sensitivity was clearly lower*. On the other hand, the question on noninfectious rhinitis, “recurrent or chronic nasal symptoms (sneezing, runny or stuffy nose) not related to a cold” (question 1), was neither specific nor sensitive (Table 4) in diagnosing current allergic rhinitis. The corresponding figures were found for “irritation of the eyes not related to a cold” (question 3) (Table 4).

Discussion

Sensitive questions are useful during the early stages of a diagnostic work-up for screening of the diseased subjects. In population studies of the risk factors of a disease, a high positive predictive value (proportion of truly diseased among positive questionnaire respondents), as well as high specificity (small number of false positive answers), is important to confirm the diagnosis.

Validation measures depend on the prevalence of the disease and the characteristics of the population. In the original postal survey, the prevalence of reported asthma and “shortness of breath with wheezing apart from respiratory infection” during lifetime was low; 5.5% and 9.1%, respectively. To obtain enough asthmatics for clinical examination, we selected two random samples based on having had or not having had

symptoms suggestive of asthma. Using weights for proportions of “asthmatics” and “nonasthmatics” in the questionnaire study was considered to reflect more accurately the young adult population. With this method we could not exclude the fact that subjects with symptoms were somewhat eager to participate, although the weighting regarded subjects without any atopic symptoms as well. The weighting emphasizing examined “nonasthmatics” decreased sensitivity and increased not only the specificity of questions on asthma, but also that of questions on allergic rhinitis and conjunctivitis (data not shown). This means that among symptomatic subjects and among populations with a higher prevalence of the diseases better sensitivity and somewhat poorer specificity than shown in the present study could be assumed.

Furthermore, validity measures among the study population, young adults starting university studies, may not differ much from Finnish young adults in general, but caution is needed when generalizing the results to other age groups.

Validity of questions on asthma and asthma-like symptoms

Respiratory questionnaires have been validated mainly in relation to another questionnaire (6, 21–23), non-specific bronchial hyperreactivity (BHR) (5, 6, 22–27), clinician’s interview (28, 29), and a combination of these methods (30). In the European Community Respiratory Health Survey (ECRHS), among subjects with self-

Table 4. Validity of questionnaire items on lifetime allergic rhinitis/conjunctivitis in relation to confirmed current allergic rhinitis/conjunctivitis*. Validity measures adjusted for proportions of asthma and nonasthma groups in original questionnaire study. Detailed questions in Appendix 2

Questionnaire item	Positive predictive value†	Specificity	Sensitivity
Hay fever or nasal allergy diagnosed by doctor	0.76	0.93	0.52
Hay fever or allergic nasal symptoms as from pollen or animals	0.75	0.87	0.87
Recurrent or chronic nasal symptoms apart from respiratory infection	0.41	0.69	0.48
Allergic eye condition diagnosed by a doctor	0.85	0.98	0.30
Allergic eye symptoms as from pollen or animals	0.82	0.93	0.79
Eye irritation apart from respiratory infection	0.31	0.63	0.43

* Includes symptoms of allergic rhinitis/conjunctivitis during last year at physician’s interview and at least one skin prick test of >3 mm and/or Phadiatop Combi® >0.35 kU/l.

† True positives divided by all positives.

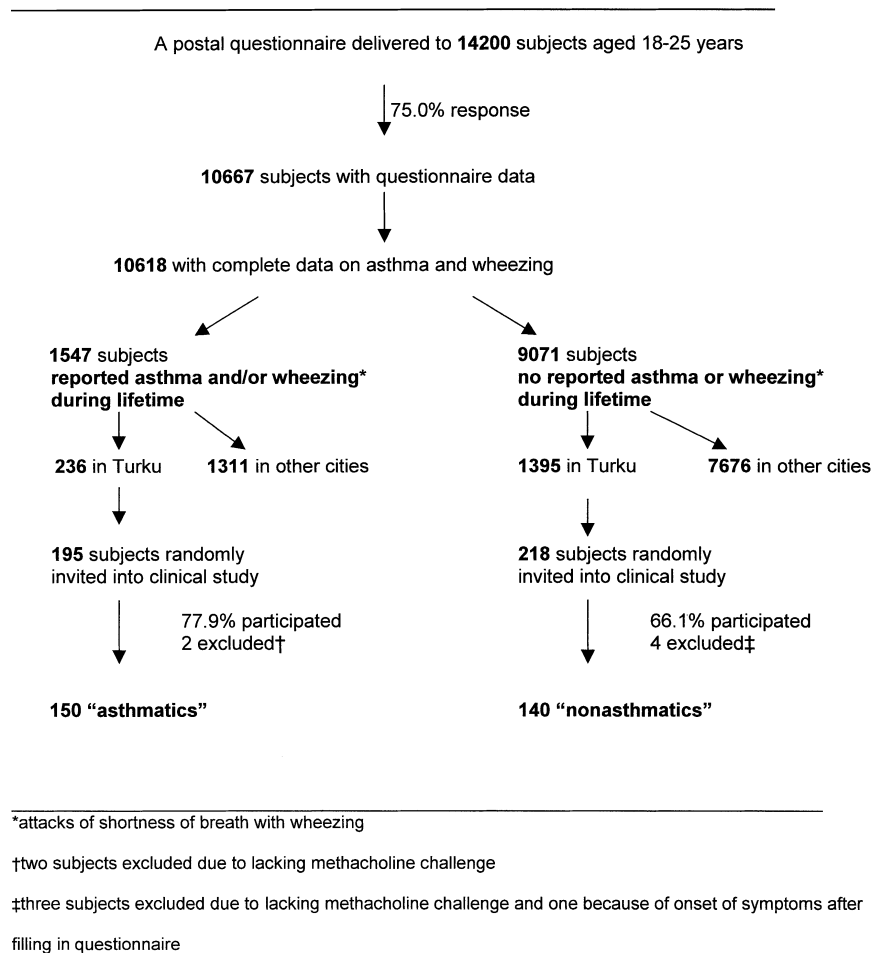


Figure 1. Selection of clinical sample.

reported asthma, only 48% had BHR (31). However, BHR is fairly common among people with no asthma symptoms, in particular atopic subjects (32), smokers (33), and women (31, 34). Thus, at least among these subjects, BHR alone as the reference standard of asthma biases estimation of the validity of the questions.

We adopted typical symptoms of asthma at the clinician's interview with objective measurements, including BHR, bronchial obstruction, or reversibility of obstruction, as criteria. These criteria were chosen to match the confirmation of asthma diagnosis in clinical practice. A comparable algorithm, including asthma symptoms, diagnostic history, and lung function, was used in genetic studies of asthma, in which defining the phenotype is important (29).

For use in population studies of risk factors for asthma, questions on "asthma" and "doctor-diagnosed asthma" in the Tuohilampi questionnaire will be recommended due to their high PPV and specificity (Table 3). However, the quite low sensitivity of diagnosis-based questions still suggests underdiagnosis,

due possibly to mild symptoms not requiring a doctor's consultation. Recently, among the Swedish population, self-reported asthma in the ECRHS questionnaire yielded somewhat higher sensitivity (0.48), but lower specificity (0.90) and PPV (0.28) when validated against BHR (31).

Symptom-based questions have been recommended to avoid underestimation of the prevalence, to achieve comparable results in different populations, and to screen even patients with mild symptoms. Surprisingly, in the present study, the question on "attacks of shortness of breath with wheezing" detected only 45% of asthmatics, but did not attract many false positive cases. Of these wheezers, 42% fulfilled the criteria of current asthma, in comparison to 76% and 82% among those with "asthma" and "doctor-diagnosed asthma". When the International Union against Tuberculosis and Lung Disease (IUATLD) questionnaire in Finnish was validated for BHR among young men, the sensitivity of the question on "wheeze" during the preceding 12 months was much higher (0.95) and the specificity lower (0.74) (25). The higher sensitivity in

that study is partly explained by characteristics of the subjects, of whom 50% were smokers and 50% were asthmatics. In the Tuohilampi questionnaire, the question on “attacks of shortness of breath” is combined “with wheezing”, leading to higher specificity and lower sensitivity than separate questions. By the addition of two further questions on “breathing normal between the attacks” and “not only at times when having a cold”, a fairly specific “asthma” question was formulated. However, the combination of questions was clearly less sensitive, a finding reported also in other studies validating multiple symptom-based questions (6, 23).

The question on “cough with wheezing” was most sensitive, detecting that 76% of asthmatics, but only 25% of positive respondents fulfilled the criteria of current asthma. When “not only at times when having a cold” was included, a higher specificity with a clear loss in sensitivity was noticed, and still only 56% fulfilled the criteria of asthma. Apparently, the validity of the question on “cough with wheezing” in detecting asthmatics will be lower in the general population, which includes a larger number of smokers and chronic bronchitis patients. A comparable question on “cough with wheezing” has not been used in earlier widely distributed questionnaires. The question on “dry cough at night” and “not associated with cold” in the ISAAC written questionnaire, was neither sensitive (sensitivity 0.38) nor specific (specificity 0.65) in predicting BHR among adolescents (23). In the IUATLD questionnaire, subjects responding to only cough questions (without wheezing) were not different from normal subjects in terms of BHR and lung function (30), suggesting that cough questions may be inappropriate in defining asthma in adults.

Validity of questions on allergic and noninfectious rhinitis and conjunctivitis

In the Tuohilampi questionnaire, the questions on nasal and eye allergies are formulated separately to assess conjunctival diseases more exactly. This approach is different from earlier questionnaires: for example, the American Thoracic Society (ATS) questionnaire asks about “rhinitis and/or conjunctivitis”, and in the ISAAC questionnaire nasal problems are followed by a question on increasing specificity: “accompanied by itchy, watery eyes”. A recent study among pregnant women evaluated a screening questionnaire for atopy that included self-reported or physician-diagnosed allergy to allergens such as those of pets and house-dust mite, and a combination of these questions (13).

Skin prick testing (11, 34) or specific IgE measurements (13, 36, 37) as criteria of allergic rhinoconjunctivitis tend to underestimate the sensitivity of the questions, because not all those sensitized have symptoms. Triggers and seasonal occurrence of symp-

toms are commonly used by clinicians to exclude allergy; thus, physician’s diagnosis seems to agree well with specific questions (38). To avoid validation bias, we added symptoms at interview to measures of sensitization.

The prevalence of allergic rhinitis is known to be highest, and the onset of perennial rhinitis most common, in the young adult population (39). In the original questionnaire study, the lifetime prevalence of doctor-diagnosed allergic rhinitis was 19.2% and that of allergic conjunctivitis 9.9%. Students with a mean age of 22 years seemed to be aware of allergic diseases and also had had good access to allergy tests (30% were tested for allergy earlier). Thus, not only the specificity but also the sensitivity of questions referring to “allergic nasal symptoms (sneezing etc.), from pollen or animals” and “allergic eye symptoms (watering, etc.) related to pollen or animals” was reasonably high; 0.87 and 0.79, respectively. Two-thirds of these subjects also had current nasal or eye allergy in the clinical examination. The question seemed to work better in screening than the combination of questions on specific allergies studied among Dutch pregnant women, in which the sensitivity was 0.55 at the maximum (13).

In the southwest London study, the question on “sneezing/runny nose/blocked nose, when you do not have a cold or the flu” was highly sensitive and specific (sensitivity 0.96 and specificity 0.91) in identifying subjects with *rhinitis* among a population including a large number of symptomatic subjects (11). In the present study, the question on noninfectious rhinitis: “recurrent nasal symptoms (sneezing, runny or stuffy nose) not related to a cold or a flu” had low validity in diagnosing *allergic rhinitis* (Table 4), a result which is in agreement with the quite similar ISAAC rhinitis question validated among Swiss schoolchildren (35). The question, however, may work in diagnosing chronic rhinitis whether allergic or not.

In summary, among the young adult population, the questions on reported “asthma” and “doctor-diagnosed asthma” throughout life had the highest positive predictive value, thus detecting “real” asthmatics among positive questionnaire respondents, and were most specific, not detecting many asthmatics among negative respondents. On that basis, these questions are suitable for use in risk-factor studies. The combination of the most sensitive questions useful in screening, such as those on “cough with wheezing” and “attacks of shortness of breath with wheezing”, with a further item, “also apart from a cold”, considerably increased the specificity almost to that of the diagnosis-based questions, but an equally high PPV was not achieved. Questions referring to “allergic” nasal and eye symptoms throughout life worked well in screening and diagnosing, but it was by a further question, “diagnosed by doctor”, that the most exact diagnosis was obtained.

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Appendix 1. Bronchial asthma and asthma-like symptoms

- 1a. Have you ever had a cough with wheezing or whistling?
 - 0) No (Skip to next framed question).
 - 1) Yes
- 1b. Has this cough with wheezing or whistling appeared (Only one answer.)
 - 1) only when you had a cold, "flu", or other chest infection?
 - 2) also when you did not have a cold, "flu", or other chest infection?
- 2a. Have you ever had attacks of shortness of breath with wheezing?

"Attacks" here mean occasional shortness of breath, not, for example, breathlessness after exercise.)

 - 0) No
 - 1) Yes →
- 2b. Has your breathing been normal between these attacks?
 - 0) No
 - 1) Yes
- 3a. Have you ever had asthma?
 - 0) No
 - 1) Yes →
- 3b. Has a doctor diagnosed your asthma?
 - 0) No
 - 1) Yes in 19___/20___ (Give your best estimate.)
4. Have you had symptoms of asthma or attacks of shortness of breath with wheezing (Only one answer.)
 - 0) only at times when you had a cold, "flu", or other chest infection?

1) also during times when you did not have a cold, "flu", or other chest infection?

Appendix 2

Rhinitis

1. Have you ever had recurrent or chronic nasal symptoms (sneezing, runny or stuffy nose) not related to a cold or a "flu"?
 - 0) No
 - 1) Yes
- 2a. Have you ever had "hay fever" or other allergic nasal symptoms (sneezing, itchy, runny nose) as from pollen or animals?
 - 0) No
 - 1) Yes →
- 2b. Were you told by a doctor that you have hay fever or nasal allergy?
 - 0) No
 - 1) Yes, in 19___/20___ (Give your best estimate.)

Conjunctivitis

3. Have you ever had irritation of the eyes (watering, itching, redness) also at times when you did not have a cold or a "flu"?
 - 0) No
 - 1) Yes
- 4a. Have you ever had allergic eye symptoms (watering, itching, redness, swelling of eyelids etc.) as from pollen or animals?
 - 0) No
 - 1) Yes →
- 4b. Were you told by a doctor that you have an allergic eye condition?
 - 0) No
 - 1) Yes, in 19___/20___ (Give your best estimate.)

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