Prevalence of asthma and asthma-like symptoms in three French cities

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Background. This study is part of the European Community Respiratory Health Survey (ECRHS), which uses a common methodology in different areas throughout the world. This paper describes the prevalences of reported asthma, asthma-like symptoms and nasal allergies, their relationships to age group and sex, and the relationships of asthma-like symptoms to current asthma, in the general population aged 20–44 years of three French urban areas.

Methods. The study population of 2804 subjects in Grenoble, 3774 in Montpellier and 3152 in Paris (18th district), randomly selected from electoral rolls, answered a postal questionnaire (stage I of ECRHS). The response rates were 77.8%, 68.6% and 74.4%, respectively.

Results. The prevalences were approximately 14% for wheezing, 16% for chest tightness and 4.5% for nocturnal shortness of breath in the three areas. Asthma attacks in the last 12 months were reported by 2.7% of subjects in Grenoble, 3.5% of subjects in Montpellier and 4.0% of subjects in Paris (P = 0.02). For nasal allergies, the prevalences were 28.0%, 34.3% and 30.8%, respectively (P < 0.001). Asthma was inversely correlated to age (higher prevalence in the youngest) but was not related to sex. Neither age distribution nor sex ratio explained the differences between areas. Among the asthma-like symptoms, wheezing and nocturnal shortness of breath correlated strongly with asthma, chest tightness correlated moderately and nocturnal coughing correlated poorly.

Conclusion. The prevalences observed were higher than expected from previous comparable French studies in young adults. These results are consistent with the hypothesis of a recent increase of asthma and allergies.

Introduction

Asthma is an increasingly serious cause of morbidity in many countries, and mortality rates associated with asthma have been increasing since the mid-1970s, especially in 5–34-year-olds (1, 2). Hospital admissions have increased even more substantially, particularly among children (3). These consequences may be due to artefacts of procedure, but are more likely to be due to changes in prevalence or severity of the disease (4). Nevertheless the only reliable evidence of an increasing prevalence is from surveys which have been repeated with an interval of at least 10 yr in the same areas, using the same methods and the same epidemiological definitions (positive answers to validated questions) on each occasion. All such studies have shown an increased prevalence of asthma (1, 5). The same trends were observed in general practice surveys conducted in England and Wales (6). Despite a possible change in recognition of asthma by physicians, the results of these studies probably reflect a true change because both asthma symptoms and allergic rhinitis have also increased (5, 7).

However, there are insufficient comparable data about the current prevalence of asthma as most epidemiological studies have used different methods to study different populations; therefore discrepancies of reported prevalence between countries are difficult to interpret. For this reason Burney et al. initiated the European Community’s Concerted Action on Asthma Prevalence and Risk Factors (the European Community Respiratory Health Survey: ECRHS). The study aimed to assess the prevalence and risk factors of asthma and asthma-like symptoms in several areas of different countries using a
standardized protocol, which includes two stages: a postal questionnaire sent to representative samples of populations (stage I) and a full length questionnaire with further tests in subsamples of those subjects who answered the postal questionnaires (stage II) (8,9).

We present herein the prevalences of reported asthma, asthma-like symptoms and nasal allergies, their relationships to age group and sex, and the relationships of asthma-like symptoms to current asthma in the general population (aged 20-44 years) of three geographically different French urban areas, using the protocol of the screening stage of the ECRHS.

Methods

THE SAMPLES

Five French centres participated in the first stage of ECRHS and performed the study independently in 1991 and 1992. Approval by the National Ethics Committee was obtained centrally for the five centres, and permission for computerized data processing was obtained by each centre from the National Committee for Data Processing and Freedom. Anonymous joint computerization of the data was arranged by three centres in view of common analyses. The results of these centres are reported herein.

The three study areas were the entire cities of (i) Grenoble and (ii) Montpellier, and (iii) the 18th district of Paris. These are urban areas in different geographical locations: Grenoble is located in the Alps, at low altitude; Montpellier is a Mediterranean city; and the 18th district is one of the 20 inner-city administrative units of Paris.

The study areas were selected according to the guidelines of the ECRHS, i.e. using pre-existing administrative boundaries with total population of around 150,000, from which a representative sample of a minimum of 3000 subjects (1500 of each sex) aged 20-44 years should be included in the study. In the three areas, electoral rolls were used as sampling frames. Random samples were obtained by simple random sampling in Paris and stratified by sex in Montpellier and Grenoble. Since electoral rolls are not constantly updated, we considered that all the subjects whose unopened questionnaires were returned by the post office marked 'not known' were outside the sampling frame and not eligible to take part in the study. After excluding those subjects, the sample size was 3703 in Grenoble, 5619 in Montpellier and 4799 in Paris.

QUESTIONNAIRE

The prevalence of asthma and asthma-like symptoms was assessed by a simple self-administered questionnaire (screening questionnaire of the ECRHS) (8), sent by post.

Seven questions were about the following symptoms in the last 12 months:
1. Wheezing;
2. Waking up with a feeling of tightness in the chest (chest tightness);
3. Being woken by an attack of shortness of breath (nocturnal shortness of breath);
4. Being woken by an attack of coughing (nocturnal coughing);
5. Attack of asthma (current asthma).

Two more questions dealt with:
6. Current asthma medications (asthma medication); and
7. Nasal allergies including hay fever (nasal allergies).

The questions were translated into French by two translators, then translated back into English by an independent translator. The latter translation was then compared with the original version and any discrepancy in the wording led to changes in the French version.

The question 'Have you ever had attacks of asthma?' (asthma-ever) was added to allow comparison of the results of the present study with previous studies conducted in large samples of the French population.

STUDY DESIGN

The questionnaire was sent by post accompanied by an information letter without mention of asthma. The initial mailing was followed by up to two reminder letters in Grenoble and Montpellier, and up to three reminder letters and a telephone call, whenever possible, in Paris. In Grenoble, a random sample of 100 non-respondents was visited at home to assess the reasons for non-response.

STATISTICAL ANALYSIS

The SAS-PC statistical package was used for statistical analysis. Associations between categorical variables were tested by chi-square tests. The variable 'response status' was constructed: subjects were classified into five categories in Paris and three categories in Grenoble and Montpellier, according to whether they had responded to the initial mailing or to one of the various reminders.

The relationships of asthma-like symptoms and nasal allergies to current asthma were determined as odds-ratios.
Mantel–Haenszel chi-square was used to test linear trends in the associations between age groups and morbidity.

**Results**

**PARTICIPATION**

In Grenoble, 2804 subjects responded to the questionnaire, 3774 in Montpellier and 3152 in Paris. Adjusted response rates* were 77.8%, 68.6% and 74.4%, respectively. The rate was slightly higher among women in Grenoble (79.7% vs. 76.0% among men, \(P=0.008\)) and in Montpellier (69.9% vs. 67.4%, \(P=0.004\)), but not in Paris. There was no significant relationship between response rate and age in Grenoble. In Paris, response rate was slightly but significantly higher for the youngest (81.3% in those aged 20–24 years) and lower for the oldest age groups (73.0% in those aged 40–44 years). The ages of non-respondents were not known for the Montpellier sample.

The age distributions in the selected samples were significantly different from those of the area populations according to the 1990 census data. As expected, the young were under-represented, since their enrolment in the electoral roll is often delayed. In Grenoble, the proportion of those aged 20–24 years was 12.5% in the selected sample and 13.0% in respondents vs. 29.0% in the census population. In Paris, the corresponding proportions were 10.4%, 11.3% and 17.0%, respectively. In Montpellier, the proportion of 20–24-year-olds was 12.2% among respondents vs. 31.5% in the census population.

The respondents were classified into five age groups (20–24 years, 25–29 years, 30–34 years, 35–39 years and 40–44 years). The proportions of those aged 20–24 years were less than 13%, the proportions of subjects in each of the three intermediate age groups were approximately 20%, and the proportions of those aged 40–44 years were greater than 28%. The percentages of men among respondents were 49.3% in Grenoble, 50.3% in Montpellier and 46.4% in Paris, and were not significantly different between the five age groups for any of the three areas.

We assessed a possible over-representativity of symptomatic subjects among respondents by testing the relationships between symptoms and response status, and by analysing the survey of the 100 non-respondents in Grenoble. There were no differences in prevalences of symptoms according to the response status in any of the three areas, except for nasal allergies which were significantly more frequent in respondents to the initial mailing both in Montpellier and in Paris. Of the 100 non-respondents surveyed, 55 did not live at their registered address. 33 refused to answer and 12 were willing to complete the questionnaire. Of these 12 subjects, two reported wheezing in the last 12 months, two had been woken by chest tightness, three had been woken by an attack of coughing, none reported current asthma, and four reported nasal allergies.

**PREVALENCE OF ASTHMA AND SYMPTOMS**

Table 1 shows the prevalence of reported asthma, asthma-like symptoms and nasal allergies in the three areas. Asthma-ever, current asthma, asthma medications and nasal allergies were significantly less frequent in Grenoble than in the two other areas, and nasal allergies were most frequent in Montpellier. The proportion of subjects with nocturnal shortness of breath, current asthma and/or asthma medication (Questions 3, 5 and 6) was 6.6% in Grenoble, 7.2% in Montpellier and 7.7% in Paris (not statistically different). This variable corresponded to the definition of the subjects to be included in the symptomatic sample of the second stage of ECRHS.

Table 2 shows the prevalences of the conditions studied, separately in males and females, in the three areas. The only relationships between symptoms and sex were the following: greater frequency of wheezing among men than women in Grenoble; greater frequency among women than men of nocturnal coughing in the three areas; and greater frequency among women than men of chest tightness in Montpellier and Paris.

Few of the symptoms correlated with age. Table 3 shows the frequencies of the variables that had significant linear trends with age in at least one area. The prevalence of current asthma was significantly greater in the youngest age group in Paris alone, whereas the prevalence of asthma-ever and wheezing tended to decrease with increasing age in all three areas.

The relationships of asthma-like symptoms and nasal allergies to reported current asthma are shown in Table 4. As expected, nasal allergies were six- to eight-fold more frequent among current asthmatics than non-asthmatics. Among the asthma-like symptoms, wheezing and nocturnal shortness of breath correlated strongly with asthma, chest tightness correlated moderately and nocturnal coughing correlated poorly. Nevertheless all these relationships were statistically significant.

Of those subjects who reported asthma attacks in the last 12 months, the percentages of subjects currently taking any medicine for asthma were 48.0%
Table 1  Prevalence (%) of reported asthma, asthma-like symptoms and nasal allergies in the three areas

<table>
<thead>
<tr>
<th></th>
<th>Grenoble n=2804</th>
<th>Montpellier n=3774</th>
<th>Paris n=3152</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheezing (Question 1)</td>
<td>14.3 (13.0-15.6)</td>
<td>14.0 (12.9-15.1)</td>
<td>14.4 (13.2-15.6)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Wheezing with breathlessness (Question 1-1)</td>
<td>8.3</td>
<td>8.8</td>
<td>9.3</td>
<td>n.s.</td>
</tr>
<tr>
<td>Wheezing apart from colds (Question 1.2)</td>
<td>10.1</td>
<td>8.6</td>
<td>8.8</td>
<td>n.s.</td>
</tr>
<tr>
<td>Chest tightness (Question 2)</td>
<td>15.0</td>
<td>16.7</td>
<td>16.7</td>
<td>n.s.</td>
</tr>
<tr>
<td>Nocturnal shortness of breath (Question 3)</td>
<td>4.7</td>
<td>4.1</td>
<td>4.6</td>
<td>n.s.</td>
</tr>
<tr>
<td>Nocturnal coughing (Question 4)</td>
<td>24.8</td>
<td>25.4</td>
<td>26.5</td>
<td>n.s.</td>
</tr>
<tr>
<td>Current asthma (Question 5)</td>
<td>2.7</td>
<td>3.3</td>
<td>4.0</td>
<td>0.02</td>
</tr>
<tr>
<td>Asthma medication (Question 6)</td>
<td>2.1</td>
<td>3.4</td>
<td>3.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Nasal allergies (Question 7)</td>
<td>28.0</td>
<td>34.3</td>
<td>30.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Asthma-ever (cumulative prevalence)</td>
<td>7.4</td>
<td>9.2</td>
<td>9.3</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Values in parentheses indicate 95% confidence limits.

Table 2  Prevalence (%) of reported asthma, asthma-like symptoms and nasal allergies in the three areas according to sex

<table>
<thead>
<tr>
<th></th>
<th>Grenoble M=1381 F=1423 P-value</th>
<th>Montpellier M=1899 F=1875 P-value</th>
<th>Paris M=1462 F=1689 P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheezing (Question 1)</td>
<td>16.2 12.4 0.004</td>
<td>14.7 13.2 n.s.</td>
<td>14.7 14.2 n.s.</td>
</tr>
<tr>
<td>Wheezing with breathlessness (Question 1-1)</td>
<td>9.1</td>
<td>7.6</td>
<td>n.s.</td>
</tr>
<tr>
<td>Wheezing apart from colds (Question 1.2)</td>
<td>11.1</td>
<td>9.1</td>
<td>n.s.</td>
</tr>
<tr>
<td>Chest tightness (Question 2)</td>
<td>13.9</td>
<td>16.1</td>
<td>n.s.</td>
</tr>
<tr>
<td>Nocturnal shortness of breath (Question 3)</td>
<td>4.4</td>
<td>4.9</td>
<td>n.s.</td>
</tr>
<tr>
<td>Nocturnal coughing (Question 4)</td>
<td>21.3</td>
<td>28.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Current asthma (Question 5)</td>
<td>2.8</td>
<td>2.5</td>
<td>n.s.</td>
</tr>
<tr>
<td>Asthma medication (Question 6)</td>
<td>2.2</td>
<td>2.0</td>
<td>n.s.</td>
</tr>
<tr>
<td>Nasal allergies (Question 7)</td>
<td>29.2</td>
<td>26.8</td>
<td>n.s.</td>
</tr>
<tr>
<td>Asthma-ever (cumulative prevalence)</td>
<td>8.0</td>
<td>6.8</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

M, male; F, female.

in Grenoble, 58.3% in Montpellier and 56.3% in Paris.

Discussion
The prevalence of reported asthma was high in each of the three areas: 7.4-9.4% for asthma-ever and 2.7-4.1% for current asthma. The true prevalence of asthma in the populations of the areas sampled is likely to be greater than observed in the samples for two reasons. Firstly, the prevalences were greater in the youngest age group, and the youngest were under-represented. Secondly, questions on asthma or
asthma attacks are considered as highly specific (in that people who claim to have the disease nearly always seem to have it), but seriously insensitive (since many subjects are unaware of having asthma but would be so diagnosed if clinically investigated) (10,11).

The participation rates (77.8%, 68.6% and 74.4% in Grenoble, Montpellier and Paris, respectively) were satisfactory for a postal survey in a general population sample, randomly selected from electoral rolls. In two recent studies of population samples from electoral rolls, the participation rates were 72% (12) and 56% (13). In another study conducted in a multistage stratified family cluster sample, 78% of the selected subjects were studied (14). Our response rate in Paris was obtained following four reminders. This is unlikely to have biased the results since the prevalence of asthma and asthma-like symptoms was not related to response status. The participation rate in the three areas is obviously a conservative figure: approximately one-third of the people contacted by the telephone reminder in Paris told us that the subject selected for the study had left that address at least 1 yr previously. Moreover, 55 of the 100 non-respondents surveyed in Grenoble were not found at their registered address, suggesting that a subsample of non-respondents were actually not eligible. In the three East Anglian towns participating in the ECRHS, the most common cause of non-response was that the subject had moved (15).

The questionnaire of the ECRHS (stage I) included questions that had previously been used in epidemiological studies. The questions on wheezing were derived from the first questionnaire about respiratory symptoms of the British Medical Research Council (MRC questionnaire, 1960) (11). The other questions on asthma-like symptoms were developed to measure the prevalence of current asthma in large populations, since answers to questions on asthma were considered to be dependent on access to and use of health care, and the questions on wheezing were criticized because 'wheezing' is not specific enough (16). These new questions were included in the questionnaire of the International Union Against Tuberculosis and Lung Disease (IUATLD questionnaire, 1986) (11,16,17). The question on nocturnal shortness of breath was also introduced in the 1986 version of the MRC questionnaire. The question 'Have you ever had asthma?' was first used in the 1978 version of the questionnaire about respiratory diseases from the American Thoracic Society and the Division of Lung Diseases, National Heart, Lung and Blood Institute, U.S.A. (ATS-DLD-78), whereas the 1966 and 1986 versions of the MRC questionnaire asked about 'bronchial asthma' (11). The question 'Have you ever had attacks of asthma?' has been used in French studies since 1976 (5). In the present study, we used this question, rather than 'Have you ever had asthma?' which might have been more sensitive and consequently might have overestimated the prevalence, and biased the comparison with previous studies.

We analysed the relationships between current reported asthma and current symptoms considered as asthma-like. In spite of its poor sensitivity, the question on current asthma identifies subjects who are very likely to be asthmatics (10,11). In the absence of a single gold standard, it is legitimate to use it to validate the questions on asthma-like symptoms. Chest tightness correlated moderately with asthma, and nocturnal coughing correlated poorly. Chest tightness was initially included in the group of questions to be used to select symptomatic subjects for the second stage of ECRHS. This question was then discarded from the group of questions because a large number of subjects who could not be considered
to be asthmatics gave a positive answer. Our results show that this symptom is less closely related to asthma than wheezing and nocturnal shortness of breath. The question on nocturnal coughing is even less relevant since one subject out of four gave a positive answer, and the symptom correlated very poorly with asthma. The prevalences of chest tightness and nocturnal cough observed in our study were very similar to those observed among Australian adults using the same questions (12). Among the new questions, nocturnal shortness of breath seems particularly satisfactory according to our results, since the odds-ratios towards current asthma were between 19 and 27, according to the area. When the IUATLD questionnaire was tested against bronchial hyperresponsiveness, nocturnal shortness of breath seemed to be a better predictor than any other question (15).

About one-half of current asthmatics said that they were currently taking medications for asthma. However, there is a time discrepancy between the two relevant questions: the last 12 months for current asthma and present time for current medications.

We will not compare the prevalence of asthma described in this study with other geographical areas, because few surveys in other areas employed the same methodology. The final international comparison of the results from all the areas participating in the ECRHS will provide a much more complete comparison than we could. The prevalences of asthma and nasal allergies among our samples were higher than expected from comparable previous studies in France: in two studies of 8140 Parisian students in 1968 and 10 559 students in 1982, the prevalences were 3.3% and 5.4%, respectively, for asthma-ever, and 3.8% and 10.2%, respectively, for allergic rhinitis (5). Among the Parisian subjects aged 20–24 years in this study, 14.2% reported asthma-ever and 28.3% reported allergic rhinitis. The true increase is probably greater than that observed, since university students are believed to have a higher prevalence of asthma than the general population (16). These results are consistent with an increase of asthma and allergy. Practically all repeat surveys of asthma throughout the world, spanning periods of 10 yr or more, have shown similar increases both in adults (11,19) and in children or adolescents (1,20). This increase in the prevalence of asthma and asthma-like symptoms cannot be due to the study methodology since the questions used in all these studies were the same on the first and second occasions. Possible changes in asthma recognition and artefacts of diagnosis have been studied, but they do not seem to account for the increase (4). Further evidence has been provided by some studies on the increase of asthma prevalence. Haastela et al. found that the proportion of men exempted from military service because of disabling asthma had risen five-fold between 1966 and 1989 whereas the proportion of men exempted for other somatic causes had not increased (19). Shaw et al. showed that the prevalence of asthma and wheeze increased from 1975 to 1989, but that wheezing associated with colds had not, suggesting that the change observed was not related to changes in the use or understanding of the word ‘wheezing’ (20). Other allergic diseases, such as atopic eczema, also seem to be increasing (21).
The prevalence of asthma and its associated symptoms was higher in the 20–24-year-old group than among the older age groups. This is also consistent with an increasing prevalence of asthma. The prevalence of asthma is believed to be at its highest during childhood, to fall during adolescence, to remain fairly constant between ages 20–44 years and to increase again after age 45 years (1,22). Thus, the higher prevalences in the youngest age group suggests that these subjects belong to generations which have a more frequent incidence of asthma (23).

As expected, we did not observe any relationship between asthma and sex, since prevalence is generally similar among men and women in adults (1,18). In our study of Parisian students in 1982, the male predominance of asthma, which is common among children (1,24), was only observed in those aged less than 21 years (5).

The prevalence of asthma differed between the three areas studied: current asthma and asthma-ever were less frequent in Grenoble than in Montpellier and Paris, whereas nasal allergies were more frequent in Montpellier than in the two other areas. Neither age nor sex can explain these differences: the age distributions of responders were similar in the three areas, and sex was not related to these conditions.

In conclusion, the major results of this study were: (i) the prevalence of asthma was higher than expected from previous studies; (ii) that prevalence was higher in the youngest age group; and (iii) that prevalence was significantly lower in one of the three areas, Grenoble, which is a low altitude city in the Alps. These results are likely to be explained by changes over time and differences between the areas in environmental factors. Stage II of ECRHS, completed by further data collection, will enable us to consider the indoor environment, including mite allergen measurements, as well as outdoor pollution and pollen counts, which can be involved in the differences observed.

Acknowledgements

These results are from a local analysis of data collected for the European Community Respiratory Health Survey. Any final international comparison may use a different form of analysis.

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