Prevalence of asthma and asthma-like symptoms in Athens, Greece

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Asthma is a common chronic condition and there is evidence that its prevalence may be rising. The European Respiratory Health Survey (ECRHS) was planned to produce comparable data on asthma epidemiology in Europe. In Greece, in particular, a similar study has not been conducted previously and no epidemiological data are available on adult asthma prevalence. Furthermore, the role of air pollution in the pathogenesis of asthma is currently an issue of debate. Athens is a city with high air pollution, and a study of asthma epidemiology in this city may confirm or refute a possible link with the expression of asthma. A questionnaire developed by the ECRHS was sent to a random sample of 3533 households in Peristeri, an industrialized borough of Athens. Responses were received from 2774 households (response rate 78%). Of all the data on individual subjects, only those from 3325 adults aged 20-44 years were considered, according to the study protocol. The self-reported current prevalence of asthmatic attacks and asthma-like symptoms were as follows: asthma attack 2.4%, use of asthma medication 2.1%, awakening by shortness of breath 5.6%, awakening by cough 17.8%, wheezing 15.8% and nasal allergies 18.4%.

It is concluded that the prevalence of asthma and related symptoms in this region of Athens is rather low, despite the high air-pollution levels in the city.

Introduction

The prevalence of asthma in adults in Athens, Greece has not been estimated previously. This study presents the European Community Respiratory Health Survey (ECRHS) results for asthma and asthma-like symptom prevalence in this highly air-polluted area. Asthma prevalence was examined in adults aged 20-44 years and children were not included.

Asthma is a common chronic disease that can have a profound effect on quality of life. There is evidence that the prevalence and severity of asthma may be increasing world-wide (1-4). The reasons for this increase cannot be clearly defined since the pathogenesis of asthma is linked to many possible inducing factors. Postulated explanations include higher allergen exposure owing to changes in housing styles (5), indoor and outdoor pollution (6,7), and under-diagnosis or undertreatment of asthma in the past. Athens is a city with high levels of air pollution. A comparison of asthma prevalence in this city with other less polluted regions might clarify whether air pollution can be implicated in the pathogenesis of asthma. Currently, however, it is difficult to interpret and compare data from published studies because of the lack of a universally accepted definition of asthma and differences in survey methodology.

The ECRHS was designed to produce data on asthma epidemiology in Europe using a standardized questionnaire delivered to a defined population sample (8), so that data will be comparable. Many centres have participated in
FIG. 1. ECRHS Stage I Questionnaire.

1. Have you had wheezing or whistling in your chest at any time in the last 12 months? If 'no' go to Question 2, if 'yes';
   1.1 Have you been at all breathless when the wheezing noise was present?
   1.2 Have you had this wheezing or whistling when you did not have a cold?
2. Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?
3. Have you been woken up by an attack of shortness of breath at any time in the last 12 months?
4. Have you been woken by an attack of coughing at any time in the last 12 months?
5. Have you had an attack of asthma in the last 12 months?
6. Are you currently taking any medicine (including inhalers, aerosols or tablets) for asthma?
7. Do you have any nasal allergies including hay fever?
8. What is your date of birth?
9. What is today's date?
10. Are you male or female?

the study world-wide. Athens is the southernmost European centre in the study.

Materials and Methods

The protocol used in the study has been described previously (8). Briefly, an urban area with administrative boundaries and a population of at least 150 000 people had to be selected. The initially selected sample size was big enough to obtain responses from at least 1500 men and 1500 women aged 20–44 years living in the study area. Children were not included. These people had to answer the ECRHS Stage I questionnaire (Fig. 1) containing questions about wheezing, chest tightness, shortness of breath, cough, asthma attacks, medication and nasal allergies. The 20–44 years age group was chosen because all relevant symptoms are rarely due to chronic obstructive pulmonary disease. Congenital heart or lung disease may also be responsible for such symptoms, but their prevalence is low.

In Athens, an industrialized borough with a population of 170 000 was selected. A highway runs through part of the area and there is a lot of heavy traffic as well as ordinary cars. Most centres participating in the ECRHS identified their sampling frame through registers including information on age, sex and address for each inhabitant in the selected area (electoral boards, general practitioner's register etc.). In Athens, such registers do not necessarily include people living within a certain area. Therefore, another approach had to be taken, so electricity boards were used since they are specific to the area and all houses are equipped with electricity. A random sample was selected and questionnaires were sent to 3533 households accompanied by a letter explaining about the study and asking all people in the age range of 20–44 years and living in the household to fill in the questionnaire. The initial response rate was low and non-responders were contacted again by home visits. Care was taken so that the subjects filled in the questionnaire without any interference from the investigator.

Results from the questionnaire were entered into computer files and were statistically validated by the co-ordinating centre and by the Greek group. Possible associations between the answers to any two questions were tested with the Pearson Chi square statistic using the Systat R statistical package for Mackintosh. \( P<0.05 \) was considered significant.

Results

RESPONSE RATES

Response rates were based on households' answers. From the 3533 households to which the questionnaire was initially mailed, only 552 households responded (response rate 15.6%). The remaining 2981 households were contacted again by home visits. Of these, 422 houses were empty, and the people of 337 households denied to participate. Six hundred and fifty-four households did not belong in the age range of 20–44 years but were included in the evaluation of response rates. Accordingly, the response to home visits was 74.5%.

Unfortunately, the registers used did not contain information on age, so 66% of the responding households contained people who were inside the age range for the ECRHS study, and 34% of households contained people outside the age range. The 34% of households with people
who did not belong in the appropriate age group could not be included in the evaluation of prevalence. They were, nevertheless, counted as responders because they wished to participate. Considering responses to mailing of the questionnaire and home visits, the overall response rate is raised to 78.5%, based on household responses. Figure 2 shows the distribution of household answers. Finally, 1840 households took part in the study and the questionnaire was answered by a total of 3325 people, 20–44 years old (1624 men and 1701 women), living in these households.

PREVALENCE RATES

Table 1 shows prevalence rates for asthma symptoms, use of medication and nasal allergies as derived from the questionnaire. There was a trend for female preponderance in the prevalence of most self-reported symptoms which reached statistical significance in Question 2 (Q2) (awakening by chest tightness) and Q7 (nasal allergies) (P<0.0004). Analysis of prevalence rates derived from the mailing of the questionnaire resulted in higher prevalence rates as compared with home visits and overall data analysis (Table 2). The prevalence of symptoms with respect to age was also examined. Prevalence in age groups 20–24, 25–34 and 35–44 years was estimated separately. With the exception of Q7, the frequency of positive answers to all of the questions increased proportionally with age (Fig. 3). Groups were balanced in terms of gender.

Statistical analysis of the present data shows that, in relation to Q5 (asthma attacks), Q3 (awakening by shortness of breath) and Q6 (asthma medication) have higher χ² values (Q3, 732.6; Q6, 1700.6) than the remainder of the questions (Q1, 269.5; Q2, 353.2; Q4, 156.1). Co-estimation of Q3, Q5 and Q6 increases the prevalence of asthma in Athens to 6.5%.

**Discussion**

This study showed a rather low prevalence of self-reported asthma and asthma-like symptoms in Athens, as compared with other centres in the study. Data from all centres are not yet available, but results from ECRHS in Sweden and Italy have been published and prevalence is higher than in Athens, as shown in Table 3 (9,10). Since there is no universally accepted definition of asthma, any or all the symptoms mentioned in the questionnaire of this study...
FIG. 3. Prevalence of asthma and asthma-like symptoms in different age groups. Q1, wheezing (△), \(P<0.0005\); Q2, awakened by chest tightness (●), \(P=0.001\); Q3, awakened by shortness of breath (+), \(P=0.018\); Q4, awakened by cough (○), \(P=0.0453\); Q5, asthma attack (●), \(P=0.026\); Q6, asthma medication (○), \(P=0.030\); Q7, nasal allergies (▲), \(P=0.708\).

might be used for estimation of asthma prevalence. This means that the true prevalence of asthma in any given region lies between the highest and the lowest prevalence of referred positive answers in all relevant symptoms, and may, in fact, be higher than the prevalence of self-reported asthma. In the present study, the lowest prevalence was 2.1% for Q6 (asthma medication) and the highest prevalence was 17.8% for Q4 (awakening by cough). Question 5 (asthma attack) deals directly with asthma. Statistical analysis of these data shows that Q3 and Q6 are better correlated to Q5, having higher Chi-square values than the remainder of the questions. Considering Q3, Q5 and Q6 together, the prevalence of asthma in Athens increases to 6.5%. Whether a similar phenomenon will be noted in other centres of the study remains to be seen. Long-term follow-up of people with positive answers to all questions will either confirm or reject the hypothesis that Q3, Q5 and Q6 are indeed better indicators of asthma.

During the analysis of the present data, it was made obvious that the degree of response may affect prevalence rates. These results show that response rates are inversely related to prevalence rates. This has recently been shown in another ECRHS report from Italy (9). Epidemiological studies should have high response rates since low numbers of responses may include a higher percentage of answers from affected people. Mailing of questionnaires is a quicker and cheaper way for collection of data in epidemiological studies. However, care should be taken because affected subjects tend to respond more readily. Therefore, more expensive and time-consuming methods such as personal contact may be better indicated.

The present data also show that self-reported symptoms become more frequent with age. This might reflect a true increase in asthma prevalence since asthma may develop at any age, and new cases are added to the existing ones. It may also reflect the impact of environmental factors, such as smoking, on respiratory health. This is in accordance with data in the literature showing that mortality rates tend to be higher in the older asthmatics (2). However, increased mortality rate does not necessarily suggest increased asthma prevalence and it might also be due to other factors.

**Table 3. Overall observed prevalence rates (%) at ECRHS Stage I in Italy (Pavia, Turin, Verona), Sweden (Uppsala) and Greece (Athens)**

<table>
<thead>
<tr>
<th></th>
<th>Italy</th>
<th>Sweden</th>
<th>Greece</th>
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<tbody>
<tr>
<td>Q1 Wheezing</td>
<td>9.9</td>
<td>19.0</td>
<td>15.8</td>
</tr>
<tr>
<td>Q2 Chest tightness*</td>
<td>8.1</td>
<td>9.7</td>
<td>11.6</td>
</tr>
<tr>
<td>Q3 Shortness of breath*</td>
<td>7.1</td>
<td>5.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Q4 Cough*</td>
<td>29.4</td>
<td>25.4</td>
<td>17.8</td>
</tr>
<tr>
<td>Q5 Asthma attack</td>
<td>3.7</td>
<td>3.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Q6 Asthma medication</td>
<td>2.0</td>
<td>4.9</td>
<td>2.1</td>
</tr>
<tr>
<td>Q7 Nasal allergies</td>
<td>15.9</td>
<td>22.2</td>
<td>18.4</td>
</tr>
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Results for Italy and Sweden are from de Marco et al. (9) and Bjornson et al. (10), respectively.

*Awakened by.
In the present study, a trend for female preponderance is noticeable, and this is also in accordance with data in the literature (11).

In recent years, an increase in asthma prevalence and severity has been witnessed worldwide (3,4,12). There is debate as to whether pollution is one of the major risk factors (13,14). Many studies have shown that exposure to NO\textsubscript{2}, SO\textsubscript{2}, particulate matter and acid aerosols increases symptoms of asthma and hospital admissions (7,15,16). Pollution may also lead to augmented allergenicity of allergens (17). Although Athens is a highly polluted city (Tables 4 and 5) (18), the present study does not show a high prevalence of self-reported asthma in relation to other centres.

However, it was not possible to ascertain whether the prevalence of asthma in Athens has increased because of pollution, since no other similar study has previously been performed in Greece.

Apart from pollution, allergen exposure may be another significant risk factor for the development of asthma (19). Children are sensitized to house dust and house dust mite very early in life (20,21), and according to some researchers, this may be one reason for increased asthma prevalence (22). A steep rise in prevalence has been noted in countries such as England, Australia and New Zealand (5) with high humidity and housing styles that have changed in the last decades to include indoor temperature increase with central heating, wall-to-wall carpets, restriction of ventilation with double glazing, and use of certain types of air conditioning; conditions that enable house dust mites to thrive. Living-in pets are another important source of allergen. In Greece, wall-to-wall carpets are practically non-existent, pets in the house are infrequent and the climate in Athens is very dry and warm so windows are open for most of the year.

ECRHS Stage II results (8) on environmental risk factors, bronchial hyper-reactivity and atopy may further illuminate the relationship between risk factors and asthma. It may also help define whether particular symptoms are predictive or indicative of true asthma. Repeated clinical check-ups and examination of biopsy specimens can possibly be more reliable in confirming the disease and in estimating real asthma prevalence.

### References


