

# Prevalence of asthma and asthma-like symptoms in young adults living in three East Anglian towns

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## SUMMARY

**Background.** The European Community respiratory health survey is examining the prevalence of asthma and risk factors for asthma.

**Aim.** As part of this multinational survey, a study was undertaken to determine the prevalence of asthma and asthma-like symptoms in young adults living in Cambridge, Ipswich and Norwich using a postal questionnaire.

**Method.** A previously validated symptom questionnaire was sent to 2500 men and 2500 women aged 20–44 years living in and registered with a general practitioner in each of the three towns.

**Results.** In total, approximately 9000 adults responded. The prevalence of symptoms suggestive of asthma was found to be similar in the three towns. Of respondents, 8% reported having been woken by an attack of shortness of breath at some time in the last 12 months, higher than previously reported. Five per cent reported having had an asthma attack.

**Conclusion.** General practitioners wishing to examine asthma prevalence in their own practice population could use a similar methodology.

**Keywords:** asthma; symptoms; morbidity; young adults.

## Introduction

ASTHMA is an important cause of morbidity in many countries and there is evidence that it is increasing in prevalence, not only in the United Kingdom, but also in other countries.<sup>1–8</sup> The European Community respiratory health survey is a collaborative multinational study examining the prevalence of asthma and risk factors for asthma and has developed a protocol to determine asthma prevalence in large community based samples of young adults. Three centres in East Anglia took part in the survey and the prevalence of asthma in East Anglia will be compared with the prevalence of asthma in 40 other participating centres in the main analysis (as yet to be conducted).

This paper presents the methodology used to obtain data in East Anglia and presents the East Anglian results. These data are

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presented separately from the main survey analysis so that health professionals, in particular general practitioners, in the UK have an early opportunity to compare these results with asthma morbidity in young adults in their own practice populations.

## Method

### Area selection

Three areas were studied: Cambridge, Ipswich and Norwich. These were selected because they were in the same region, appeared to have widely different mortality from asthma<sup>9</sup> and had each a total population of approximately 150 000. The study areas were defined by postcode. The study was performed independently in each area between October 1990 and June 1991.

### Sampling

A list of all men and women aged 20–44 years, living within the designated postal code area and registered with a general practitioner, was obtained from the relevant family health services authority. A random sample of 2500 men and 2500 women was generated from each list and randomly divided into three. In Cambridge all individuals with an address containing the words 'college' or 'hall' were removed from the sampling frame prior to selection to minimize the number of temporarily resident students in the sample.

### Questionnaire

The self administered European Community respiratory health survey questionnaire was used, based on the questionnaire developed for the International Union Against Tuberculosis and Lung Disease.<sup>10–13</sup> The questionnaire asked whether, in the past 12 months, respondents had had wheezing or whistling in the chest (and if so whether they had been breathless, and whether they did not have a cold at the time); whether they had woken up with a feeling of chest tightness; had been woken by an attack of shortness of breath; had been woken by a coughing attack; or had had an asthma attack. In addition, subjects were asked if they were currently taking any medication for asthma and whether they had any nasal allergies including hay fever. The questionnaire also asked for the subject's sex and date of birth.

### Mailing

Mailing was carried out in three separate waves with a random third of all participants being mailed during each wave. The waves were separated by at least two months. Within each wave three postal attempts were made to elicit a response. There were 21 days between the first and second mailing and between the second and third mailing. Forty days after the third mailing all individuals from whom there had been no response and who were not known to have died, refused to take part or moved (temporarily or permanently) were categorized as non-respondents.

If questionnaires were returned but the age and sex of respondents were not compatible with the family health services authority register, attempts were made to verify the data. Unopened questionnaires returned by the post office marked 'moved' or 'not known' were coded as moved. People were only coded as refusals if there was written or spoken evidence that they did not wish to take part. The failure to reply to letters was not con-

sidered to be a refusal. Residents were considered to be temporarily away if they normally resided at the address given but were living away for the period of the study (discovered by letters from one individual abroad, or from the individual's family).

#### Follow up of non-respondents

A random 25% of all non-respondents were followed up by either a telephone call (if their number was available in the telephone directory) or by up to three home visits. Wherever possible home visits were conducted at different times of the day to try and gain a response and neighbours were asked if the subject being sought lived at the given address.

#### Analysis

The response to the survey was considered in two ways: the response to the first three mailings; and the response from the follow up of the 25% sample of non-respondents.

The prevalence of reported symptoms was considered in three ways: the primary prevalence — the prevalence of symptoms among those responding to any of the three mailings of all three waves; the non-respondent prevalence — the prevalence of symptoms among the non-respondents; and the adjusted prevalence — the prevalence for the whole sample, assuming the results from the 25% random sample were representative of all non-respondents to the first three mailings.

The influence of age and sex on response rate was considered in each centre and in all three centres combined.

Each of the main questions was examined to assess the influence of age and sex on each symptom; if early respondents were more likely to have symptoms than late respondents; and if there was a variation in the reporting of symptoms associated with season. Season was defined as spring (March, April, May), summer (June, July, August), autumn (September, October, November) and winter (December, January, February). The effect of area and its interaction with age, sex and season was tested. Only significant effects are reported.

Analyses were by multiple logistic regression using the statistical programme *GLIM* (generalized linear interactive modelling).<sup>14</sup>

Permission for the study was granted from the district ethics committee and permission to use the family health services authority register was given by the local medical committee.

#### Results

The names of 30 246 men and 25 905 women in Cambridge (22 865 and 21 558 after removal of all addresses which were colleges or halls); 23 226 men and 22 779 women in Ipswich;

and 26 286 men and 26 142 women in Norwich aged between 20 and 44 years on 1 October 1990 were included in the sampling frame.

#### Response

The outcome of the first three mailings and of the 25% non-respondent follow up is shown in Table 1. After excluding subjects who were not eligible to take part (wrong age, temporarily away, had moved away or died) the response rate differed significantly between areas, being highest in Ipswich and lowest in Cambridge ( $P<0.001$ ). Response was significantly higher among women than men ( $P<0.001$ ) and increased with increasing age group ( $P<0.001$ ).

Up to 31% of the 25% non-respondent sample completed the questionnaire when personally requested to do so, but despite intensive follow up it was still difficult to obtain information on all subjects. The most common cause of non-response was that the subject had moved.

#### Symptom prevalence

There was no significant variation in the prevalence of symptoms between areas, and as adjustment for non-response had no significant effect on the prevalence of symptoms within areas, the primary prevalence of symptoms in all three areas combined is presented in Table 2. One in four of all respondents reported experiencing wheeze in the last 12 months, and half of these experienced breathlessness when they wheezed. Eight per cent of respondents had been woken by an attack of shortness of breath, and 5% reported having had an asthma attack. More than a quarter of those who responded complained of nasal allergies and/or hayfever.

Further analysis of symptom prevalence, excluding results obtained from the follow up of the 25% sample of non-respondents, showed particular associations.

**Wheeze.** The prevalence of wheeze was significantly lower among women than men ( $P<0.05$ ) and decreased with age group ( $P<0.01$ ): the percentage prevalence among women in the three age groups 20–24 years, 25–34 years and 35–44 years was 26.3% of 898, 24.7% of 2152 and 22.9% of 1883, respectively. This compared with the prevalence among men in the three age groups: 30.4% of 672, 25.2% of 1747 and 25.7% of 1541, respectively. The prevalence varied between mailings in Norwich but not in the other areas.

**Waking with chest tightness.** The reported prevalence of waking with chest tightness showed seasonal variation ( $P<0.01$ ), being highest in autumn and winter and lowest in spring, and was also

**Table 1.** Outcome after three mailings of the questionnaire, and after follow up of 25% of non-respondents.

	% of subjects with outcome					
	After 3 mailings			25% of non-respondents		
	Cambridge (n = 5000)	Ipswich (n = 5000)	Norwich (n = 5000)	Cambridge (n = 391)	Ipswich (n = 302)	Norwich (n = 349)
Responded	50.3	66.8	60.8	20.2	17.2	31.2
Refused	0.1	0.3	0.3	12.8	27.2	11.7
Had moved	18.0	8.0	10.4	47.1	34.4	38.7
Were temporarily away	0.4	0.2	0.3	0.8	2.0	0.3
No response	29.8	23.5	27.1	19.2	19.2	17.8
Had died	0.1	0.1	0.1	—	—	—
Were of wrong age/sex <sup>a</sup>	1.3	1.2	1.0	—	—	—

<sup>a</sup>n = number of subjects in group. <sup>Q</sup>Questionnaire received from person of different age/sex to that on family health services authority register.

**Table 2.** Primary prevalence of asthma and asthma-like symptoms in all three areas combined.

	% prevalence (95% CI) of symptoms among 8893 subjects
<i>Symptom experienced in last 12 months</i>	
Wheeze	25.1 (24.2 to 26.0)
Wheeze without a cold	17.6 (16.8 to 18.4)
Wheeze and breathlessness	13.8 (13.1 to 14.5)
Woken:	
By cough	28.2 (27.3 to 29.1)
With chest tightness	18.0 (17.4 to 18.7)
By breathlessness	8.1 ( 7.5 to 8.6)
Asthma attack	5.1 ( 4.7 to 5.6)
Hay fever/nasal allergies	27.8 (26.9 to 28.7)
Taking asthma medication	6.6 ( 6.1 to 7.2)

CI = confidence interval.

significantly related to age group ( $P<0.05$ ), being highest in the age group 25–34 years (Table 3).

*Waking with cough.* Waking with cough was significantly related to season ( $P<0.001$ ), being generally lowest in summer and highest in winter (Table 3). The prevalence was greater among women than men, particularly in the 25–34 years age group.

*Asthma medication.* The prevalence of taking asthma medication was significantly related to age group ( $P<0.001$ ). For the age group 20–24 years it was 7.7% of 1570, for the age group 25–34 years 7.3% of 3899 and for 35–44 years it was 5.4% of 3424. The relationship between current asthma medication and age group remained significant at the 1% level even after adjustment for the reporting of wheeze in the last 12 months: 24.3% of those 440 respondents aged 20–24 years reporting wheeze reported taking asthma medication, 24.9% of those 971 aged 25–34 years and 19.2% of those 828 aged 35–44 years. A significantly higher proportion ( $P<0.05$ ) of those reporting having been woken by

**Table 3.** Prevalence of symptoms of waking with chest tightness and with cough among men and women in different age groups, by season.

Symptom	% prevalence (no. in group) reported by subjects during			
	Autumn	Winter	Spring	Summer
<i>Waking with chest tightness in men and women aged (years)</i>				
20–24	18.7 (166)	20.7 (357)	15.5 (659)	17.5 (388)
25–34	20.3 (414)	21.3 (783)	16.9 (1703)	18.4 (999)
35–44	19.2 (365)	17.4 (674)	15.0 (1529)	17.1 (856)
<i>Waking with cough in men aged (years)</i>				
20–24	27.1 (70)	21.4 (145)	20.6 (301)	18.6 (156)
25–34	20.3 (177)	24.9 (354)	19.1 (754)	17.5 (462)
35–44	23.9 (163)	25.9 (324)	23.3 (673)	19.9 (381)
<i>Waking with cough in women aged (years)</i>				
20–24	24.0 (96)	35.4 (212)	31.3 (358)	27.6 (232)
25–34	33.3 (237)	39.4 (429)	36.0 (949)	31.3 (537)
35–44	32.2 (202)	37.7 (350)	29.2 (856)	37.1 (475)

shortness of breath in the younger age group than in the older age groups were receiving treatment: 48.8% of those 121 respondents aged 20–24 years, 39.3% of those 324 aged 25–34 years and 33.6% of those 274 aged 35–44 years. Of the 457 respondents who reported an asthma attack in the last 12 months 24.1% denied taking asthma medication.

*Hay fever.* The prevalence of hay fever (or nasal allergies) was highest in the age group 20–24 years but was also higher among early respondents than among those who responded later. For example, after the first mailing, the prevalence among those 1026 respondents aged 20–24 years was 32.7%, among those 2685 aged 25–34 years it was 29.4% and among those 2403 aged 35–44 years it was 26.6%. This compares with values at the third mailing of 30.3% of 229, 28.6% of 471 and 19.6% of 378, respectively. No seasonal variation in the reporting of hay fever and nasal allergies was observed.

*Asthma attacks and waking with breathlessness.* The prevalence of these two symptoms was not related to age, sex, area or season. There was no evidence that those with these symptoms reported earlier in the survey than those who responded later.

#### Symptom prevalence among non-respondents

In Cambridge, Norwich and Ipswich asthma attacks were reported significantly less frequently among those in the non-respondent sample who eventually completed the questionnaire than among those who completed it after three mailings ( $P<0.05$ ) (Table 4). In Cambridge and Ipswich there was a lower prevalence and in Norwich a higher prevalence of being woken at night by shortness of breath among the non-respondents than among the respondents ( $P<0.05$  in the case of Norwich). The non-respondents had a lower prevalence of reported hay fever/nasal allergies than respondents in Cambridge and Ipswich but this was only significant in Cambridge ( $P<0.05$ ).

The prevalence of all other symptoms among the non-respondent sample was similar to that among respondents. Even in the presence of significant differences between the primary prevalence and non-respondent prevalence there was little effect on the adjusted prevalence (Table 4).

**Table 4.** Primary, non-respondent and adjusted prevalences of reported asthma attack, waking with breathlessness, and hay fever in Cambridge, Ipswich and Norwich.

Prevalence	% prevalence of symptom		
	Asthma attack	Waking with breathlessness	Hay fever
<i>Cambridge</i>			
Primary ( $n = 2516$ )	5.7	8.3	28.9
Non-respondent ( $n = 79$ )	3.8	7.6	17.7
Adjusted <sup>a</sup>	5.5	8.2	27.8
<i>Ipswich</i>			
Primary ( $n = 3338$ )	4.9	8.0	26.8
Non-respondent ( $n = 52$ )	0	3.8	17.3
Adjusted <sup>a</sup>	4.6	7.7	26.3
<i>Norwich</i>			
Primary ( $n = 3039$ )	4.9	8.0	28.0
Non-respondent ( $n = 109$ )	2.8	13.8	28.4
Adjusted <sup>a</sup>	4.7	8.7	28.1

$n$  = number of respondents in group. <sup>a</sup>Because adjusted prevalence is a theoretical sample, there is no baseline number.

## Discussion

The prevalence of asthma and asthma-like symptoms in young adults living in East Anglia has been determined using the British adaptation of the European community respiratory health survey protocol.

Self-administered questionnaires were widely acceptable (up to 67% of people responded) and were a cheap and convenient method of determining asthma prevalence in large numbers of subjects compared with clinical evaluation. Those who claim to have had asthma attacks in the last 12 months nearly always seem to have had asthma already diagnosed by their doctors,<sup>10</sup> but those who deny its presence may have the disease, and some children<sup>15</sup> and adults<sup>10,16</sup> may be diagnosed as asthmatic if clinically investigated. It seems appropriate therefore to ask subjects about their symptoms, not just about asthma.

The questions regarding symptoms in the questionnaire have been validated using bronchial hyper-responsiveness as the gold standard. Bronchial hyper-responsiveness which, when defined as a 20% fall in forced expiratory volume after inhalation of 8 micromoles of histamine using the Yan method,<sup>17</sup> has a prevalence of about 14% in young British adults, is not specific to clinically diagnosed asthma, although it is associated with it and is related to diurnal variation in peak flow<sup>18</sup> and requirement for treatment.<sup>19</sup> It is thought that virtually all people when experiencing variable airway obstruction will exhibit bronchial hyper-responsiveness<sup>20</sup> and some people with bronchial hyper-responsiveness may have no obvious lung disease although they have evidence of other atopic disease.<sup>21</sup> Bronchial hyper-responsiveness is not associated with steroid sensitive cough<sup>22</sup> but is associated with atopy, particularly in young adults, and with smoking.<sup>17</sup>

The sensitivity and specificity of each question for bronchial hyper-responsiveness varies.<sup>10-12</sup> The sensitivity is higher and the specificity is lower for questions which relate to symptoms than they are for questions which depend on the presence of asthma. This means that people with bronchial hyper-responsiveness are more likely to respond positively to symptom questions than asthma questions but at the same time more people without bronchial hyper-responsiveness will also answer in the affirmative. The question about being woken by shortness of breath seems to achieve the most reasonable balance, with a sensitivity of 0.74 and specificity of 0.97, making it a far better predictor of bronchial hyper-responsiveness than any of the questions which ask about asthma. For comparisons between two populations this question is the one that will give the least biased estimate of bronchial hyper-responsiveness.

The family health services authority register is a widely used and convenient sampling frame for postal surveys. The validity and accuracy of the sampling frame varies between areas and is dependent on the speed and accuracy with which it is updated. The Cambridge sampling frame was found to be less accurate than Norwich and Ipswich with more incorrect addresses, probably reflecting the presence of a mobile student population. It is possible that registers held within a general practice would be more accurate.

The accuracy of prevalence data can be seriously undermined by low response rates if there is evidence that those who have responded are significantly different from those who have not. The response rates for this study were lower than had been hoped, and the non-respondent sample indicates that significant differences for some symptoms in some areas were present. However, because non-response was predominantly explained by people having moved and because the prevalence in the non-respondent sample was not substantially different from the primary respondents there was little difference to the adjusted prevalence for these symptoms. Bakke and colleagues have shown that even in the presence of differing prevalence between primary

respondents and non-respondents, associations between exposure variables (in this analysis the exposure variable being age, sex, season and area) and symptom prevalence can still be valid.<sup>23</sup> In this study, although it was not reported here, associations between the presence of symptoms and age and sex in the non-respondent sample were similar to those in the primary respondents, although the power to detect a difference was low.

The prevalence of asthma-like symptoms in all three centres was higher than would be anticipated from a previous study of this age group.<sup>24</sup> The prevalence of reported waking at night with breathlessness at some time in the last 12 months was almost twice the highest prevalence found in 1986.<sup>24</sup> This may be due to differences in methodology.

As discussed previously nocturnal breathlessness is predictive of bronchial hyperreactivity to histamine, which in turn is known to be associated with clinically diagnosed asthma. Of those who responded positively to the question on nocturnal breathlessness, a higher proportion of those in the younger age groups were taking asthma medication compared with the older age groups. This may reflect a tendency of doctors to treat asthma symptoms more readily in younger subjects than older subjects.

The methodology used in this study was simple and could be adopted for use within any area or within any general practice with suitable computing support. Alternatively, the prevalence estimates could be applied directly to the practice population so that general practitioners can estimate the numbers of patients likely to suffer from respiratory symptoms. It is possible that there is geographical variation in asthma prevalence in the UK, and that East Anglia is a region with a high prevalence of asthma. In the absence of sufficient other studies using the same methodology and of sufficient statistical power it is impossible to know whether this is the case.

General practitioners who run chronic disease management clinics are obliged to maintain a register of patients with asthma (Department of Health, standard fees and allowances, 1993). From the prevalence estimates presented here, the number of young adults who should be on the register will vary widely depending on the symptom thresholds at which general practitioners choose to diagnose asthma in their patients. As asthma registers become more established the temptation will be to compare prevalence of asthma between practices using register data. If useful comparisons are to be made they should be on the basis of data collected by a standardized method, such as that presented here. The questionnaire is well validated, and other studies linking it to both quality of life measures and to markers of clinical disease are in progress.

This study of the prevalence of asthma and asthma-like symptoms in young adults living in East Anglia shows that 8% of young adults reported waking with an attack of shortness of breath within the last year, a figure higher than has been previously reported,<sup>24</sup> and 5% reported having had an asthma attack in the last 12 months. General practitioners who suspect that their patients experience a higher or lower prevalence of these symptoms could use the methodology presented to determine the prevalence of symptoms in their practice populations.

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