Prevalence of respiratory symptoms among 7 and 11 year old schoolchildren and association with asthma

R D CLIFFORD,*† M RADFORD,† J B HOWELL,* AND S T HOLGATE*
Departments of *Medicine and †Child Health, University of Southampton

SUMMARY A new self administered questionnaire completed by parents was used to study the prevalences of wheeze, shortness of breath, and cough in 2503 Southampton schoolchildren aged 7 and 11 together with exacerbating factors and background information including treatment and diagnosis. The questionnaire had a response rate of 84% and was found to be highly repeatable with respect to current symptoms. The overall prevalences of wheeze and shortness of breath in the current year (1986) were 12.1% and 8.5% respectively. Social class, home ownership, parental smoking, and presence of a family pet were unrelated to symptom prevalence. According to the parents the overall diagnosis rate for asthma was 9.5%. In common with other studies, however, we found considerable evidence for undertreatment. The symptoms of wheeze and nocturnal and morning breathlessness occurred more commonly in boys, but this sex ratio decreased with increasing age. The prevalences of wheeze and shortness of breath were similar in the two age groups. In contrast, there were only small differences between the sexes with respect to cough whereas, among children without wheeze or shortness of breath, there was a fall in the prevalence of cough from 18.9% at 7 years to 8.7% at 11 years. When controlling for the other respiratory symptoms, wheeze was the only symptom significantly related to parental asthma. The fall in the prevalence of cough between the two age groups is unlikely to be related to changes in asthma prevalence and, when not associated with wheeze, may be an indicator of separate pathology.

Studies of the prevalence of asthma produce widely varying rates even among European populations.1 These differences may be largely explained in terms of varying definitions of asthma and undue reliance on general practitioner diagnoses. This is confirmed by the considerably greater concordance between studies with respect to particular respiratory symptoms. Reliable information can only be gained if wheeze has been defined and explained adequately to parents.2-4 In a cross section survey in Melbourne, Williams and McNicol recorded a cumulative prevalence of 19% for wheeze at 7 years.2 Anderson et al reported a prevalence of 11% for wheeze during the current year in 9 year olds in Croydon.3 Lee et al found a prevalence of 14.8% between school entry and 7 years in northern England and showed reasonable concordance between a questionnaire history of wheeze and a clinical diagnosis of asthma defined by 'episodic airways obstruction characterised by wheeze or breathlessness'.4 Using a similar definition, the prevalence of asthma in 470 London children aged between 18 months and 11 years was found to be 11%.5

Although epidemiological studies on the prevalence of wheeze avoid difficulties over the definition of asthma, the possibility arises that the symptom of wheeze may occur in disorders other than classical asthma. In childhood asthma, other symptoms, particularly cough and breathlessness are also known to be important. There have been a number of reports of cough being the sole presenting symptom of asthma,6-8 however, the prevalence of this and other respiratory symptoms in childhood and their importance in the absence of wheeze has not been well studied.

A number of factors are known to affect the prevalence of asthma or the symptom of recurrent
wheezing during childhood. The tendency for the symptoms to improve with age is well known, although longer term follow up shows later recurrence. Boys have a higher prevalence of asthma in childhood but this difference disappears in adults and may be reversed in some age groups. Asthma is said to be diagnosed more commonly in the upper social groupings and home owner occupiers. Fathers are less likely than mothers to admit to symptoms in their children. A variety of factors have also been implicated in the pathogenesis of episodic wheezing and asthma and include inheritance, viral infection, exposure to common allergens, and parental smoking. In this study we have used a new questionnaire developed to explore the prevalence of common respiratory symptoms in schoolchildren and their association to each other, the diagnosis of asthma, and genetic and environmental factors.

Subjects and methods

Subjects
All children in their third year at 55 Southampton first and middle schools were studied by parental questionnaire over a six week period during the second half of the school summer term. The standardised movement of children between classes conveniently divided the children into two almost exact one year age ranges: 6-8 to 7-8 years in first schools and 10-8 to 11-8 years in middle schools. The schools comprised 30 of the 40 first schools in Southampton, 18 of the 28 middle schools, and seven of the 10 combined first and middle schools. Altogether questionnaires were sent to the parents of 2981 children. Questionnaires were delivered to the schools and given to the children to take home and they, in turn, returned them to the school when they had been completed. The local education authority would not allow release of names and addresses of children by the schools, thus although it was possible to calculate return rates, we were unable to obtain comparative information on children not returning questionnaires.

Questionnaire design
In view of the lack of a complete and well validated respiratory questionnaire for use in children suitable for a study of asthma, a new questionnaire was designed. The project demanded a self administered questionnaire that was simple to complete by parents and likely to result in high compliance. The length of the questionnaire was limited to six sides of 'A4' paper.

Wheeze and dyspnoea were identified by the questions: 'Has your child ever had an attack of wheezing (by wheezing I mean noisy breathing with a whistling sound coming from the chest not the throat)' and 'Has your child ever been either unexpectedly breathless at rest or more breathless than you would expect after exercise (by breathless I mean out of breath or puffed)?' Three questions were used to identify abnormal cough. Parents were asked 'Has your child ever seemed to cough more (or to get more coughs) compared to other children'. Two further questions were designed to identify recurrent coughing, unrelated to upper respiratory tract infection, occurring at night or first thing in the morning. Symptoms within the previous 12 months were classified as current and as past if occurring >12 months before completion of the questionnaire.

Further information characterising the current symptoms was obtained using questions aimed at identifying exacerbating factors. Information was further sought on chest pain or discomfort which has been described as a presenting symptom of asthma. Morbidity was briefly assessed using two questions—one on hospital admission and the other on number of days of school lost during the past year. The last part of the questionnaire provided background information on the children. Medical diagnoses given to the parents relating to the child’s chest problem were sought together with any current medications being used. Questions on parental smoking habits, household pets, and parental asthma were also included. Social status was defined by enquiry of each parent’s occupation and the family's accommodation whether rented or owner occupied.

Repeatability and validity testing
The repeatability of the questionnaire was tested by readministration to 200 parents. Children were selected with an increased preponderance of positive answers to the key questions on wheeze, cough, and shortness of breath: 50 cases denied all symptoms, 50 had wheeze alone, 31 shortness of breath alone, and 69 both shortness of breath and wheeze (the odd numbers in the last two groups resulted from the small numbers in the shortness of breath only group). Parents were only asked to fill in the sections on respiratory symptoms to improve compliance. The questionnaire was readministered four months after the original questionnaire in an attempt to avoid deliberate mimicking of previous answers but making a major change in symptom incidence or severity unlikely.

Statistical analysis
The Statistical Package for Social Sciences edition X was used for categorisation and analysis of data. Correlations between variables were calculated using the $\chi^2$ test or, when controlling for other variables,
the Mantel-Haenszel test. Repeatability of questionnaire replies was calculated both in terms of percentage agreement and by calculation of $\chi$, which is an index of repeatability described by Cohen, calculated by the formula: $P_{O} - P_{C}/1 - P_{C}$ where $P_{O}$ represents the proportion of agreement for the question and $P_{C}$ is the proportion of agreement expected by chance. It is thus independent of chance agreement so that comparison can be made between questions with differing proportions of positive and negative replies.

**Results**

**RESPONSE RATES AND REPEATABILITY**

A total of 2503 replies were received from the 2981 questionnaires sent, representing an overall response rate of 84%. The response rates in the two age groups were similar with 1275 replies from the parents of the 7 year olds and 1218 from the 11 year old group. There were slightly more boys than girls in both age groups with a male:female ratio of 1:3:1. The response rates at different schools varied widely but there was less association with the range of social classes surrounding the school than with the quality of the relationship between the school and the parents. One school in a ‘problem area’ achieved a questionnaire return rate of 100%. The return rate for the readministered questionnaire was lower at 50% of the 200 questionnaires sent out. The social class range of the responders to the repeat questionnaire was compared with that of the responders to the first administration but no significant differences could be shown.

The results of the repeatability study are presented in table 1. The questions on wheeze were the most

Table 1 Repeatability of questions relating to current symptoms, school loss, and hospital admission

<table>
<thead>
<tr>
<th>Questions</th>
<th>% Agreement</th>
<th>$\chi$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheeze current 12 months?</td>
<td>88.9</td>
<td>0.78</td>
</tr>
<tr>
<td>Woken by wheeze?</td>
<td>86.1</td>
<td>0.53</td>
</tr>
<tr>
<td>Wheeze in the morning?</td>
<td>88.0</td>
<td>0.69</td>
</tr>
<tr>
<td>Breathless current 12 months?</td>
<td>78.1</td>
<td>0.50</td>
</tr>
<tr>
<td>Woken by breathlessness?</td>
<td>88.9</td>
<td>0.42</td>
</tr>
<tr>
<td>Breathless in the morning?</td>
<td>87.0</td>
<td>0.37</td>
</tr>
<tr>
<td>Coughs more than others?</td>
<td>80.0</td>
<td>0.57</td>
</tr>
<tr>
<td>Night time cough?</td>
<td>83.0</td>
<td>0.60</td>
</tr>
<tr>
<td>Morning cough?</td>
<td>75.0</td>
<td>0.47</td>
</tr>
<tr>
<td>School loss?</td>
<td>88.4</td>
<td>0.73</td>
</tr>
<tr>
<td>Admitted to hospital?</td>
<td>95.8</td>
<td>0.79</td>
</tr>
<tr>
<td>Ever chest pain/discomfort?</td>
<td>76.3</td>
<td>0.47</td>
</tr>
<tr>
<td>Sleep loss due to chestiness?</td>
<td>84.2</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Table 2 Prevalences of individual symptoms by age and sex. Results are given as a percentage with that symptom of the number of children whose parents replied to the relevant question in the questionnaire

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Age 7 years</th>
<th>Age 11 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls (No)</td>
<td>Boys (No)</td>
</tr>
<tr>
<td>Wheeze:</td>
<td>15-9 (623)</td>
<td>22-7 (651)</td>
</tr>
<tr>
<td>Cumulative***</td>
<td>9-5 (621)</td>
<td>14-3 (651)</td>
</tr>
<tr>
<td>Current 12 months***</td>
<td>6-3 (622)</td>
<td>7-9 (648)</td>
</tr>
<tr>
<td>Nocturnal***</td>
<td>3-5 (621)</td>
<td>8-9 (650)</td>
</tr>
<tr>
<td>Morning***</td>
<td>7-2 (621)</td>
<td>12-3 (649)</td>
</tr>
<tr>
<td>Shortness of breath:</td>
<td>4-8 (620)</td>
<td>9-0 (647)</td>
</tr>
<tr>
<td>Cumulative†</td>
<td>1-9 (620)</td>
<td>5-2 (649)</td>
</tr>
<tr>
<td>Current 12 months†</td>
<td>1-6 (619)</td>
<td>4-5 (648)</td>
</tr>
<tr>
<td>Nocturnal†</td>
<td>27-9 (623)</td>
<td>33-7 (603)</td>
</tr>
<tr>
<td>Morning†</td>
<td>17-3 (573)</td>
<td>18-2 (605)</td>
</tr>
<tr>
<td>Chest discomfort†</td>
<td>18-5 (567)</td>
<td>22-6 (606)</td>
</tr>
<tr>
<td>'Chesty' at night‡</td>
<td>18-2 (598)</td>
<td>20-3 (636)</td>
</tr>
<tr>
<td>Hospitalised with wheeze and/or shortness of breath:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative†</td>
<td>4-5 (594)</td>
<td>6-9 (622)</td>
</tr>
<tr>
<td>Current 12 months</td>
<td>4-5 (594)</td>
<td>5-0 (622)</td>
</tr>
<tr>
<td>Medical diagnosis of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma***</td>
<td>7-2 (613)</td>
<td>11-7 (642)</td>
</tr>
<tr>
<td>Bronchitis†</td>
<td>11-1 (606)</td>
<td>14-0 (636)</td>
</tr>
</tbody>
</table>

$x^2$ analyses: *p<0.05, **p<0.001 for girls v boys, ignoring age; †p<0.05, ‡p<0.001 for 7 year olds v 11 year olds, ignoring sex.
repeatable of the symptom questions. Also highly repeatable were the answers to the enquiry about hospital admissions. Low values of χ were produced for enquiries regarding specific information about symptoms such as when they occurred, and for the symptom of chest pain.

**Prevalence data**

The prevalences of individual symptoms are displayed by sex and age in Table 2. The cumulative prevalences of wheeze and shortness of breath and the prevalences of diagnosed asthma and bronchitis refer to symptoms since birth. All other symptom categories refer to symptoms within the 12 months preceding receipt of the questionnaire. The current prevalences of wheeze, shortness of breath, and cough among the whole population sample were respectively 12.1%, 11.6%, and 26.8%. The major differences between the sexes appeared to be in the symptoms of wheeze and shortness of breath, in that there were higher prevalences in boys. The label ‘asthma’ had also been given 1.4 times more frequently in boys than in girls. In contrast, cough appeared to have little relation to gender but showed a considerable and highly significant decrease in prevalence between the ages of 7 and 11 years. Among children without wheeze or shortness of breath, the prevalence of a positive answer to one of the three cough questions fell from 18.9% at 7 years to 8.7% at 11 years. The associations between each of the three symptoms were found to be highly significant (p<0.001 for each association controlling for the remaining symptom by the Mantel-Haenszel test).

The higher prevalences of wheeze and shortness of breath in boys are reflected in the higher proportion who had been admitted to hospital both in the current year and since birth with these symptoms. Nearly 5% of the whole group and 7% of 7 year old boys had been admitted to hospital with wheeze or shortness of breath. The higher prevalence of nocturnal ‘chestiness’ among 7 year olds, compared with 11 year olds, was highly significant (p<0.001) and may reflect the higher prevalence of nocturnal cough. The increase in chest pain or discomfort between 7 and 11 years is also significant, but only occurred in girls and thus is unlikely to be related to the other respiratory symptoms.

Analysis of the responses to questions on when respiratory symptoms first occurred, whether they were current, and when they last occurred was used to calculate prevalences for wheeze at each age from birth onwards. These calculated prevalences are likely to be inaccurate due to recall bias and are, therefore, not presented here. Because the degree of bias is likely to be similar between the two sexes, however, we could make observations on the differences between the sexes at different ages. The prevalence of wheeze in boys rose sharply to the age of 5 years with a slight fall off thereafter. In girls the prevalence of wheeze was lower at all ages but the rise in prevalence appeared to continue up to the age of 8 years. The ratio of the prevalence of wheeze in boys to that in girls showed a considerable, and highly significant, decrease with increasing age of the child (Figure).

**Associations between background data and respiratory symptoms**

The predominant occupation of parents among those sampled was skilled workers (45%). Sixty six percent were home owners. More than half of the children (56%) were exposed to passive smoking at home. Two thirds of families possessed a pet, this being a cat or dog in 51% of families. However, this study did not show associations between class, passive smoking, or pet ownership and any respiratory symptom. Only age, gender, and the presence of parental asthma showed significant associations with the prevalences of cough, wheeze, and shortness of breath. Parental asthma was positively associated with all three symptoms. Because of the strong associations between each of these symptoms, the Mantel-Haenszel test was used to examine the association between parental asthma and each symptom controlling for the other two. Wheeze remained highly associated with parental asthma (p=0.0012) when controlling for cough and shortness of breath, but neither cough nor shortness of breath were significantly associated with parental asthma when controlling for wheeze (p=0.4, p=0.2 respectively). In addition, no association with the more
was gained during only Discussion both.

The prevalence of 'asthma' was concentrated upon increasing importance of 'asthma' in association with either current wheeze or shortness of breath mainly as a result of difficulties over definition and underdiagnosis of the condition.\(^{31,32}\) Recent studies have included other symptoms, such as nocturnal cough, but little is known about their epidemiological validity as independent markers of asthma. We have designed and tested a childhood respiratory questionnaire for completion by parents and have used it for measuring the prevalences and inter-relationships of wheeze, shortness of breath, and cough among over 2500 children of 7 and 11 years. The associations of genetic and environmental factors to each of these symptoms have been examined. We have also presented information on morbidity, diagnosis, and treatment received by the children.

The 84% return rate for this questionnaire, containing 33 questions, compares favourably with a 74% return achieved by Mortagy et al, also in Southampton, using an adult respiratory questionnaire containing 21 questions.\(^{34}\) Salome et al reported a return rate of 85% for a self administered respiratory questionnaire used in a study of children in 25 schools in two Australian towns using similar collection and delivery methods to the present study.\(^{33}\) A remarkably high return rate of >99% was reported by Lee et al for a questionnaire containing just four questions.\(^{4}\) Apart from their greater lengths, the questionnaires used by Salome et al\(^ {33}\) and ourselves contained some 'sensitive' questions concerning occupation and housing and included a request for consent to be contacted for further study. Because of the high number of schools involved in the present study, a low return from one or two schools with appreciable effects on the overall rate was almost inevitable.

Two questions used in the present study, those for wheeze and night time cough, were similar in wording to questions used by Salome et al and had similar repeatabilities in the two studies both in terms of percentage agreement and coefficient of agreement (\(\chi^2\)).\(^ {33}\) This indicates that these indices are appropriate for comparisons of repeatability, and has the advantage of being independent of chance agreement which alters with the proportion of positive replies.\(^ {30}\) We found that questions on wheeze were the most repeatable and those on shortness of breath and chest discomfort least repeatable with the cough questions being intermediate. We also recorded high levels of repeatability for questions on school loss and hospital admission.

We have confirmed a lower prevalence of respiratory symptoms when the questionnaire was completed by the father.\(^ {17}\) It is possible that fathers were less likely to fill in the questionnaire in the case of illness in the child because of their smaller role as carers.

**Discussion**

Epidemiological studies of childhood asthma have increasingly concentrated upon the prevalence of wheeze mainly as a result of difficulties over definition and underdiagnosis of the condition.\(^ {31,32}\) Recent studies have included other symptoms, such as nocturnal cough, but little is known about their epidemiological validity as independent markers of asthma. We have designed and tested a childhood respiratory questionnaire for completion by parents and have used it for measuring the prevalences and inter-relationships of wheeze, shortness of breath, and cough among over 2500 children of 7 and 11 years. The associations of genetic and environmental factors to each of these symptoms have been examined. We have also presented information on morbidity, diagnosis, and treatment received by the children.

The 84% return rate for this questionnaire, containing 33 questions, compares favourably with a 74% return achieved by Mortagy et al, also in Southampton, using an adult respiratory questionnaire containing 21 questions.\(^ {34}\) Salome et al reported a return rate of 85% for a self administered respiratory questionnaire used in a study of children in 25 schools in two Australian towns using similar collection and delivery methods to the present study.\(^ {33}\) A remarkably high return rate of >99% was reported by Lee et al for a questionnaire containing just four questions.\(^ {4}\) Apart from their greater lengths, the questionnaires used by Salome et al\(^ {33}\) and ourselves contained some 'sensitive' questions concerning occupation and housing and included a request for consent to be contacted for further study. Because of the high number of schools involved in the present study, a low return from one or two schools with appreciable effects on the overall rate was almost inevitable.

Two questions used in the present study, those for wheeze and night time cough, were similar in wording to questions used by Salome et al and had similar repeatabilities in the two studies both in terms of percentage agreement and coefficient of agreement (\(\chi^2\)).\(^ {33}\) This indicates that these indices are appropriate for comparisons of repeatability, and has the advantage of being independent of chance agreement which alters with the proportion of positive replies.\(^ {30}\) We found that questions on wheeze were the most repeatable and those on shortness of breath and chest discomfort least repeatable with the cough questions being intermediate. We also recorded high levels of repeatability for questions on school loss and hospital admission.

We have confirmed a lower prevalence of respiratory symptoms when the questionnaire was completed by the father.\(^ {17}\) It is possible that fathers were less likely to fill in the questionnaire in the case of illness in the child because of their smaller role as carers.

**Table 3 Treatment received by 299 children with current wheeze and 178 with diagnosed asthma in association with either current wheeze or shortness of breath**

| Drug treatment | % With current wheeze | % With diagnosed asthma plus symptoms
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No treatment</td>
<td>45.8</td>
<td>19.7 (8.8)</td>
</tr>
<tr>
<td>Non-asthma</td>
<td>8.7</td>
<td>5.6 (0)</td>
</tr>
<tr>
<td>Inhaled bronchodilator</td>
<td>18.4</td>
<td>31.5 (18.2)</td>
</tr>
<tr>
<td>Prophylactic alone*</td>
<td>4.7</td>
<td>8.4 (26.7)</td>
</tr>
<tr>
<td>Prophylactic with inhaled bronchodilator</td>
<td>13.4</td>
<td>23.0 (17.1)</td>
</tr>
<tr>
<td>Oral bronchodilator†</td>
<td>4.7</td>
<td>5.1 (11.1)</td>
</tr>
<tr>
<td>Other drug regime</td>
<td>4.3</td>
<td>6.7 (8.3)</td>
</tr>
</tbody>
</table>

*Inhaled steroids and/or sodium cromoglicate.
†Oral \(\beta_2\) agonist and/or methylxanthine.
‡Either wheeze or shortness of breath during the previous 12 months.
§Figures in parenthesis refer to 26 children missing >20 days school per year.
Certainly symptoms were most prevalent in children where both parents had completed the questionnaire in conjunction, presumably reflecting increased parental involvement and concern. This impression appeared to be confirmed during the second phase of the study where one of us had the opportunity to meet a large number of the parents. The design of the study, however, did not enable us to measure the extent to which under reporting of symptoms by fathers may have been occurring. Fortunately only 9% of questionnaires were completed by the father alone. Clearly, this problem is likely to be common to all such epidemiological studies, including adult studies where males could under report their own symptoms. The sex of the responder to the questionnaire was not related to other factors such as sex or age of the child and, therefore, is not likely to represent a confounding influence upon the associations between these factors and respiratory symptoms.

The prevalence of wheeze in the year preceding the questionnaire (current prevalence) was found to be 12.1% and the cumulative prevalence from birth was 18.8%. These figures are comparable with those reported from other studies in western countries when a similar questionnaire format was used. However, there are little published data on the prevalence of other respiratory symptoms in childhood. Shortness of breath, although not occurring as frequently as wheeze, is a common complaint as indicated by a current prevalence of 8.5%. Approximately one third of parents of 7 year old children and one quarter of all parents believed that their children coughed more than others. Nocturnal cough occurred in 14.2% of the total childhood population studied and reached as high as 18.2% in 7 year old boys; however, only half of children with recurrent cough had associated wheeze.

In this study we have confirmed previous observations of a higher prevalence of wheeze in boys when compared with girls. Overall 1.37 times more boys had wheezed during the current year. These differences were reflected in the higher prevalence of shortness of breath among boys compared with girls with the greatest differences occurring in the prevalences of shortness of breath at night and in the early morning. In contrast the differences between the sexes with respect to cough were small and only just reached significance for the current 12 months with insignificant differences for nocturnal cough. Variations in symptom prevalence between the two age groups were also recorded but differed from those occurring between sexes in that they related only to the symptom of cough. A 30% decrease in the prevalence of problematic cough occurred between 7 years and 11 years, which was not accompanied by a change in the prevalence of wheeze. Indeed the most dramatic fall in cough prevalence from 18.9% at 7 years to 8.7% at 11 years occurred in children without associated wheeze or shortness of breath.

Calculation of annual prevalences of wheeze by gender revealed differences between boys and girls. Boys reached their peak prevalence of wheeze by 5 years, but in girls a gradual increase in prevalence continued up to the age of 8 years resulting in a progressive and highly significant decrease in the male to female ratio for wheeze with increasing age (figure). These trends in prevalence and male to female ratio are in line with data published from national morbidity statistics relating to asthma in general practice, and therefore would be worthy of further prospective study.

The presence of asthma in one or more of the parents had appreciable effects on the prevalence of respiratory symptoms in their children. Both wheeze and shortness of breath were reported twice as frequently and cough was 1.4 times more prevalent in this group of children. Although shortness of breath and cough were related to the presence of parental asthma, the association disappeared when we controlled for the symptom of wheeze. In contrast, wheeze remained strongly related to parental asthma even when controlling for both cough and shortness of breath. Assuming that parental asthma is responsible for an increased prevalence of asthma and no other illness in the offspring, wheeze must be a key symptom of asthma with cough and shortness of breath being related but subordinate symptoms. The latter finding, the small male to female ratio in prevalence of cough, and the fall in cough prevalence between the ages of 7 and 11 years with no associated drop in the prevalence of wheeze all point to recurrent cough being of low specificity as an epidemiological marker for asthma.

We were unable to show an association between wheeze or other respiratory symptoms and home ownership or parent's occupation. The association between respiratory symptoms and parental smoking reported by Bland et al was found from a questionnaire filled in by the children themselves. The absence of an association in our parental questionnaire may represent a degree of denial or lower expectations among parents who smoke. The repeated personal interviews and examinations in the study of Cogswell et al may well have avoided this problem. It is reassuring that the prevalence of wheeze was no greater among the two thirds of children with a feathered or furry pet despite the clear importance of animal danders as precipitants of attacks in those with pre-existing asthma.

A remarkable number of children were reported by their parents to have been in hospital with asthma. This is likely to have been reliably reported
in view of the importance of such a life event and the
good repeatability of this question. The observation
that fewer 11 than 7 year olds were admitted to
hospital, however, might suggest that parents may
have failed to recollect some admissions. The rates
for the current 12 months are nevertheless likely to
be accurate. Altogether 115 of the children had been
admitted to hospital with wheezing or breathlessness
comprising 4.9% of the sample including 4% during
the previous 12 months. It would seem unlikely that
more than a small proportion of admissions could be
accounted for by other causes of breathlessness such
as acute pneumonia. Anderson et al reported a
167% rise in hospital admissions for asthma between
1970 and 1978, and it is likely that this trend has
continued with improved awareness of the illness.

The proportion of children (9.5%) whose parents
had been told they had asthma was only slightly
lower than the 12.1% current prevalence of wheeze.
These figures compared with just one eighth of the
9.3% of children identified as having current wheeze
who had received a diagnosis of asthma in the study
of Lee et al in north Tyneside. Our diagnosis rate
also compares favourably with the 7.8% reported by
Hejine den Bak in a training practice in west Cumbria.
Levy and Bell reported a diagnosis rate of 11% but in a practice with a special interest in
asthma. The proportion of middle class parents and
home owners in this study was high in comparison
with the likely range in some inner city environments.
Presumably these parents would have higher expecta-
tions for accurate diagnosis and effective treatment
of their children if they were having disabling
symptoms. Despite the apparently excellent diag-
nosis rate, we found evidence for considerable
under treatment of asthma symptoms, as reported in
other studies. Fewer than half of children with
current wheeze were receiving any appropriate
treatment. When the children who had received a
diagnosis of asthma and had experienced shortness
of breath or wheeze during the current year were
analysed, more than a quarter were not receiving
any form of antiasthma treatment. Fifteen percent
of the children with diagnosed symptomatic asthma
were missing more than 20 days of schooling each
year, and less than half of these were receiving a
prophylactic medication with 9% not receiving any
treatment at all.

In conclusion we have developed and tested a new
questionnaire for examining the prevalence of res-
piratory symptoms in children. When applied to
a large population of 7 and 11 year old schoolchildren
the symptom of wheeze most closely paralleled the
diagnosis of asthma with respect to male:female
to ratio and association to parental asthma. Moreover
the high prevalence of cough with or without
wheezing and an appreciable decrease of this
symptom by the age of 11 years identifies a major
respiratory problem in schoolchildren, which is not
closely associated with asthma but rather is probably
associated with recurrent viral infections and later
acquisition of immunity. The study showed strong
evidence for under treatment of asthma despite a
high diagnosis rate.

The authors would like to thank Mrs L Jackson for performing the
allergen skin tests, Mr M Mullee for his valuable help with the
computing, and Dr M Campbell for helpful statistical advice.
The work was supported by a project grant from the Asthma
Research Council.

References

2. Williams H, McNicol K. Prevalence, natural history and
relationship of wheezy bronchitis and asthma in children. An
3. Anderson HR, Bailey PA, Cooper JS, Palmer JC, West S.
Medical care of asthma and wheezing illness in children: a
community survey. J Epidemiol Community Health 1983;37:
180–6.
4. Lee DA, Winslow NR, Speight ANP, Hey EN. Prevalence and
5. Levy M, Bell L. General practice audit of asthma in childhood.
manifestation of airflow hyperreactivity. Pediatrics 1981;67:
6–12.
8. Yahav Y, Katzenelson D, Shlomo B. Persistent cough—a form
11. Martin AJ, McLennan LA, Landau LI, Phelan PD. The natural
history of childhood asthma to adult life. Br Med J 1980;280:
1397–400.
12. Blair H. Natural history of childhood asthma: 20 year follow up.
13. Britten N, Davies J, Colley J. Early respiratory experience and
subsequent cough and peak expiratory flow rate in 36 year old
14. Kelly WJW, Hudson J, Phelan PD, Pain MLF, Ofilsky A.
Childhood asthma in adult life: a further study at 28 years of
15. Fleming DM, Crompton DL. Prevalence of asthma and hay fever
16. Anderson HR, Bailey PA, Cooper JS, Palmer JC, West S.
Morbidity and school absence caused by asthma and wheezing
17. Schechter MB, Samet JM, Speizer FE. Risk factors for childhood
respiratory disease: the effect of host factors and home
1971;26:249–85.
19. Sibbald B, Horn MEC, Brain EA, Gregg I. Genetic factors in
20. Clifford RD, Pugsley A, Radford M, Holgate ST. Symptoms,
ataxy, and bronchial response to methacholine in parents with
Prevalence of respiratory symptoms among 7 and 11 year old schoolchildren


Correspondence and requests for reprints to Dr RC Clifford, Institute of Child Health, Royal Hospital for Sick Children, St Michael’s Hill, Bristol BS2 8BJ.

Accepted 17 January 1989

See p 1194.