Stability of respiratory symptoms in unlabelled wheezy illness and nocturnal cough

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Abstract

Objective—To assess the natural history of respiratory symptoms not labelled as asthma in primary schoolchildren.

Design—Repeat questionnaire survey of subgroups identified from a previous questionnaire survey after a two year delay.

Subjects—The original population of 5321 Sheffield children aged 8-9 years yielded 4406 completed questionnaires in 1991 (82.8%). After excluding children with a label of asthma, there were 370 children with current wheeze, 129 children with frequent nocturnal cough, and a random sample of 222 children with minor cough symptoms and 124 asymptomatic children.

Results—Response rates in the four groups were 233 (63.0%), 77 (59.7%), 160 (72.1%), and 90 (72.6%) respectively. Of those who initially wheezed, 114 (48.9%) had stopped wheezing and 42 (18.0%) had been labelled as having asthma. Those with more frequent wheezing episodes (p<0.02) and a personal history of hay fever (p<0.01) in 1991 were more likely to retain their wheezy symptoms. In the children with frequent nocturnal cough in 1991, 20.1% had developed wheezing, 42.9% had a reduced frequency of nocturnal coughing, and 14.2% had stopped coughing altogether two years later. One sixth had been labelled as having asthma. Children with nocturnal cough were more likely to develop wheezing if they had a family history of atopy (p = 0.02). Only 3.8% and 3.3% of those with minimal cough and no symptoms respectively in 1991 had developed wheeze by 1993 (1.9% and 1.0% labelled as asthma).

Conclusions—Most unlabelled recurrent respiratory symptoms in 8-10 year olds tend to improve. Unlabelled children who have persistent symptoms have other features such as frequent wheezing attacks and a family or personal history of atopy. If a screening questionnaire were to be used to identify such children, a combination of questions should be employed.

(Part of the International Study of Asthma and Allergies in Childhood (ISAAC).)

Keywords: asthma, screening, respiratory symptoms.

Undiagnosed asthma continues to cause concern, although the proportion of wheezy children labelled and treated as having asthma has generally increased over the last decade. Suggestions have been made that there should be screening programmes to identify such children. In a selected group, Speight et al were able to show a reduction in morbidity following treatment after initial identification by a screening questionnaire as undiagnosed asthma. However, in an intervention study, Hill et al showed similar improvement in morbidity in intervention and control children with undiagnosed or undertreated symptoms. This suggests that wheezy illness improves over time, irrespective of whether it is labelled and treated as asthma.

As part of the assessment of any screening procedure the natural history of the untreated or unlabelled illness has to be known. The natural history of asthma and unlabelled recurrent milder respiratory symptoms needs further evaluation before any screening programmes are implemented. The aim of this study was to examine the changes in respiratory symptoms over a two year period in symptomatic children who had not been labelled as having asthma.

Methods

The study had been approved by the South Sheffield research ethics committee.

PRELIMINARY STUDY

All children in one school aged 8-9 years attending Sheffield primary schools were surveyed between September 1991 and March 1992, using a standardised questionnaire containing the core wheeze questions from the International Study of Asthma and Allergies in Childhood (ISAAC). The questionnaire was designed to identify both those children currently labelled as having asthma and those with a history of recurrent respiratory symptoms but not so labelled. Translations were available in Urdu, Chinese, and Bengali. The details of this study have been reported previously.

Using the data from this initial questionnaire, four groups of children were identified for reassessment after two years: group 1—current wheeze: children with wheezing within the last 12 months and without a current label of asthma; group 2—frequent nocturnal cough: children with nocturnal cough occurring more frequently than once a week in the last 12 months and no current wheeze or a current label of asthma; group 3—minimal cough: children with daytime cough or nocturnal cough less frequently than once a week but more than once a month and no current wheeze or a current label of asthma; group 4—asymptomatic: children with no recent his-
tory of wheezing or nocturnal cough and no current label of asthma.

STABILITY OF SYMPTOMS STUDY
In the second phase of the study the four groups of children were contacted by post rather than using the school to circulate the questionnaires. A letter explaining the nature of the study was sent along with another questionnaire, similar to the initial one. The study was completed between September 1993 and March 1994, which was the same season as the original study.

Non-responders were sent another questionnaire one and two, and a random sample of 10% of children in groups 3 and 4 were selected for the second survey.

STATISTICS
Data were stored on a Statsview 512+ program and were analysed using contingency tables to assess any changes over time and χ² testing for significance testing of those changes between groups with Yates’s continuity correction factor (χ²ᵧ) for small numbers. For data involving ordered proportions we have used the χ² test for trend (χ²trend) with one degree of freedom. Random numbers were used to identify cohorts of children for follow up in groups 3 and 4.

Results
PRELIMINARY STUDY
Out of the 131 private and local authority primary schools in Sheffield, 129 agreed to take part in the study. There were 4585 questionnaires returned out of a possible 5321 children eligible for the study (86.1%). Incomplete questionnaires were excluded: 46 (1.0%) with the current asthma response missing, 11 (0.2%) with current wheeze question response missing, and 122 (2.7%) with nocturnal cough question response missing. Thus 4406 of the questionnaires (82.8%) formed the study population for phase two. Figure 1 illustrates the population and the groups studied.

Table 1 Wheezy symptoms and status of labelling of asthma comparing the 1991 survey with 1993 survey for groups 1 to 4: current wheeze (n=233), frequent nocturnal cough (n=77), minimal cough (n=160), asymptomatic (n=90). Figures are number (%)

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<tbody>
<tr>
<td>Ever had asthma</td>
<td>108</td>
<td>136</td>
<td>5 (6.5)</td>
<td>20 (26.0)</td>
<td>1 (0.6)</td>
<td>6 (3.8)</td>
<td>0</td>
<td>2 (2.3)</td>
</tr>
<tr>
<td>Current asthma</td>
<td>0</td>
<td>42 (18.0)</td>
<td>0</td>
<td>12 (15.6)</td>
<td>0</td>
<td>3 (1.9)</td>
<td>0</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>Ever wheeze</td>
<td>231 (99.1)</td>
<td>188 (80.7)</td>
<td>17 (22.1)</td>
<td>31 (40.3)</td>
<td>0</td>
<td>14 (8.7)</td>
<td>0</td>
<td>4 (4.4)</td>
</tr>
<tr>
<td>Current wheeze</td>
<td>233 (100.0)</td>
<td>119 (51.1)</td>
<td>0</td>
<td>16 (20.1)</td>
<td>0</td>
<td>6 (3.8)</td>
<td>0</td>
<td>3 (3.3)</td>
</tr>
<tr>
<td>Severe wheeze*</td>
<td>19 (8.2)</td>
<td>15 (6.4)</td>
<td>0</td>
<td>5 (6.5)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Severe wheeze = wheeze, so severe as to limit the child’s speech to one or two words between breaths.
† Current wheeze = 12 month period prevalence of wheeze.
‡ Current asthma = reported as currently labelled as having asthma.

Figure 1 Results from original population in 1991 with details of the four groups identified for follow up in 1993. Numbers of children labelled as asthma in 1991 also shown.
Table 2  The changes in frequency of wheeze attacks and sleep disturbance due to wheeze between 1991 and 1993 in Group 1: current wheeze (n=233). Figures are numbers (%)

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
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<tbody>
<tr>
<td></td>
<td>None</td>
<td>1-3</td>
<td>4-12</td>
<td>&gt; 12</td>
</tr>
<tr>
<td>Wheeze attacks 1993*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>4(1.7)</td>
<td>96(41.2)</td>
<td>14(6.0)</td>
<td>0</td>
</tr>
<tr>
<td>1-3</td>
<td></td>
<td>70(30.0)</td>
<td>6(2.6)</td>
<td>0</td>
</tr>
<tr>
<td>4-12</td>
<td></td>
<td>17(7.3)</td>
<td>15(6.4)</td>
<td>2(0.9)</td>
</tr>
<tr>
<td>&gt; 12</td>
<td></td>
<td>3 (1.3)</td>
<td>3 (1.3)</td>
<td>2 (0.9)</td>
</tr>
<tr>
<td>Total</td>
<td>5 (2.1)</td>
<td>186(79.8)</td>
<td>36 (16.3)</td>
<td>4 (1.7)</td>
</tr>
<tr>
<td>Sleep disturbance 1993†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>68 (29.2)</td>
<td>64 (27.4)</td>
<td>18 (7.7)</td>
<td>5 (2.2)</td>
</tr>
<tr>
<td>&lt; 1/week</td>
<td>12 (5.2)</td>
<td>34 (14.6)</td>
<td>7 (3.0)</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>1-2/week</td>
<td>6 (2.6)</td>
<td>6 (2.6)</td>
<td>3 (1.3)</td>
<td>4 (1.7)</td>
</tr>
<tr>
<td>&gt; 2/week</td>
<td>0</td>
<td>2 (0.9)</td>
<td>1 (0.4)</td>
<td>2 (0.9)</td>
</tr>
<tr>
<td>Total</td>
<td>86 (36.9)</td>
<td>106 (45.5)</td>
<td>29 (12.4)</td>
<td>12 (5.2)</td>
</tr>
</tbody>
</table>

*  Wheeze attacks in the preceding 12 months; 1-3 = 1-3 occasions; 4-12 = 4-12 occasions; > 12 = more than 12 occasions.
†  Sleep disturbance due to wheeze in the last 12 months; < 1/week = occurring less than once a week; 1-2/week = occurring one or less than two times per week; > 2/week = occurring more than two times per week.

second surveys are illustrated in tables 1 and 2. During the two year period, 42 (18.0%) had been labelled as having asthma. Four of these children had stopped wheezing but had developed frequent nocturnal cough. The remainder had continued to wheeze.

The 119 children (51.1%) who were still wheezing after two years were more likely to have had frequent wheezing on the initial survey ($\chi^2_{\text{pooled}} = 5.98, p < 0.02$) and had a more frequent personal history of hay fever [35/119 (29.4%) compared to 14/114 (12.3%), $\chi^2 = 8.9, p = 0.01$. A personal history of eczema, male gender, family history of atopy, and other respiratory symptoms including severe wheeze and nocturnal or day time cough (tables 3 and 4) were not significantly different.

Severe wheeze (defined as wheezing so severe as to limit the child’s speech to one or two words between breaths) was reported in 19 children in 1991 (8.2%). This symptom persisted in only four children. A further 11 children (4.7%) who had not had severe wheeze in 1991 had developed the symptom in 1993. Thus there was a total of 15 children in the initial wheezy group who had severe wheeze in 1993. Ten of these children had been labelled as having asthma.

We compared the 38 wheezy children who had been labelled as having asthma by 1993 with the 81 children who were still wheezing but had not been labelled as having asthma. The children were more likely to be labelled as having asthma if they were female [21/49 (42.9%) vs 17/70 (24.3%), $\chi^2 = 3.76, p = 0.05$], if they had a past history of asthma [27/38 (71.0%) vs 32/78 (41.0%), $\chi^2 = 9.22, p < 0.01$, and if they had more frequent nocturnal cough ($\chi^2 = 4.88, p < 0.05$).

Other demographic data and initial respiratory symptoms including severe speech limiting wheeze were not significantly different. The changes in prevalence of nocturnal and day time cough are illustrated in tables 3 and 4.

Non-responders—There were 137 (37%) children in this group who did not respond to the second questionnaire. There were two differences between the responders and the non-

Table 3  Changes in nocturnal cough symptoms between 1991 and 1993 in the 233 children who initially reported current wheeze in 1991. Figures are number (%). Two groups: 114 children who had stopped wheezing by 1993 and 119 who continued to wheeze in 1993

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
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<tbody>
<tr>
<td></td>
<td>Never</td>
<td>&lt; 1/week</td>
<td>1-2/week</td>
<td>&gt; 2/week</td>
</tr>
<tr>
<td>Stopped wheezing by 1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>3 (12.8)</td>
<td>14 (12.8)</td>
<td>1 (0.9)</td>
<td>18 (16.5)</td>
</tr>
<tr>
<td>Never</td>
<td>2 (1.8)</td>
<td>65 (59.6)</td>
<td>15 (13.8)</td>
<td>82 (75.2)</td>
</tr>
<tr>
<td>&lt; 1/week</td>
<td>0</td>
<td>3 (28.3)</td>
<td>5 (5.5)</td>
<td>9 (8.3)</td>
</tr>
<tr>
<td>&gt; 1/week</td>
<td>5 (4.6)</td>
<td>82 (75.2)</td>
<td>22 (20.2)</td>
<td>109 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>11 (9.3)</td>
<td>87 (73.7)</td>
<td>20 (17.0)</td>
<td>118 (100)</td>
</tr>
</tbody>
</table>

< 1/week = nocturnal cough occurring less than once a week; > 1/week = nocturnal cough occurring more than once a week.

Note: six incomplete answers on questionnaires.

Table 4  The changes in day time cough symptoms between 1991 and 1993 in the 233 children who initially reported current wheeze in 1991. Figures are number (%). Two groups: 114 children who had stopped wheezing by 1993 and 119 who continued to wheeze in 1993

<table>
<thead>
<tr>
<th></th>
<th>1991</th>
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<tbody>
<tr>
<td></td>
<td>Never</td>
<td>&lt; 1/week</td>
<td>1-2/week</td>
<td>&gt; 2/week</td>
</tr>
<tr>
<td>Stopped wheezing by 1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>1 (0.9)</td>
<td>26 (24.1)</td>
<td>0</td>
<td>27 (25.0)</td>
</tr>
<tr>
<td>Never</td>
<td>3 (2.8)</td>
<td>61 (56.5)</td>
<td>13 (12.0)</td>
<td>77 (71.3)</td>
</tr>
<tr>
<td>&lt; 1/week</td>
<td>3 (2.8)</td>
<td>1 (0.9)</td>
<td>4 (3.7)</td>
<td>8 (7.5)</td>
</tr>
<tr>
<td>&gt; 1/week</td>
<td>4 (3.7)</td>
<td>90 (83.4)</td>
<td>14 (12.9)</td>
<td>108 (100)</td>
</tr>
<tr>
<td>Total</td>
<td>2 (1.7)</td>
<td>87 (75.0)</td>
<td>4 (3.4)</td>
<td>93 (80.2)</td>
</tr>
</tbody>
</table>

< 1/week = day time cough occurring less than once a week; > 1/week = day time cough occurring more than once a week.

Note: nine incomplete answers on questionnaires.
responders on initial questionnaire. The non-responders had significantly more frequent attacks of wheezing ($X^2_{rend} = 3.9, p<0.05$) and were more likely to have had a previous label of asthma ($X^2 = 3.845, \ p = 0.05$). Other demographic data including male gender, and initial respiratory symptoms including severe speech limiting wheeze, were not significantly different.

**Group 2—frequent nocturnal cough**

There were 77 replies out of the 129 children with frequent nocturnal cough (59.7%). Sixteen children (20.1%) had developed wheeze; in five cases this was severe. Both the frequency of night disturbance and the frequency of wheeze attacks in these 16 children were significantly greater than the wheezing symptoms reported in the children in group 1 who had continued to wheeze ($X^2_{rend}$ for attacks = 27.06, $p<0.001$ and $X^2_{rend}$ for night disturbance = 16.59, $p<0.001$).

Twelve children (15.6%) had now been diagnosed as having asthma, including three with severe speech limiting wheeze, and six with wheeze attacks more than four times in a year. Thus, two children with speech limiting wheeze and four with wheeze attacks more often than four times a year remained unlabelled. There were 45 children (58.4%) who had less frequent nocturnal cough and 11 of those (14.3%) had lost their cough symptoms altogether.

The initial questionnaire responses of children in group 2 who developed wheezing were compared to those who had not developed wheezing. The only difference was in the family history of atopy: 26 non-wheezing children (43.3%) and 12 wheezing children (80.0%) reported a family history of atopy ($X^2 = 5.07, \ p = 0.02$). A personal history of eczema and hayfever, gender, and other respiratory symptoms were not significantly different on initial questionnaire.

**Non-responders**—There were 52 children who did not reply to the second questionnaire (40.3%). There were no features on the initial questionnaire that were significantly different from those who did respond.

**Group 3—minimal cough**

We received replies from 160 out of 222 children surveyed from this group (72.1%). In the second questionnaire three children (1.8%) had been labelled as currently having asthma. Six children (3.8%) had developed wheeze (including two of the children with diagnosed asthma), three reported one to three wheeze attacks in the last year and two reported between four and 12 attacks. Three children reported sleep disturbance due to wheeze more than once a week. No speech limiting wheeze was reported. The third child who had been diagnosed as having asthma reported frequent nocturnal and daytime cough. Only nine subjects had developed frequent nocturnal cough, four of them reporting daytime cough more often than once a week.

**Non-responders**—Sixty two children who did not respond to the second questionnaire (27.9%). There were no significant differences in the features on the initial questionnaire in those children who responded and those who did not.

**Group 4—asymptomatic**

We received replies from 90 out of 124 children surveyed in this group (72.6%). In the second questionnaire one child (1.1%) had been diagnosed as currently having asthma. The three children (3.4%) who reported they were now currently wheezy (including the child with diagnosed asthma) reported only one to three attacks over the last year and were disturbed at night less than once a week. No speech limiting wheeze was reported. One child (1.1%) had developed frequent nocturnal cough, while 39 (43.8%) reported minimal nocturnal coughing symptoms (that is, less than once a week).

**Non-responders**—There were 34 children who did not respond to the second questionnaire (27.4%); there were no significant differences in the demographic and symptomatic data compared to those children who did respond.

**Discussion**

The natural history of asthma is not clear. The numerous hospital and community based studies suggest that asthma improves over time, although symptoms may return later in life after an apparent improvement and loss of symptoms. Children with infrequent episodic asthma will be wheeze-free as adults in about 50% of subjects while only 25% of children with frequent episodic asthma will be asymptomatic as adults, and those children with persistent asthma will continue to have problems as adults in about 95% of cases.

Most of the subjects in these studies were children with a diagnosis of asthma. There are few data on the progress of undiagnosed respiratory symptoms in children and it is important to ascertain the patterns of development of symptoms, particularly if screening programmes are to be implemented.

The high morbidity reported in a group of undiagnosed wheezy children and the subsequent reduction of school absenteeism apparently due to treatment with inhaled steroids reported from Newcastle suggests that screening for undiagnosed asthma may be of benefit to some children. The reason that the study by Hill et al. failed to show any benefit from intervention compared to control group may have been the inadequacy of the intervention or poor outcome measures, but may also have been because undertreated or unlabelled symptoms improve over time irrespective of treatment.

This study supports the latter suggestion, as it has shown that without intervention unlabelled recurrent respiratory symptoms in 8-10 year olds generally improve. These data emphasise the need for detailed and strict control groups when assessing the affect of any intervention following a screening programme for undiagnosed asthma and they also have to
Respiratory symptoms in wheezy illness and nocturnal cough

be considered when assessing any form of treatment intervention studies.

In our study nearly half the children with unlabelled wheeze in 1991 had lost their wheeze two years later. Less than one fifth had been labelled as having asthma. The associations identified in this study for persistence of wheezing in 1993 were more frequent wheezing and a personal history of hay fever in 1991. A more detailed study of preschool children involving skin testing, bronchial hyperreactivity testing, and examination of all the children with wheezy symptoms including those diagnosed as asthma over a three year period shows similar results and associations.20

In this study, those children who had been diagnosed as having asthma over the two years were more likely to be diagnosed if they were female, had other coughing symptoms, and had previously been labelled as having asthma. The recent suggestion that symptomatic females are less likely to be diagnosed as having asthma compared to symptomatic males cannot be supported by these data.

It is of interest that the presence of nocturnal cough in the initial study did not appear to be a predictor of prognosis of wheeze but it is a predictor of attaining an asthma label. It may be that nocturnal cough is more likely than mild wheeze to result in repeated doctor consultation.

The implications of unlabelled nocturnal coughing in the absence of wheeze and its relation to asthma is still a matter of debate.22 The data from the group of children with nocturnal cough in this study suggest that although over 50% of them had a major improvement in symptoms, just over 20% of children with nocturnal cough developed wheezing, and in this group there was a high morbidity.

We found that children with nocturnal cough and a family history of atopy were more likely to develop wheezing. The association of a family history of atopy with nocturnal cough and the subsequent development of asthma has been noted before.23 However, a recent cross sectional community based study of persistent nocturnal cough found that the prevalence of a family or personal history of atopy resembled that in an asymptomatic group rather than a polysymptomatic asthma group.24

Hospital based longitudinal studies of isolated nocturnal cough suggest that a large proportion of children go on to develop mild to moderate asthma.25 In contrast to these studies, Lewis26 found that only 25% of 6 year old children with chronic cough had developed wheeze two years later, while over 80% reported an improvement in their symptoms. Brooke et al reported that only 7.2% of preschool children with current cough as a sole symptom in their community based study went on to develop wheeze three years on.20 The difference may be due to the ages of the children studied, but also children in the nocturnal cough group in our study were selected on the basis of the presence and frequency of night cough, whereas those in the preschool study were selected on the presence of current cough alone, so the data probably reflect the progress of a group with less severe symptoms. We have initially defined a group of children with nocturnal cough having more frequent cough symptoms and thus this difference is probably amplified. Notwithstanding this difference, our data support the notion that most children with nocturnal cough as a sole symptom do not go on to develop wheezing.22

The minimal symptoms and asymptomatic groups (groups 3 and 4) show that only a minority of children with few or no symptoms at the age of 8 years go on to develop wheezing by the age of 10, and those symptoms are neither severe nor frequent.

The initial questionnaire used the standardised core wheeze questions of the ISAAC study and the return rate of 86.2% was comparable with other similar studies.20 The 12 month period prevalence of wheeze of 17% in this study was slightly higher than the levels reported in a contemporaneous national study in the United Kingdom with levels of 15.9%,20 but was less than reports from Australia with levels of 23.1%31 and 25.4%.32 The prevalence of frequent nocturnal cough in the absence of current wheeze was 4.3%, which was very similar to the 4.9% reported from Aberdeen although much less than the 11.2% of 7 year olds reported in an Australian study.

The short term reproducibility of questions on current wheeze is very good but is lower for nocturnal symptoms.33 Parental observation of nocturnal cough shows poor agreement with nocturnal recordings and so it is reasonable to suggest we have a representative sample of the wheeze population but we have probably underestimated those children with nocturnal cough.24

It could be argued that the completion of the study was an intervention itself and although we were not identifying subjects and treating them, the process of sending a questionnaire to some families may have alerted them to attend a medical practitioner for assessment. We did not attempt to measure potential placebo effect and we must assume that if there was an intervention influence, it was minimal and had the same affect throughout the study groups.

We identified children with respiratory symptoms but no diagnosis of asthma for the second phase of the study, based on the response to the question concerning a current diagnosis of asthma. There are clear problems with using this definition when assessing the prevalence of asthma in a community study; there is no epidemiological gold standard for an acceptable definition of asthma. Studies that have used a 'doctor diagnosis' of asthma rather than the presence of current wheeze have underestimated the amount of asthma in the community.33 A response to a question asking about a doctor diagnosis of asthma may be inaccurate, as replies may influenced by many factors such as parental recall, access to health services, the training and attitudes of the medical practitioner, and parental acceptance of the label.33,34 As this study was to examine the progress of symptomatic children who did not have a label of asthma for their symptoms, irrespective of the reasons why they had not been given the label, we feel that this was a
valid method for identifying undiagnosed asthma in this context.

The lower return rates for the second phase questionnaire of between 59.7% and 72.6% may reduce the power of the comparisons and conclusions drawn from the study but these return rates are similar to other two stage follow up studies.\textsuperscript{26} We obtained a lower return rate from the second postal survey than from the first, school distributed, survey. There could be a number of reasons for this, but it shows that the use of schools to circulate and collect questionnaires is more likely to yield a higher return rate than a postal study, and is probably the best method for prevalence studies.

The characteristics of the responders and non-responders can be compared by examining the initial questionnaire responses. The non-responders for the wheeze question were likely to have had more frequent attacks of wheezing and were more likely to have been previously given a label of asthma. We know from those who responded that the more frequent the wheezing in the initial questionnaire the more likely a child was to persist in wheezing two years later. Thus, with a return rate of 63% for the wheeze question group, we may have underestimated the proportion of children who would retain their symptoms. For the other three groups, there were no features on the initial questionnaire that were significantly different in the non-responder group compared to the responders. It is apparent that the parents of symptomatic subjects were less likely to return the second questionnaire than the parents of those without symptoms. This may be because if a child has symptoms it may take longer to complete the questionnaire and this effect may be less for those subjects with cough compared to those with wheeze. This difference in response rate among the groups may therefore have an influence on our comparisons between groups.

It is of concern that there was still a small number of children with severe symptoms whose asthma remained undiagnosed over that two year period. There were five children who reported speech limiting wheezing from group 1 who remained unlabelled. In the night cough group, six children who had gone on to develop frequent or speech limiting wheeze appeared not to have a label of asthma. It is now clear that since the initial concerns about the under-diagnosis of asthma\textsuperscript{2} there has been an improvement in the diagnosis of wheezing illness.\textsuperscript{2} Indeed there are groups of children who are being overtreated for trivial symptoms but conversely there are children with marked impairment from their asthma who are being undertreated.\textsuperscript{46} In children with a current label of asthma there is significant morbidity even with treatment.\textsuperscript{19}

Currently some centres screen schoolchildren with the question ‘Has your child wheezed in the last 12 months?’\textsuperscript{28} As nearly 50% of unlabelled children who answer yes to this question will have lost their symptoms two years later irrespective of intervention, one has to question the usefulness of screening in this manner. One could argue that it may be more appropriate to use a combination of questions to screen for undiagnosed asthma using the features associated with persistence of symptoms. However, the majority of subjects who went on to have persistent symptoms in this study did not have a personal history of hay fever; had the children with attacks of wheezing more frequently than four times a year been single out for intervention in 1991 this would have missed 50% of all the children who reported similar frequency of wheeze attacks in 1993.

Screening children cross sectionally with exercise tests is not appropriate because of the poor reproducibility and within individual variability of responses in community populations,\textsuperscript{41} and inhalation challenge tests have been shown to have a poor relation to clinical symptoms longitudinally.\textsuperscript{42} If undiagnosed symptoms are considered to cause sufficient morbidity within the community a blanket screen with one ‘current wheeze’ question would identify many children with minimal symptoms and many would lose those symptoms irrespective of intervention. The usefulness of a screening questionnaire containing a combination of questions needs further evaluation.

Within its limitations, this study has shown that the majority of unlabelled respiratory symptoms in 8-10 year olds tend to improve and those unlabelled children who persist with their symptoms over time have other features such as more frequent attacks of wheezing and a personal history of atopy. It also highlights the importance of the use of appropriate control groups in intervention studies, whether they are studies assessing the value of screening for undiagnosed asthma or studies assessing the affect of treatment on the prognosis of asthma.

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Respiratory symptoms in wheezy illness and nocturnal cough

27 Lewis HM. Cough—but is it asthma? Arch Dis Child 1994;70:594.