The use of a screening questionnaire to identify children with likely asthma

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SUMMARY

Background: *The theory that airway remodelling and possible fixed asthma may result from failure to treat asthma airway inflammation highlights the importance of the early identification of patients with likely asthma.*

Aim: *To identify children with likely asthma whose condition is unknown to the medical services.*

Study: *Postal questionnaire survey.*

Setting: *Children in two general practice populations in 1999.*

Method: *Parents completed the postal questionnaire surveys. Two validated scoring systems were used to identify children with 'likely asthma': first, three or more positive responses to five key questions; second, three or more positive responses to the same five questions and one more severe symptom (e.g. exercise-induced wheeze). Questionnaire responses were linked to practice records to determine those with a recorded diagnosis of asthma (ever) or of inhaled medication (past 12 months).*

Results: *Using the first scoring system, 22.5% of children were identified as having likely asthma; more than one-third of these (35.1%) had no corroborative evidence recorded in the practice records. With the second system, 15.5% had likely asthma, a quarter of whom had no corroborative evidence. Depending on the scoring system chosen, between 3.5% and 8% of children in these practices had likely asthma but no corroborative evidence in their records.*

Conclusions: *Children identified using either of these scoring systems would require full clinical assessment to determine their need for medical intervention. These findings have implications for the allocation of health care resources.*

Keywords: *screening questionnaire; children; asthma.*

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Introduction

ALTHOUGH the prevalence of asthma in children is increasing[1-3] the condition is still thought to be under-diagnosed.[4-7] As a result there may be many children in the community who might benefit from treatment but whose condition is unknown to the medical services. This possibility gives rise to particular concern in view of the theory that airway remodelling and possible fixed asthma can ensue from failure to treat asthma airway inflammation.[8] The identification of these children in a given population therefore assumes considerable importance.

A number of recent questionnaire surveys have estimated the prevalence of respiratory symptoms in children of different ages.[9-11] Although some have been proposed to determine the prevalence of asthma using definitions such as wheeze as the single diagnostic criterion[12,13] or a combination of wheeze and bronchial hyperreactivity,[14] no reported study has been validated as a cost-effective screening method to identify children with likely asthma in a given population. The use of wheeze alone, while giving a very high sensitivity, would produce an unacceptably high rate of false positives; the addition of bronchial hyperreactivity as a diagnostic criterion in screening would create practical problems in an epidemiological study. Further, no questionnaire study has been able to link the results to the child's medical records to identify those children with likely asthma but unknown to the medical services.

These problems are addressed in the present paper which forms part of the Wythenshawe Community Asthma Project (WYCAP),[15,16] a long-term prospective investigation into the natural history of asthma in two general practice populations in South Manchester each with about 7000 patients. A principal objective has been to use a parent-completed questionnaire to determine the prevalence of respiratory symptoms in the study populations. The information obtained has been aggregated using a simple scoring system to identify children with likely asthma.[17] Clinicians might use the results of such screening surveys to check their medical records to identify those currently unknown to the medical services. These children would require full clinical assessment to establish their true asthma status. However, before doing so practitioners need to know the likely workload implications of such a screening system and, in particular, the number of children who may be called for clinical assessment using a particular scoring system.

Method

A postal survey was carried out in 1999. Similar surveys had been conducted in the same population in 1993 and 1995. Questionnaires were sent to the parents or guardians of all children registered with two general practices on a

HOW THIS FITS IN

What do we know?

Although the prevalence of asthma is increasing it is still underdiagnosed. Early identification and treatment of children with the condition is thought to be important.

What does this paper add?

This paper describes a method for identifying children with possible asthma using a validated postal questionnaire. These children would require full clinical assessment to determine their true asthma status.

Manchester housing estate. The questionnaire (available from the authors on request) included questions about respiratory symptoms used in the International Study of Asthma and Allergies in Childhood (ISAAC).[18] It also asked if the child had received more than three courses of antibiotics in the previous year for respiratory symptoms — a circumstance previously regarded as the first indication of asthma in young children and used as a key item in a previous study.[19] Two additional questions asked about a history of hay fever or eczema, and a family history of asthma. The questionnaires were sent out on practice-headed paper. Non-responders were sent reminders four and eight weeks after the first mailing.

To identify children with likely asthma, two simple scoring systems were developed. The first considered a child to have likely asthma if there were positive responses to three or more out of five key questions: wheezed in the past year; had a dry cough at night in the absence of a cold or respiratory infection in the past year; received more than three courses of antibiotics for respiratory symptoms (both upper and lower respiratory tract) in the past year; had a history of hay fever or eczema; had a family history of asthma in first degree relatives. The second system, aimed at identifying children with more severe disease, required three or more positive responses to the same five questions in addition to the presence of at least one of the following symptoms, indicating more severe disease: wheeze occurring on more than three occasions in the previous 12 months, wheeze affecting speech, exercise-induced wheeze, or wheeze causing at least weekly waking from sleep.

The evaluation of these scoring systems against consensus expert opinion following detailed clinical examination of a random sample of responders has been described in detail previously.[17] In summary, the first system had a positive predictive value (PPV) of 84% (95% confidence interval [CI] = 74–90%) and sensitivity of 44% (95% CI = 33–55%) for identifying children deemed by the experts to have likely asthma defined as 'those who after clinical review would be recommended a trial of asthma medication'. The second scoring system, suggesting more severe disease, had a PPV of 96% (95% CI = 88–99%) and sensitivity of 36% (95% CI = 28–45%). Thus whichever scoring system is chosen for screening, few false positives would be identified. The positive predictive values are dependent on the prevalence of likely asthma in the population under investigation.

The practice records of all children identified by either system as having likely asthma were examined to determine whether they contained a recorded diagnosis of asthma at any time or a prescription for inhaled asthma medication in the past year. Children without such recorded corroborative evidence constitute the group of children who are likely to require clinical evaluation to determine their true asthma status, if a screening programme were implemented by the practice.

Prevalence rates of positive responses to the various questions were calculated as annual point prevalence and expressed as a percentage of all responders. Confidence interval analysis was used to calculate 95% confidence intervals for proportions and their differences.[20] Tests for linear trend in prevalence across different age groups were based on the chi-squared statistic derived by Armitage.[21]

Results

Only children aged five to 15 years at the time of the survey are considered in this paper. Questionnaires were dispatched to 3122 children. Replies were received in respect of 2034 (65.2%), of whom 1563 replied to all the key questions. To establish if non-responders were materially different from responders, random samples of 100 children in each group were compared with respect to their age, sex, total number of consultations, and number of consultations for respiratory complaints in the previous year, for each survey. There were no important differences between the groups for any of these parameters. It is unlikely, therefore, that non-responders will have materially biased our results.

The age and sex distributions were similar between the two practice populations as were replies to the questionnaires; the results for the two populations have therefore been combined.

There was a high prevalence of respiratory symptoms in these populations. Thus wheeze was reported by 24.7% and night cough by 28.3% of responders; 16.6% replied that they had been prescribed asthma medication in the previous year.

Using the first scoring system, 22.5% of children were categorised as having likely asthma (Table 1). More than one-third of these children (35.1%) had no corroborative evidence of asthma (7.9% of all responders).

Using the second scoring system (Table 1) fewer children were classified as being likely asthmatics (15.5%) reflecting the greater stringency of this system. Even so, about one-quarter of these children (25.1%) had no corroborative evidence of asthma in their records and accounted for 3.9% of all responders.

The level of potential underdiagnosis showed no significant trends with age. Thus the proportion with possible asthma with no corroborative evidence (first scoring system) was 39.6% for children aged five to eight years, 29.2% for those aged nine to 12 years, and 37% for those aged over 12 years. Corresponding figures using the second scoring system were 29.1%, 21.7%, and 23.8% respectively.

Of the 352 children who gave three or more positive replies (1999 survey), 73 had no history of wheeze. Of these, 60 had suffered from night cough without respiratory infection in the past year, of whom 59 in addition gave a history of hay fever/eczema.

Table 1. Possible asthma: Proportion (%) of responders with possible asthma and with possible asthma but no recorded corroborative evidence[a] (n = 1563).

	First scoring system[b] % (95% CI)	Second scoring system[c] % (95% CI)
Possible asthma	22.5 (20.4–24.6)	15.5 (13.7–17.3)
Possible asthma but no corroborative evidence	7.9 (6.6–9.4)	3.9 (3.0–5.0)

[a]No evidence of asthma (ever) or of asthma medication (in last year) in general practice records. [b]Three or more positive responses from five key questions. [c]Three or more positive responses plus at least one of four symptoms suggesting more severe disease.

Discussion

The postal respiratory questionnaire survey conducted in 1999 in two general practice populations in Manchester revealed similar levels of symptoms in both practices, with a higher prevalence than found in a comparable national study in children aged five to 17 years that reported the prevalence of wheeze as 15.0% and night cough as 12.5%.[9] Although one recent national survey[3] reported considerably higher levels of symptoms than the present study in children aged 12 to 14 years (e.g. wheeze 33.3%); the increase was probably partly owing to the use of child- as opposed to parent-completed questionnaires.

Approximately one-third (first scoring system) and one-quarter (second scoring system) identified as having likely asthma had no corroborative evidence in their medical records. This level of possible underdiagnosis is lower than other reported work,[4-7] although direct comparison is difficult owing to differences in the definitions used and in methodology.

The true level of underdiagnosis is likely to be less than our reported figures as the diagnosis of likely asthma, made on the basis of questionnaire response alone, will in some cases be reversed after clinical assessment.

There are a number of possible reasons for the levels of underdiagnosis found, including underpresentation of symptoms by parents and underdiagnosis by the primary health care team. Incomplete practice records may also explain why some likely asthmatics had no corroborative evidence in their medical records. However, both practices were fully computerised at the time of the surveys, with diagnosis and medication being routinely recorded on the computer during the consultation. In addition, a search of a random sample of handwritten medical records from the 1993 survey failed to identify a significant number of children with the diagnosis recorded in the notes but not on the computer. It seems likely therefore that incomplete records will have accounted for only a small proportion of the unknown cases. It is also possible that some of these children may have had recurrent wheeze owing to conditions other than true asthma. Many clinicians, however, will agree that it is still important to identify these children as they also may benefit from clinical assessment and possible intervention.

As the final diagnosis of asthma can only be made on the basis of clinical evaluation, to identify all asthmatics in a given population (100% sensitivity) every patient would require examination; this would clearly be impractical for screening in general practice where a system of prioritising those children who would most benefit from clinical review would be needed.[20] The proposed scoring systems based on a simple questionnaire were therefore aimed at identifying those children most likely to have the condition, with the emphasis on achieving a high positive predictive value with few false positives at the expense of missing some asthmatics. The threshold chosen for a particular screening survey will depend on the balance between PPV and sensitivity, the number of children identified whose condition is unknown to the medical services, and the resources available to the practice. Resource implications would include administration of the questionnaire, recall of patients for clinical review, and the medical, nursing and administrative costs of the actual assessments. The extra costs incurred in treating previously unknown asthmatic children would also need to be considered. Any screening programme would have to be repeated regularly to take account of new patients in the practice who have not been previously screened and of those with newly developed symptoms. The frequency of these surveys would also merit careful consideration. A pragmatic solution may be to invite for examination only those with more severe symptoms; for example, those identified by the second scoring system, which has a higher positive predictive value and will therefore produce fewer false positives although it will miss a larger number of asthmatics. Lastly, account would also need to be taken of the adult population, as a survey from the same practices[12] concluded that between 5% and 7% of adults had potentially undiagnosed asthma and may also benefit from clinical assessment.

In these populations, whichever scoring system was used a significant proportion of children (between 3.5% and 8%) would require medical assessment. In practice, (1999 survey) 123 (first scoring system) and 61 (second system) children in the two practices combined would be categorised as having potentially undiagnosed asthma. According to the evaluation of our scoring system,[17] it is likely that 103 (first system, PPV = 84%) and 59 (second system, PPV = 96%) of these would be recommended for a trial of asthma medication. It is of interest that one in five children classed as having likely asthma reported no wheeze in the past year. A screening procedure that relied on wheeze alone would have missed these children.

Conclusions

The considerable implications of our findings in terms of health care resources would need to be measured against the potential benefits of identifying and treating a group of

asthmatics, previously unknown to the medical services. These results are not necessarily representative of the country as a whole. Further studies are planned in other populations to determine if this potential unmet need exists elsewhere and to examine the cost/benefit implications of finding these children.

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