

## Increasing prevalence of asthma diagnosis and symptoms in children is confined to mild symptoms

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### Abstract

**Background**—The prevalence of childhood asthma is increasing but few studies have investigated trends in asthma severity. We investigated trends in asthma diagnosis and symptom morbidity between an eight year time period in a paired prevalence study.

**Methods**—All children in one single school year aged 8–9 years in the city of Sheffield were given a parent respondent questionnaire in 1991 and 1999 based on questions from the International Survey of Asthma and Allergy in Children (ISAAC). Data were obtained regarding the prevalence of asthma and wheeze and current (12 month) prevalences of wheeze attacks, speech limiting wheeze, nocturnal cough and wheeze, and exertional symptoms.

**Results**—The response rates in 1991 and 1999 were 4580/5321 (85.3%) and 5011/6021 (83.2%), respectively. There were significant increases between the two surveys in the prevalence of asthma ever (19.9% *v* 29.7%, mean difference 11.9%, 95% confidence interval (CI) 10.16 to 13.57, *p*<0.001), current asthma (10.3% *v* 13.0%, mean difference 2.7%, 95% CI 1.44 to 4.03, *p*<0.001), wheeze ever (30.3% *v* 35.8%, mean difference 5.7%, 95% CI 3.76 to 7.56, *p*<0.001), wheeze in the previous 12 months (17.0% *v* 19.4%, mean difference 2.5, 95% CI 0.95 to 4.07, *p*<0.01), and reporting of medication use (16.9% *v* 20%, mean difference 3.0%, 95% CI 1.46 to 4.62, *p*<0.001). There were also significant increases in reported hayfever and eczema diagnoses.

**Conclusions**—Diagnostic labelling of asthma and lifetime prevalence of wheeze has increased. The current 12 month point prevalence of wheeze has increased but this is confined to occasional symptoms. The increased medication rate may be responsible for the static prevalence of severe asthma symptoms. The significant proportion of children receiving medication but reporting no asthma symptoms identified from our 1999 survey suggests that some children are being inappropriately treated or overtreated.

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Keywords: asthma prevalence; children; diagnostic labelling; asthma treatment

Childhood asthma is common, especially in the UK.<sup>1</sup> Several studies have reported increases in the prevalence of asthma and associated asthma morbidity symptoms using serial questionnaire surveys,<sup>2-7</sup> but there has been controversy as to whether or not the prevalence of asthma is still increasing. The International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire has been validated and has been used to investigate the prevalence of asthma throughout the world.<sup>1</sup> We used a parent respondent questionnaire based on the ISAAC questions to investigate changes in asthma morbidity and treatment between 1991 and 1999 in two large cohorts of Sheffield children aged 8–9 years.

### Methods

The methods for the 1991 survey have been described previously<sup>8</sup> and were replicated in the 1999 study. Briefly, all primary schools in Sheffield with year 4 pupils (aged 8–9 years) were approached for the 1999 survey. Individually labelled questionnaires were distributed to schools with instructions for children to take them home for their parents to complete. Non-responders were sent a second identical questionnaire. The  $\chi^2$  test was used to compare the differences between the surveys. The study was approved by the South Sheffield Research Ethics Committee and the Sheffield Education Authority.

### Results

The results of the 1991 Sheffield schools survey have been reported previously.<sup>8</sup> A total of 5011 of 6021 questionnaires (83.2%) were returned from the 1999 survey. Of all responses where sex was specified, 2459 of 4912 (50.1%) were male. 156 of 5011 respondents (3.1%) indicated that they did not wish to take part in the survey. 4340 questionnaires were returned with all 15 questions completed (354 and 66 returned questionnaires had 14 of the 15 and 13 of the 15 questions completed respectively; a further 253 had fewer than 13 questions completed). Wherever possible answers from part completed questionnaires were included in the data analysis.

Symptoms reported in the preceding 12 months in the two surveys are compared in table 1. Although there were significant increases in the prevalence of wheeze and in

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Table 1 Prevalence of asthma and asthma morbidity symptoms in 1991 and 1999

|                                       | Survey year       |                   | % change (95% CI)       | p value |
|---------------------------------------|-------------------|-------------------|-------------------------|---------|
|                                       | 1991              | 1999              |                         |         |
| Wheeze in previous 12 months          | 771/4563 (17.0%)  | 932/4803 (19.4%)  | +2.51 (0.95 to 4.07)    | <0.01   |
| Wheeze ever                           | 1376/4564 (30.3%) | 1720/4810 (35.8%) | +5.66 (3.76 to 7.56)    | <0.001  |
| Current asthma*                       | 466/4539 (10.3%)  | 624/4800 (13.0%)  | +2.73 (1.44 to 4.03)    | <0.001  |
| Asthma ever                           | 811/4543 (17.9%)  | 1428/4806 (29.7%) | +11.86 (10.16 to 13.57) | <0.001  |
| Wheeze attacks 1–3/year               | 438/4560 (9.6%)   | 551/4766 (11.6%)  | +1.96 (0.71 to 3.20)    | <0.001  |
| Wheeze attacks >3/year                | 324/4560 (7.1%)   | 353/4766 (7.4%)   | +0.30 (–0.75 to 1.35)   | NSD     |
| Nocturnal wheeze at least once a week | 220/4548 (4.8%)   | 251/4757 (5.3%)   | +0.44 (–0.45 to 1.33)   | NSD     |
| Nocturnal cough at least once a week  | 361/4435 (8.1%)   | 392/4784 (8.2%)   | +0.05 (–1.06 to 1.17)   | NSD     |
| Frequent exertional wheeze or cough   | 174/4493 (3.9%)   | 217/4901 (4.4%)   | +0.55 (–0.25 to 1.36)   | NSD     |
| Speech limiting wheeze in last year   | 136/4558 (3.0%)   | 125/4749 (2.6%)   | –0.4 (–1.04 to 0.30)    | NSD     |
| Eczema ever                           | 820/4523 (18.1%)  | 1497/4809 (31.1%) | +13.0 (11.27 to 14.72)  | <0.001  |
| Hayfever ever                         | 554/4508 (12.3%)  | 787/4802 (16.4%)  | +4.1 (2.68 to 5.2)      | <0.001  |

Data are shown as number/denominator (%).

CI = confidence interval; NSD = no significant difference.

\*Defined by a positive answer to the question “Does your child have asthma at present?”

asthma diagnosis, the increase was confined to wheeze  $\leq 3$  times yearly; more frequent symptoms were unchanged. Current wheeze, lifetime wheeze, current asthma (defined by a positive answer to the question “Does your child have asthma at present?”), and lifetime asthma were significantly higher in boys than in girls (21.4% *v* 17.4% ( $p < 0.001$ ), 38.8% *v* 33.0% ( $p < 0.001$ ), 14.0% *v* 12.0% ( $p < 0.01$ ), and 32.6% *v* 27.1% ( $p < 0.001$ ), respectively).

Overall, in the 1999 survey 939 of 4700 children (20.0%) were reported to be taking asthma medication compared with 768 of 4533 children (16.9%) in 1991 (mean difference 3.0%, 95% confidence interval (CI) 1.46 to 4.62,  $p < 0.001$ ). Medication details for children with diagnosed asthma were available in 422 children in 1991 and 487 in 1999. Between surveys inhaled corticosteroid usage increased from 34.4% to 66.1% ( $p < 0.001$ ), inhaled bronchodilator usage increased from 79.6% to 92.8% ( $p < 0.001$ ), and sodium cromoglycate usage decreased from 23.2% to 3.7% ( $p < 0.001$ ). Notably, in the 1999 survey we found that 249 of 931 children (26.7%) receiving asthma medication reported no wheezing in the last 12 months; even in those taking regular inhaled corticosteroids this figure was 19.4%. A further 192 (20.6%) children receiving asthma medication were reported not to have a current diagnosis of asthma.

## Discussion

We have shown increases in the prevalences of reported wheeze, diagnosed asthma, and reported eczema and hayfever in 8–9 year old Sheffield children between 1991 and 1999. The point prevalence of wheeze in the past 12 months increased by an absolute value of 2.4% over 8 years. This increase could be due to methodological or response variations, changes in parental or doctor behaviour, in either labelling or treatment, or a genuine change in inherent susceptibility or in environmental factors. We have used consistent methodology and achieved good response rates, so it is unlikely that these differences could be due to differences in methodology or population characteristics. Similarly, the response rates of 85.3% in 1991 and 83.3% in 1999 suggest that any bias due to non-responders is minimal.

Our observations are supported by a number of previous studies.<sup>2–7</sup> Burr *et al* studied two cohorts of 12 year old children using question-

naire and exercise provocation tests 15 years apart between 1973 and 1988.<sup>2</sup> The point prevalence of “wheeze ever” increased from 17% to 22% and “current asthma” from 4% to 9%. Between 1964 and 1989 asthma in Aberdeen school children increased from 4.1% to 10.1%<sup>4</sup> and a repeat survey in 1994 reported a further rise to 19.6% with, in contrast to our study, an increase in asthma severity.<sup>6</sup> Venn *et al* reported cross sectional survey data between 1988 and 1995 which showed absolute increases in lifetime and 12 month wheeze prevalences and diagnosed asthma in children aged 4–11 years.<sup>7</sup> These studies have suggested that the asthma prevalence rate has continued to rise and that this cannot be ascribed solely to diagnostic labelling, in contrast to the observations of Hill *et al*.<sup>3</sup> Magnus and Jaakkola consider that information biases and changes in diagnostic labelling might explain the increases in wheeze and asthma seen in other repeated surveys and have suggested that “objective measures” should be used.<sup>9</sup> Since we have previously shown that the free running exercise test had much poorer reproducibility than questionnaire data,<sup>10</sup> we decided not to include such a measure in our initial survey.

Our results suggest that the increase in wheezing is largely due to infrequent and minor wheezing symptoms. This might be because of increased perception or reporting of wheezing, or a genuine increase in minor wheezing. The prevalence of diagnosed eczema and hayfever in Sheffield has also increased significantly, in keeping with other studies.<sup>2–4</sup> This continuing increase in atopic disease may also be contributing to the rising prevalence of wheeze. An alternative explanation for the increase in wheeze and asthma apparently being confined to mild cases could be the increased use of inhaled corticosteroids. This is supported by the increase in reported medication usage in asthmatic children. In a population prevalence study in children aged 7.5–8.5 years from a single London borough, the prevalence of frequent wheeze attacks was unchanged between 1978 and 1991 while markers of severe asthma fell over the same period.<sup>5</sup> The authors concluded that this finding was due to an “improvement in treatment received by wheezy children”. However, our findings suggest that at least some of the

apparent increase may be due to changes in the perception of minor wheezing symptoms.

A final point to be noted in our results is the high use of asthma medication in children who lack either a recent history of wheeze or a diagnosis of asthma. This suggests that asthma is being overtreated or overdiagnosed in a significant number of children and reinforces the need to review and step down asthma treatment in children when symptom control is adequate.

In conclusion, our results suggest an increase in the prevalence of both diagnosed asthma and current wheeze between 1991 and 1999 in 8–9 year old Sheffield children. This appears to be due to the combination of an increase in minor wheeze symptoms and a rise in diagnostic labelling. We found no significant change in asthma severity. Although this may be due in part to an increase in prescription of anti-inflammatory medication, the large number of children without current wheeze who are receiving asthma medication suggests that there may be significant overtreatment of children with such drugs.

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## Effect of intravenous pamidronate on bone mineral density in adults with cystic fibrosis

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### Abstract

**Background**—Low bone mineral density (BMD) is prevalent in adults with cystic fibrosis. The aim of this study was to assess the effect of intravenous pamidronate on BMD in these subjects.

**Methods**—Patients were invited to participate if they had a BMD Z score of  $-2$  or less in the lumbar spine, proximal femur, or distal forearm. Patients were randomised to receive either 30 mg intravenous pamidronate every 3 months + 1 g calcium daily (pamidronate group) or 1 g calcium daily (control group). All pancreatic insufficient patients were prescribed oral vitamin D supplements.

**Results**—After 6 months of treatment the pamidronate group (n=13) showed a significant increase in absolute BMD compared with the control group (n=15) in the lumbar spine (mean difference 5.8% (CI 2.7% to 8.9%)) and total hip (mean difference 3.0% (CI 0.3% to 5.6%)). However, the pamidronate group showed a reduction in BMD compared with the control group in the distal forearm (mean differ-

ence  $-1.7%$  (CI  $-3.7%$  to  $0.3%$ )). The use of pamidronate was associated with a high incidence of bone pain in non-corticosteroid treated individuals.

**Conclusion**—Intravenous pamidronate increases axial BMD in adults with cystic fibrosis, but the high incidence of bone pain associated with this treatment might limit its use.

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Keywords: cystic fibrosis; bone mineral density; osteoporosis; pamidronate; bisphosphonates

Low bone mineral density (BMD) is prevalent in adults with cystic fibrosis.<sup>1,2</sup> Biochemical and histomorphometric studies suggest that osteoblastic activity is reduced and that osteoclastic activity is increased.<sup>3,4</sup> As bisphosphonates are potent inhibitors of osteoclastic bone resorption, they are a logical therapeutic choice to treat adult cystic fibrosis patients with low BMD. The aim of this study was to assess the effect of intravenous pamidronate on BMD in adults with cystic fibrosis.