Prevalence and severity of asthma, rhinitis, and atopic eczema: the north east study

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Abstract

Using the international study of asthma and allergies in childhood (ISAAC) questionnaire, 3000 children aged 6–7 years from various schools in the north east of England were studied. In this population, the lifetime prevalence rates of various symptoms and diagnoses were: wheezing, 29.6%; atopic eczema, 27.8%; rhinitis, 23.1%; and self reported asthma, 22.7%. Rhinitis was reported by 44% and 40% of boys and girls with asthma, respectively. Atopic eczema was reported by 46% of both boys and girls with asthma. The prevalence rates of reported asthma, and of symptoms suggestive of asthma, were higher than those reported from studies conducted on UK children in 1992.

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The national survey of asthma in children aged 5–17 years in the UK[1] revealed that in the past year, 15.0% of children had wheezed, 2.2% had more than 12 attacks, and 2.3% had experienced a speech limiting attack. It was also found that with increasing age, morbidity related to wheezing declined to a greater extent than the annual period prevalence.

Kaur and colleagues[2] studied the prevalence of asthma symptoms in 12–14 year old British children and found that the national 12 month prevalence of any wheezing, speech limiting wheeze, four or more attacks of wheeze, and frequent night waking with wheeze was 33.3%, 8.8%, 9.6%, and 3.7%, respectively. They found that the prevalence of self reported symptoms, diagnosis, and treatment of asthma was high among 12–14 year olds throughout the UK, with little geographical or urban–rural variation.

Another ISAAC UK national study of 12–14 year old children throughout England, Wales, Scotland, and the Scottish Islands[3] showed that 18.2% of children reported recent rhinoconjunctivitis. They found that geographical variations were generally small but the prevalence of symptoms was significantly higher in Scotland and northern England. It was also higher in girls and subjects born within the UK. Of all children, 47.6% reported one or more current symptoms and 4% reported all three symptoms (asthma, rhinoconjunctivitis, atopic eczema).

As one of the participating centres of ISAAC, we surveyed the prevalence of asthma and allergic disease in 6–7 year old schoolchildren in the north east. The aim of our study was to investigate the prevalence and severity of asthma, rhinitis, and atopic eczema in these children. Our results will be compared with other studies using the same ISAAC protocol.

Methods

We obtained school lists from the Department of Education in the North East Region of England. We prepared sampling frames of mixed sex state schools with over 100 pupils in each school year. We randomly selected one school from each sampling frame, to produce 78 schools for study. We used the ISAAC written questionnaire for asthma, rhinitis, and atopic eczema. We sent 3750 questionnaires to parents or guardians of 6–7 year old children. Three thousand and fifty five questionnaires were returned, of which 55 were incomplete. Thus, we analysed 3000 fully completed questionnaires, with a final response rate of 80%.

The ISAAC written questionnaire[4] includes questions on past and current wheezing episodes, wheezing frequency, sleep disturbance, speech limitation during attacks, exercise induced wheezing, and persistent cough unrelated to respiratory infections. Other questions are concerned with the presence and severity of rhinitis and atopic eczema. For each of the symptoms, a 12 month period prevalence was calculated by dividing the number of positive responses to each question by the number of completed questionnaires.

Data were analysed using SPSS for Windows. The χ^2 test was used to assess the association between categorical variables. Logistic regression was used to estimate risk factors for current wheeze and severe asthma attack. Estimates of the odds ratio (OR), standard errors, and 95% confidence intervals (95% CI), were based on the asymptomatic likelihood theory. A p value < 0.05 was considered to be significant.

POWER CALCULATIONS

With a sample size of 3000, the power to detect the difference in one year prevalence of wheezing and severe asthma between two centres will be 99% and 90%, respectively, at the 1% level of significance.

Results

Tables 1 and 2 show the prevalence and severity of asthma, rhinitis, and atopic eczema. The prevalence rates were significantly greater in boys than in girls ($p < 0.001$). Wheeze was the most common symptom affecting boys, with a lifetime prevalence of 35%; whereas eczema was the most common allergic disease of girls, with a lifetime prevalence of 27%. Boys were

Table 1 Self reported prevalence (%) of asthma, rhinitis, and eczema and their related symptoms (written questionnaire)

Symptom	*OR (95%CI)*	*p Value*	*Boys (n = 1455)*	*Girls (n = 1545)*	*Boy:girl ratio*	*All (n = 3000)*
Asthma						
Ever wheezed	1.73 (1.42 to 2.11)	< 0.001	35.0	24.0	1.5	29.6
Wheeze in the past year	1.18 (0.89 to 1.57)		21.5	15.4	1.4	18.0
Wheezing with exercise past year	1.50 (1.16-1.96)	< 0.01	16.4	11.1	1.5	13
Persistent cough past year	1.12 (0.91 to 1.36)		28.6	26.0	1.5	27.7
Ever had asthma	1.83 (1.89 to 2.32)	< 0.001	27.7	18.3	1.5	22.7
Rhinitis						
Ever had rhinitis	1.41 (1.14 to 1.74)	< 0.01	25.0	20.4	1.2	23.1
Rhinitis in the past year	1.32 (0.99 to 1.79)	< 0.05	22.6	18.8	1.2	20.5
Associated itchy eye in the past year	1.56 (1.05 to 2.34)	< 0.05	11.6	8.1	1.4	10.0
Ever had hay fever	1.58 (1.18 to 2.13)	< 0.01	12.0	7.9	1.5	10.1
Eczema						
Chronic rash ever	0.89 (0.67 to 1.16)		17.8	18.7		18.1
Chronic rash in the past year	0.72 (0.49 to 1.02)		14.7	16.9		15.7
Chronic rash with typical distribution			13.2	14.7		13.8
Ever had eczema	1.05 (0.84 to 1.31)		27.8	27.0		27.8
Age at which itchy rash first occurred						
< 2 years			7.7	8.3		8.0
2–4 years			3.6	4.7		4.2
⩾ 5 years			5.0	4.8		4.9

CI, confidence interval; OR, odds ratio.

Table 2 Prevalence of reported symptoms (%) indicating severity of asthma, rhinitis, and eczema

Symptom	*OR (95% CI)*	*Boys (n = 1455)*	*Girls (n = 1545)*	*Boy:girl ratio*	*All children (n = 3000)*
Wheeze in past year					
Number of wheezing episodes					
1 to 3		13.4	8.8	1.5	10.8
4 to 12		5.6	4.5	1.2	5.1
> 12	0.86 (0.49 to 1.48)	2.4	1.7	1.4	1.8
Woken by wheeze					
< 1 each week		9.4	5.4	1.7	7.4
⩾ 1 each week	1.39 (1.09 to 1.75) (p < 0.01)	6.3	5.3	1.2	5.7
Limitation of speech during wheezing attack	1.07 (0.60 to 1.92)	4.2	3.1	1.4	3.5
Rhinitis in past year					
Interference with daily activity					
Little		11.9	8.8	1.4	10.4
Moderate		2.4	1.5	1.6	1.9
Severe		0.4	0.7		0.5
Rashes in past year					
Persistent rash without clearing		6.5	7.0		6.2
Kept awake by rash					
< 1 each week		4.0	5.1		4.5
⩾ 1 each week	0.59 (0.29 to 1.25)	2.5	2.3		2.1

CI, confidence interval; OR, odds ratio.

significantly more likely than girls to report asthma, wheeze ever, current wheeze, wheeze with exercise, night time cough, rhinitis ever, current rhinitis, and hay fever. There were no significant sex differences for eczema or chronic rash.

In boys and girls, the highest prevalence of rhinitis was in June; 13.3% in boys and 10.1% in girls. November and December were the months with the lowest prevalence of rhinitis in boys (4.0%) and girls (3.5%).

The combination of asthma, eczema, and rhinitis was seen in 6.7% of boys, 3.7% of girls, and 5.2% of all children, whereas 52.6% of boys, 45.2% of girls, and 48.9% of all children had asthma, or eczema, or rhinitis.

Table 3 shows the association between various symptoms and parental smoking. There was an association between maternal smoking and asthma ever ($p < 0.01$), wheeze ever ($p < 0.001$), and wheeze with exercise ($p < 0.01$). There was an association between paternal passive smoking and wheeze ever ($p < 0.01$). Asthma and its symptoms were more prevalent in children that were exposed to cigarette smoke in their home environment. Children of parents who smoke had significantly higher prevalence rates of asthma

Table 3 Effect of parental passive smoking on reported asthma and asthma symptoms

	Paternal smoking		*Maternal smoking*		*Prevalence (%) of symptoms*		
Symptoms	*OR*	*95% CI*	*OR*	*95% CI*	*No parent smokes*	*One parent smokes*	*Both parents smoke*
Asthma ever	1.10	0.84 to 1.44	1.39 (p < 0.01)	1.12 to 1.74	20.6 (p < 0.01)	26.4	28.7
Wheeze ever	1.38 (p < 0.01)	1.11 to 1.72	1.46 (p < 0.001)	1.19 to 1.79	25.6 (p < 0.001)	28.0	36.9
Limitation of speech past year	1.21	0.63 to 2.31	1.12	0.66 to 1.90	2.7	3.7	4.3
Wheeze past year	0.80	0.61 to 1.16	1.15	0.86 to 1.54	15.5	16.9	21.6
Wheeze with exercise past year	1.04	0.76 to 1.44	1.38	1.05 to 1.81	11.5	13.2	17.4
Night time cough past year	0.93	0.74 to 1.20	1.05	0.85 to 1.29	26.6	27.4	28.5

OR, odd ratio; CI, confidence interval: both by univariant regression.

Table 4 Prevalence of asthma, asthma symptoms, and other allergic disorders in our study compared with other studies

Symptoms	*Our study (6–7 years) (n = 3000)*	*National survey*			*Italy (6–7 years)[26] (n = 18737)*	*Singapore (6–7 years)[27] (n = 2012)*
		1992 (5–7 years)[1] (n = 2067)	*1995 (12–14 years)[2] (n = 5719)*	*1999 (12–14 years)[3] (n = 3709)*		
Ever wheezed	29.6	24.4***	49.9***		24.0***	28.6
Current wheeze	18.0	16.7	34.1***		7.7***	16.5
Exercise induced wheezing	13.0	9.8***	28.7***		1.7***	8.4***
Current night time cough	27.7	16.4***	31.8***		18.0***	14.9***
Ever had asthma	22.7	12.8***	20.3***		9.0***	18.5***
Current number of wheezing episodes						
1-3	10.8	8.2			4.6	
4-12	5.1	5.2	9.3		1.1	
> 12	1.8	2.5			0.4	
Woken by wheeze past year						
< 1 per week	7.4				1.5	
⩾ 1 per week	5.7	6.1	4.0		0.6	
Current limitation of speech	3.5	3.2	8.7		1.1	9.2
Ever having eczema	27.8			24.1***		3.0***
Current severe flexural rash	6.2			2.8***		8.8***
Current chronic rash	15.7			18.7***		6.1***
Ever having hay fever	10.1			33.1***		6.3***
Current rhinitis	20.5			19.4		27.6***

***p < 0.001, significant differences between our study and other studies.

(p < 0.01), wheeze ever (p < 0.001), current wheeze (p < 0.05), and wheeze with exercise (p < 0.01) compared with children whose parents did not smoke.

There were also negative associations between maternal smoking and both hay fever (p < 0.05) and eczema (p < 0.05). Paternal or maternal smoking had no significant effect on the number of wheeze attacks, severe wheeze limiting speech, sleep disturbances from rash, current rhinitis, rhinitis ever, and night time cough.

Both a history of rhinitis in the past 12 months (or current rhinitis) and itchy rash in the flexural areas in the past 12 months (or current eczema) were associated with current wheeze (current rhinitis: OR, 5.04; 95% CI, 3.31 to 7.69; p < 0.001; current eczema: OR, 2.73; 95% CI, 1.75 to 4.26; p < 0.001).

Rhinitis was reported by 44% and 40% of boys and girls with asthma, respectively. The prevalence rates of current rhinitis in boys and girls with asthma were 42% and 37%, respectively. Twenty five per cent of boys with asthma and 20% of girls with asthma reported having hay fever at some time in their life. Eczema was reported by 46% of boys and girls with asthma. Current chronic rash was reported by 22% and 28% of boys and girls with asthma, respectively.

Discussion

The ISAAC questionnaire has been tested and validated.[5] Its validity and repeatability have been confirmed in relation to bronchial hyperreactivity[6] and physician diagnosed asthma,[7] and are similar to those of questionnaires for adults.[8] Jenkins and colleagues[7] found that consistent responses to the questions wheezing ever and any wheeze within the past 12 months had a sensitivity of 85%, specificity of 91%, and positive and negative predictive values of 61% and 94%, respectively. The assessment of childhood respiratory symptoms by questionnaires is accurate and reproducible.[9]

Our study confirms the male preponderance of respiratory symptoms in younger children.[10] However, when more severe respiratory symptoms, such as speech limiting wheeze and wheeze with sleep disturbance were examined, the sex difference became less obvious (table 2). One possible explanation for this finding is that boys might tend to underestimate whereas girls might tend to overestimate the severity of the disease.[11] This could explain why self completed questionnaires on older children generally show a female predominance of asthma symptoms, whereas in younger children, using parental completed questionnaires, there is a male predominance. However, some studies in adults[12] show that the atopy rate is 20% higher in men than in women, and others[13] indicate that the higher prevalence of asthma in boys could also be a result of their smaller airways relative to lung size compared with girls.

As expected, we found a strong association between reported asthma symptoms and symptoms of other atopic disorders. Regarding the association of allergic rhinitis and eczema with childhood asthma, Anderson and colleagues[10] showed that it was a characteristic feature of the atopic trait. Children with a history of eczema at the age of 7 years are more likely to have persistent asthma from early childhood throughout adolescence and into adult life.[14] We also found a male predominance in rhinitis symptoms.

A review of the literature by Hood *et al* suggests that there is no consistent association between parental smoking and respiratory symptoms in school aged children.[15] Passive smoking as a result of parental smoking has been associated with the development of bronchial hyperresponsiveness,[16] the development[17] and exacerbation of asthma,[14] and recurrent wheezing[18] in susceptible children. Recent meta-analyses of passive smoking[19] indicate that exposure to environmental tobacco smoke has a greater effect on more severe wheeze, both within studies, where odds ratios were reported for different severity measures, and between studies, where odds ratios, were highest in studies with low prevalence rates of wheeze. Other meta-analyses by the same authors[20] indicate that the incidence and recurrence of wheezing illness increased when there was smoking in the household, particularly by

the mother, whereas the incidence of asthma during the school years was less strongly affected by parental smoking.

We found an association between maternal smoking and asthma, other allergic symptoms, and wheeze symptoms. Of those children not exposed to parental smoking, 15.5% suffered from wheezing in the past 12 months. This figure increased slightly to 16.9% when one parent smoked and by over a third to 21.6% when both parents smoked. Other symptoms such as night time coughing with no cold also increased when the children were exposed to passive smoking, although this effect was smaller. Our results are similar to those of Kay *et al*,[21] who found that parental smoking appeared to increase the prevalence of asthma, especially when both parents smoked.

We found negative associations between maternal smoking and both hay fever and eczema. This confirms the negative relations between maternal smoking and hay fever reported by Austin and Russell.[22] They also found that cough was significantly increased in children whose mothers currently smoked. There was a strong association between cough and current wheeze. They showed a reduced risk of hay fever in children whose mothers smoked.

Our findings also confirm the negative relation between passive smoking and seasonal rhinitis, which has been reported by Sibbald and Rink.[23] Burr *et al* found a negative relation between maternal smoking and skin sensitivity.[24] Their results indicated that maternal smoking during pregnancy was associated positively with IgE at 3 months and negatively with skin sensitivity at 7 years.

Maternal smoking appeared to raise IgE values in infancy.[25] The increase in serum IgE seemed to be transitory and was not associated with atopy or disease at the age of 7 years.

In our study, the 12 month period prevalence of wheezing in these children was 18%; nearly one fifth of our children had wheezing. Approximately one in two children who wheezed reported having one to three wheezing attacks. About one third had frequent sleep disturbances—one or more times each week. About one fifth had limitation of speech during wheezing attacks. This is a major public health problem.

Table 4 compares our study with other national and international studies. Comparing children in our study (6–7 year olds) with the national survey of asthma in British children (5–7 year olds) conducted nationwide in 1992,[1] the prevalence rates of asthma and asthma symptoms were higher in our study than in the study conducted in 1992 ($p < 0.001$). This confirms that the prevalence of asthma and asthma symptoms in the UK is increasing.

When our study (6–7 year olds) was compared with the second national survey,[2] conducted on 12–14 year olds in 1995, the prevalence rates of asthma and asthma symptoms in our study were significantly lower ($p < 0.001$) than those reported for the north east in the national survey. However, when the children in our study (6–7 year olds) were compared with those in the third national survey conducted on 12–14 year olds,[3] the prevalence rates of eczema ever and current severe flexural rash were significantly higher ($p < 0.001$) in our study, whereas the prevalence rates of hay fever and current chronic rash were significantly lower ($p < 0.001$).

When the children in our study were compared with children from Italy (6–7 year olds) studied in 1997,[26] the prevalence rates of asthma and asthma-like symptoms were significantly higher ($p < 0.001$) in our study population. In addition, comparing children in our study with children from Singapore (6–7 year olds),[27] the prevalence rates of wheezing with exercise, persistent night time cough, asthma ever, eczema ever, current chronic rash, and hay fever were significantly higher in our children than those from Singapore ($p < 0.001$). However, the prevalence rates of current severe flexural rash and current rhinitis in our study were significantly lower than those found in children from Singapore ($p < 0.001$).

Our study provides an up to date description of the scale and distribution of asthma, rhinitis, and eczema in 6–7 year old children from the north east of England. The study would be a suitable baseline for monitoring future trends in the prevalence, and severity of asthma among these children.

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