
Prevalence and severity of asthma, rhinitis, and atopic eczema in 13- to 14-year-old schoolchildren from the northeast of England

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Objective: To investigate the prevalence and severity of asthma, rhinitis, and atopic eczema in schoolchildren from the northeast of England.

Methods: We randomly selected 3,000 children from 80 schools. We used the ISAAC (International Study of Asthma and Allergies in Childhood) written questionnaire.

Results: The lifetime prevalence rates of symptoms were: rhinitis, 32.8%; wheezing, 31.3%; hay fever, 23.7%; and self-reported asthma, 22.3%. Rhinitis was reported by 53% and 61% of boys and girls with asthma, respectively. Girls 13 to 14 years of age had higher prevalence rates of asthma, rhinitis, and eczema symptoms than boys; a reverse sex ratio has been shown in this age group. Atopic eczema was reported by 32% of boys with asthma and 37% of girls with asthma.

Conclusions: The prevalence rates of reported asthma, and symptoms suggestive of asthma, were higher than those previously reported in UK children. The present study would be a suitable baseline for monitoring future trends in the prevalence and severity of asthma and allergic disorders among these children, and provides a framework for further etiologic research into the genetics, lifestyle, environmental, and medical care factors affecting these conditions.

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INTRODUCTION

Respiratory disease has an effect on morbidity and mortality at all ages. The total number of hospital admissions in England and Wales with a discharge diagnosis of asthma rose considerably through the 1970s and 1980s, increasing from just less than 20,000 per year in the early 1960s to 80,000 per year by the mid-1980s.

Recent studies suggest that the prevalence of asthma is rising in children and adolescents.^{1–3} Environmental factors, especially those related to “westernization,” and respiratory infections might be important in the increasing frequency of the disease.

An international childhood asthma prevalence study, the International

Study of Asthma and Allergies in Childhood (ISAAC), was formed in 1992.⁴ The ISAAC project has three phases. Phase I uses core questionnaires to evaluate the prevalence and severity of asthma and allergic disease in defined populations. Phase II covers management, including medications and health services delivery; indoor environmental risk factors, including physical conditions, chemical irritants, and allergens; other respiratory symptoms; bronchial responsiveness testing; skin tests for allergy; serum IgE; and physical examination. Phase III will investigate whether asthma prevalence is increasing and whether the increases are uniform throughout the world, and will identify factors which may be related to these increases.

The summary results of all phase I ISAAC surveys have been published.⁵ There were differences of between 20-fold and 60-fold among centers in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic

eczema, with 4-fold to 12-fold variations between the 10th and 90th percentiles for the different disorders. For asthma symptoms, the highest 12-month prevalences were from centers in the United Kingdom, Australia, New Zealand, and Republic of Ireland, followed by most centers in North, Central, and South America; the lowest prevalences were from centers in several Eastern European countries, Indonesia, Greece, China, Taiwan, Uzbekistan, India, and Ethiopia.

The National Survey of asthma in children aged 5 to 17 years in the United Kingdom⁶ showed that in the past year, 14.2% of children had wheezed, 2.2% had >12 attacks, and 2.2% had experienced speech-limiting attacks.

Another ISAAC UK national study of 12- to 14-year-old children⁷ 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.

The ISAAC UK national study of 12- to 14-year-old children⁸ found 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.

In our previous study of 6- to 7-year-olds,⁹ the lifetime prevalence rates of various symptoms were: wheezing, 29.6%; atopic eczema, 27.8%; rhinitis, 23.1%; and self-reported asthma, 22.7%.

Nearly one-fifth of children had wheezing and approximately 1 in 2 children who wheezed reported having one to three wheezing attacks. About

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one-third had frequent sleep disturbances one or more times each week. About one-fifth had limitation of speech during wheezing attacks.

As one of the participating centers of ISAAC, we surveyed the prevalence of asthma and allergic disease in 13- to 14-year-old schoolchildren in the northeast. Our results will be compared with other studies using the same ISAAC protocol.

MATERIALS AND METHODS

The study has been approved by the University of Sunderland Ethical Committee, head teachers, and parents/guardians of children. The study was part of ISAAC. We used the ISAAC written questionnaire for asthma, rhinitis, and eczema. Each subject was given an ISAAC written questionnaire to complete. We prepared sampling frames of mixed-sex state schools with more than 100 pupils in each school year. We randomly selected one school from each sampling frame, to produce 33 schools for study. Thirty-one agreed to participate and were able to provide 3,000 schoolchildren 13 to 14 years old

as potential subjects. The response rate was 90%.

The ISAAC written questionnaire¹⁰ 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 analyzed using SPSS for Windows. The χ^2 test was used to evaluate the association between categorical variables. Logistic regression was used to estimate risk factors for current wheeze and severe asthma attack. Estimates of 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 Calculation

With a sample size of 3,000, the power to detect the difference in 1-year prevalence of wheezing and severe asthma between two centers 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 girls than boys (*P* < 0.05 vs *P* < 0.001). Wheeze and rhinitis were the most common symptoms affecting the children, with lifetime prevalence rates of 34.3% and 35.4% in girls and 28.9% and 32.1% in boys, respectively.

Girls were more likely to report asthma, wheeze ever, current wheeze, wheeze with exercise, night-time cough, rhinitis ever, current rhinitis, and hay fever than boys. Girls were significantly (*P* < 0.001) more likely to report atopic eczema or chronic rash.

The combination of asthma, rhinitis, and atopic eczema was seen in 5.1% of these children, whereas 51.2% of them

Table 1. Self-Reported Prevalence (%) of Asthma, Rhinitis, and Eczema and Their Related Symptoms (Written Questionnaire) in 13- to 14-Year-Old Schoolchildren

Symptom	OR (95% CI)	<i>P</i> value	Boys (N = 1510)	Girls (N = 1490)	Boys:girls ratio	All (N = 3000)
Asthma						
Ever wheezed	0.77 (0.50–1.04)	<0.01	28.9	34.3	0.8	31.3
Wheeze in the past year	0.79 (0.60–1.10)		18.0	21.8	0.8	19.9
Wheezing with exercise last year	0.58 (0.32–1.26)	<0.001	19.4	28.6	0.7	22.8
Persistent cough last year	0.82 (0.70–1.18)		19.1	22.6	0.8	20.4
Ever had asthma	0.95 (0.79–1.25)		22.0	23.0	0.9	22.3
Rhinitis						
Ever had rhinitis	0.87 (0.49–1.46)		32.1	35.4	0.9	32.8
Rhinitis in the past year	0.89 (0.66–1.14)		27.5	31.7	0.9	28.9
Associated itchy eye in the the past year	0.82 (0.72–1.16)		16.1	21.3	0.8	17.7
Ever had hay fever	0.79 (0.72–0.86)	<0.01	23.1	28.1	0.8	23.7
Eczema						
Chronic rash ever	0.53 (0.42–0.62)	<0.001	13.9	22.8	0.6	18.2
Chronic rash in the past year	0.66 (0.51–0.75)	<0.01	11.3	20.5	0.6	15.6
Chronic rash with typical distribution	0.52 (0.40–0.68)	<0.001	8.8	15.9	0.6	12.4
Ever had eczema	0.69 (0.48–0.78)	<0.001	13.9	22.8	0.6	18.2
Age at which itchy rash first occurred						
<2 years			4.2	4.6		4.4
2–4 years			0.9	2.8		1.8
≥5 years			7.8	13.9		10.6

CI, confidence interval; OR, odds ratio; *P* indicates significance between boys and girls.

had asthma, rhinitis, or eczema. Fifty-three percent of boys with asthma, 61% of girls with asthma, and 57% of children with asthma had rhinitis, whereas 32%, 37%, and 34% had eczema, respectively. Thirty-nine percent of boys with asthma, 49% of girls with asthma, and 44% of all children reported having hay fever.

Table 3 shows the association between various symptoms and paternal and maternal smoking. There was an association between paternal smoking and wheeze ever ($P < 0.001$), wheeze with exercise ($P < 0.01$), and night-time cough ($P < 0.01$). There was no significant association between maternal smoking and asthma symptoms.

Asthma and asthma-like symptoms were more prevalent in children who were exposed to cigarette smoke in their home environment. Children of parents who smoke cigarettes had significantly higher prevalence rates of wheeze ever ($P < 0.05$), current limitation of speech ($P < 0.01$), current wheeze with exercise ($P < 0.05$), and current night-time cough ($P < 0.05$) compared with children whose parents did not smoke.

There were also negative associations between paternal smoking and both current chronic rash ($P < 0.01$) and lifetime chronic rash ($P < 0.05$). There was negative association between maternal smoking and both eczema ever ($P < 0.01$) and hay fever ever ($P < 0.05$).

Table 2. Prevalence of Reported Symptoms (%) Indicating Severity of Asthma, Rhinitis, and Eczema

Symptoms	Boys (N = 1510)	Girls (N = 1490)	Boys:girls ratio	All children (N = 3000)
Wheeze in past year				
Number of wheezing episodes				
1 to 3	12.1	12.1	1.0	12.4
4 to 12	3.8	5.5	0.7	4.7
>12	1.1	2.1	0.5	1.7
Woken by wheeze				
<1 each week	6.3	7.8	0.8	6.9
≥ 1 each week	1.7	3.2	0.5	2.8
Limitation of speech during wheezing	3.5	6.0	0.6	4.7
Rhinitis in past year				
Interference with daily activity				
Little	13.3	15.3	0.9	13.9
Moderate	3.2	2.7	1.2	3.0
Severe	0.9	2.4	0.4	1.5
Rashes in past year				
Persistent rash without clearing	4.7	5.8	0.8	5.6
Kept awake by rash				
<1 each week	2.7	5.9	0.5	4.2
≥ 1 each week	1.1	3.2	0.3	2.3

Both a history of rhinitis in the past 12 months (or current rhinitis) and a history of itchy rash in the flexural areas in the past 12 months (or current eczema) were significantly associated with current wheeze and severe wheezing attacks in these children (OR current rhinitis: 6.00, CI: 4.00 to 10.80; OR current eczema: 3.00, CI: 2.00 to 5.70).

Rhinitis was reported by 53% and 61% of boys and girls with asthma, respectively. The prevalence rates of current rhinitis in boys and girls with

asthma were 48% and 55%, respectively. Thirty-nine percent of boys and 49% of girls with asthma reported having hay fever at some time in their life. Eczema was reported by 32% of boys and 37% of girls with asthma. Current chronic rash was reported by 20% and 32% of boys and girls with asthma, respectively.

DISCUSSION

The validity and repeatability of the ISAAC questionnaire has been re-

Table 3. Effect of Parental Passive Smoking on Reported Asthma and Asthma Symptoms

Symptoms	Paternal smoking		Maternal smoking		Prevalence (%) of symptoms		
	OR	95% CI	OR	95% CI	No parent smokes	One parent smokes	Both parents smoke
Asthma ever	1.18	(0.94–1.24)	0.99	(0.81–1.18)	20.2	22.6	23.7
Wheeze ever	1.49	(1.30–1.60)	1.14	(1.02–1.25)	26.8	31.0	33.6
	$(P < 0.001)$				$(P < 0.05)$		
Limitation of speech past year	1.15	(1.00–1.27)	1.43	(1.30–1.53)	2.7	5.4	6.2
					$(P < 0.01)$		
Wheeze past year	0.91	(0.80–1.88)	0.80	(0.69–0.98)	17.4	19.0	21.4
Wheeze with exercise past year	1.35	(1.22–1.47)	1.08	(0.90–1.13)	19.6	22.6	25.3
	$(P < 0.01)$				$(P < 0.05)$		
Night-time cough past year	1.37	(1.24–1.48)	1.16	(1.00–1.25)	17.1	20.8	23.0
	$(P < 0.01)$				$(P < 0.05)$		

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

ported in relation to bronchial hyper-reactivity¹¹ and physician-diagnosed asthma,¹² and are similar to those of questionnaires for adults.¹³

There was female preponderance of respiratory symptoms, rhinitis, and atopic eczema in our study. Recent reports^{6,10,14} indicate that the male predominance seen in preadolescent children had generally decreased by the later teenage years; a reverse sex ratio has been shown that girls aged 13 to 14 years had higher rates for most symptoms. The present study confirms this reverse sex ratio.

One possible explanation for this finding is that, at this age group, boys might tend to underestimate whereas girls might tend to overestimate the symptoms. However, it seems that more than one factor is contributing to the reversal in the male/female ratio.¹⁴

There was an association between paternal smoking and several asthma symptoms. However, we cannot explain the reason for the lack of association between maternal smoking and asthma symptoms. Our results are similar to those of Kay et al¹⁵ who found that parental smoking seemed to in-

crease the prevalence of asthma, especially when both parents smoked.

The negative association between hay fever, atopic eczema, and chronic rash with both paternal and maternal smoking confirms the negative associations we found in our younger children (6- to 7-year-olds)⁸ and the study reported by Austin and Russell.¹⁶

In our study, the 12-month period prevalence of wheezing in these children was 20%. Approximately 1 in 2 children who wheezed reported having one to three wheezing attacks. About 1 in 6 children who wheezed reported having frequent sleep disturbances one or more times per week. About one-fourth of children who wheezed reported having 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 (13- to 14-year-olds) with the national survey of asthma in British children (11- to 13-year-olds) conducted in 1992 and published in 1994,⁶ the prevalence rates of asthma and asthma-like symptoms were significantly 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 United Kingdom is increasing.

When our study (13- to 14-year-olds) was compared with the second national survey,⁷ conducted on 12- to 14-year-olds in 1995 and published in 1998, the prevalence rates of asthma and asthma symptoms in our study were significantly lower ($P < 0.0001$) than those reported for the northeast in the national survey. We found similar findings in our study on 6- to 7-year-olds.⁹

When the children in our study (13- to 14-year-olds) were compared with those in the third national survey conducted on 12- to 14-year-olds in 1995 and published in 1999,⁸ the prevalence rates of eczema ever, current chronic rash, and hay fever ever were significantly lower ($P < 0.001$) in our study, whereas the prevalence rates of current severe flexural rash and current rhinitis were significantly ($P < 0.001$) higher.

When the children in our study were compared with children from Germany (12- to 15-year-olds) in a study con-

Table 4. Prevalence of Asthma, Asthma Symptoms, and Other Allergic Disorders in the Present Study Compared with Other Studies

Symptoms	Our Study (13-14 year old children) (N = 3000)	National Survey (year survey conducted)			Germany ⁽¹⁰⁾ (12-15 year old children) (N = 2050)	Singapore ⁽¹⁷⁾ (12-15 year old children) (N = 4102)
		1992 ⁽⁶⁾ (11-13 year old children) (N = 1251)	1995 ⁽⁷⁾ (12-14 year old children) (N = 5719)	1995 ⁽⁸⁾ (12-14 year old children) (N = 3709)		
Ever wheezed	31.3	21.7‡	49.9‡		33.0	18.6‡
Current wheeze	19.9	14.2‡	34.1‡		20.0	9.9‡
Exercise-induced wheezing	22.8	11.4‡	28.7‡			13.2‡
Current night time cough	20.4	11.3‡	31.8‡			11.4‡
Ever had asthma	22.3	13.6‡	20.3			20.7
Current number of wheezing episodes						
1-3	12.4	7.2‡			16.0‡	
4-12	4.7	4.5	9.3‡		3.0	14.8‡
>12	1.7	2.2			1.0	6.6‡
Awakened by wheeze past year						
<1 per week	6.9				4.0‡	29.5‡
>1 per week	2.8	3.7	4.0‡		2.0	11.8‡
Current limitation of speech	4.7	2.2	8.7‡		6.0*	23.6‡
Ever having eczema	18.2			24.1‡		4.1‡
Current severe flexural rash	5.6			2.8‡		9.5‡
Current chronic rash	15.6			18.7‡		7.0‡
Ever having hay fever	23.7			33.1‡		3.7‡
Current rhinitis	28.9			19.4‡		41.5‡

* $P < 0.05$, † $P < 0.01$, ‡ $P < 0.001$, significance differences between our study and other studies.

ducted in 1991 and published in 1993,¹⁰ the prevalence rates of current wheezing episodes (one to three episodes) and current limitation of speech were significantly lower in our study population, whereas the prevalence rate of sleep disturbances because of wheezing (<1 night per week) was significantly higher in our study.

Comparing children in our study with children from Singapore (12- to 15-year-olds),¹⁷ the prevalence rates of asthma and asthma-like symptoms in our study were significantly higher ($P < 0.001$) than those from Singapore. We found similar findings in our study of 6- to 7-year-olds.⁹ However, the prevalence rate of asthma severity (episodes of wheezing and sleep disturbance from wheezing) in our study was significantly lower ($P < 0.001$). The prevalence rates of eczema ever, current chronic rash, and hay fever in our study were significantly higher ($P < 0.001$) and the prevalence rates of current severe flexural rash and current rhinitis in our study were significantly lower ($P < 0.001$) than those in the Singapore study.

CONCLUSION

Our study provides description of the scale and distribution of asthma, rhinitis, and atopic eczema in 13- to 14-year-old children from the northeast of England. The present study would be a suitable baseline for monitoring future trends in the prevalence and severity of asthma among these children.

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