

REVIEW

Burden of allergic disease in the UK: secondary analyses of national databases

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Summary

Background Although allergy represents an important source of patient morbidity and healthcare utilization, there is little reliable information on the overall disease burden posed by allergic conditions in the UK.

Objectives Focusing on the following conditions: allergic rhinitis, anaphylaxis, asthma, conjunctivitis, eczema/dermatitis, food allergy and urticaria/angioedema, we sought to (i) describe the prevalence, incidence and outcomes of allergic disorders; (ii) describe the NHS healthcare burden posed by allergic disorders; (iii) estimate the costs of allergic disorders from a healthcare perspective.

Methods Secondary analyses of data from the Health Survey for England, Scottish Health Survey, International Study of Allergies and Asthma in Childhood, European Community Respiratory Health Survey, Morbidity Statistics from General Practice 1991/1992, Royal College of General Practitioners Weekly Returns Service, Prescribing Analysis and Cost data, Hospital Episodes Statistics and national mortality data.

Results Thirty-nine percent of children and 30% of adults have been diagnosed with one or more atopic conditions. Six percent of general practice consultations and 0.8% of hospital admissions are for allergic diseases. Treatments for asthma and other allergic disorders currently account for 10% of primary care prescribing costs. Direct NHS costs for managing allergic problems are estimated at over one billion UK pounds per annum.

Conclusions Allergic disorders are common throughout the UK, affecting males and females of all ages and peoples from all social classes and ethnic groups. They currently represent a substantial burden of morbidity and health service cost.

Keywords allergy, epidemiology, healthcare utilization, public health, UK

Introduction

In Britain, as in many European countries [1], there is little reliable information at the national level about the nature and magnitude of the burden posed by allergic conditions and the costs that these incur. Such information is important epidemiologically in order to provide a baseline from which to monitor disease trends and is required for health service and workforce planning.

The aim of this study was to quantify the current health burden posed by allergic diseases in the UK. We focused on the main allergic conditions encountered in the UK, namely, allergic rhinitis, anaphylaxis, angioedema, asthma, conjunctivitis, eczema/dermatitis, food allergy and urticaria. Specifically, we sought to describe the prevalence, incidence and outcomes of allergic disorders; describe the burden currently posed by allergic disorders to NHS primary and secondary care; estimate the healthcare costs of allergic disorders for the UK population. Secondary objectives were to comment on variations of allergic disease by socio-economic status and ethnic origin in the UK and on the UK's place in international allergy rankings.

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Methods

Datasets

In order to maximize the generalizability of our results, we confined our analyses to data from routine health information sources and large, high-quality, national and international surveys. These included the Health Survey for England [2, 3], Scottish Health Survey [4], International Study of Allergies and Asthma in Childhood (ISAAC) [5] and the European Community Respiratory Health Survey (ECRHS) [6] for estimates of symptomatic and clinician diagnosed disease prevalence; Morbidity Statistics from General Practice 1991/1992 (MSGP4) [7, 8] and the Royal College of General Practitioners Weekly Returns Service [9] and Prescribing Cost Analysis (PCA) [10] data for primary health care utilization; Hospital Episodes Statistics (HES) [11] for data on hospital admissions; and national mortality data [12]. A brief description of these datasets is given in Appendix 1.

Definitions

The working definitions used for our analyses were determined largely by the definitions employed in the original datasets. The definitions of allergic diseases were based on WHO International Classification of Diseases (ICD) codes

for HES, RCGP Weekly Returns Service, MSGP4 and mortality data (Appendix 2). The definitions from ISAAC, ECRHS, Health Survey for England and the Scottish Health Survey are based on the questions used in those surveys (Appendix 3). Children were defined as those aged under 15 years; young adults those aged 15–44 years; and older adults those aged 45 years and over. Ethnicity and socio-economic status were defined using the classification scheme used within individual datasets.

Statistical methods

Rates were calculated using mid-year population estimates from National Statistics [13]. These figures were age-standardized for reporting on ethnic and social class specific disease rates. All analyses were completed using Stata 8.

Assessing costs

Costs are based on a National Health Service perspective at 2000 prices. They therefore do not include costs of over-the-counter medications, or any estimates of the costs, monetary and otherwise, of missing school or work or any estimates of the loss in quality of life suffered. Costs of hospital in-patient stay were calculated using unit costs of Healthcare Resource Group procedures for asthma, skin procedures and allergies, from the Department of Health National Schedule of Reference Costs [14]. Sensitivity analyses around these estimates are based on the interquartile range of costs for these procedures in NHS trusts. Costs of general practice (GP) consultations were derived from a Department of Health funded report that gives estimates of unit costs of GP

consultations lasting on average 9.4 min [15]. Sensitivity analyses around these estimates excluded the costs of direct care staff and extended the consultation time to 12.6 min.

Community prescription costs were estimated using PCA data, which provided a measure of the number of items dispensed and the net ingredient cost (NIC). NIC refers to the cost of the drug before discounts and does not include any dispensing costs or fees. It does not include any adjustment for income obtained where a prescription charge is paid at the time the prescription is dispensed or where the patient has purchased a pre-payment certificate.

Results

Prevalence, incidence and outcomes of allergic disorders

Thirty-nine percent of children and 30% of adults have been diagnosed with one or more of asthma, eczema and hayfever (Table 1). Over half of teenagers, whose answers were self-reported instead of parentally reported, said they had asthma, eczema or hayfever. Thirty-eight percent of children and 45% of adults experienced symptoms suggestive of allergic rhinitis, asthma or eczema in the preceding 12 months. Raised levels of house dust-mite-specific IgE (more than 0.1 kU/L) were present in 27% of children aged 11–15 years, 28% of adults aged 16–44 and 12% of those aged 45+. Allergic problems frequently co-exist. Eleven percent of children (2–15 years), 10% of young adults (16–44) and 5% of older adults (45+) have been diagnosed with more than one atopic disorder.

Table 1. Prevalence (%) of symptoms and diagnoses of asthma, hayfever and eczema and the effects of symptoms on sleep and daily activities

	Age			
	13/14	2–15	16–44	45+
Asthma				
Ever wheezed	49	28	32	33
Wheezed last year	32	18	19	22
Asthma ever	21	21	14	10
Wheeze affected activities quite a bit/a lot	5	4	2	5
Wheeze disturbed sleep ≥ 1 nights per week	6	4	3	5
Allergic rhinitis				
Sneezing/blocked nose without cold, ever		22	36	32
Rhino-conjunctivitis symptoms last year	19	11	19	12
Hayfever ever	35	9	19	10
Nasal allergy affected activities moderately/a lot	6	–	–	–
Eczema				
Ever itchy skin condition		31	40	36
Itchy skin last year	16	22	27	25
Eczema ever	22	24	16	9
Flexural rash disturbed sleep ≥ 1 nights per week	3	–	–	–
Number of diagnosed atopic conditions				
1	33	28	25	19
2	15	9	8	4
3	4	2	2	1
1 or more	52	39	35	24
House dust mite specific IgE				
% with >0.1 kU/L	–	27*	28	12

*11 years and over only.

Table 2. International comparison of the prevalence (%) of symptoms of allergy

Country average	Adults (22–40 years)			Children (13–14 years)	
	Wheeze 12 months	Nasal allergy 12 months	Specific IgE*	Wheeze 12 months	Rhinitis symptoms 12 months
Austria	14.3	16.4		11.6	10.5
Belgium	16.7	23.0	36.2	12.0	14.5
Estonia	26.8	18.1		10.8	4.5
France	14.3	30.9	31.2	13.5	15.9
Germany	17.2	18.2	36.2	13.8	13.5
Greece	16.0	18.4	24.9	3.7	6.3
Ireland	28.0	20.1	40.8	29.1	19.3
Italy	9.4	15.1	27.2	8.9	13.4
Portugal	18.4	16.1		9.5	7.0
Spain	22.2	14.1		10.3	15.1
Sweden	20.7	21.9	32.3	12.9	11.6
UK	26.6	27.0	40.1	32.2	18.5

*Any of cat, grass, mould, mite or local allergen.

Table 3. Mean weekly GP episode incidence (rate per 100 000) in 2002

	Total	Asthma	Hayfever/allergic rhinitis	Atopic dermatitis and related conditions
Total	73	28	25	20
Male	66	25	22	18
Female	79	30	27	22
0–14	144	46	34	63
15–44	67	25	31	11
45+	45	21	14	10

Other studies have shown little evidence of variation in prevalence between UK regions in prevalence of asthma symptoms or diagnosis [16]. Internationally, the UK ranks in the top three out of 12 European countries for prevalence of wheeze in the last year in both adults and children (Table 2) and has amongst the highest rates of nasal allergy in adults, rhinitis symptoms in children and raised specific IgE.

There are no national data on the incidence of allergic conditions.

Almost all deaths from allergic conditions are coded as resulting from asthma. This caused 1272 deaths from asthma in 2000, a rate of 24 per million. Anaphylaxis deaths are an uncommon occurrence with 1 death recorded as due to anaphylaxis between 1990 and 2000. Further analysis of admissions and deaths data has shown that a total of 12 deaths mentioned anaphylaxis as a cause over a four-year period 1991–1995 [17].

Health service utilization

Primary care The most comprehensive survey of general practice last took place in 1991. At that time 22 150 patients per 100 000 patient years consulted GP's for eczema, asthma, allergic rhino-conjunctivitis and urticaria, which accounted for 6% of all consultations that year. The allergic conditions for which patients most commonly consulted GPs were eczema (5060 patients consulting per 100 000 patient years), asthma (4210 per 100 000 patient years) and allergic rhinitis (2830 per 100 000 patient years). More recent estimates from

a sample of British practices, which report weekly, showed that in 2002 weekly consultations for asthma, allergic rhinitis/hayfever and atopic dermatitis and related conditions numbered 73 800, 5% of all consultations recorded. Mean weekly GP episode incidence rates from this sample were 28, 25 and 20 per 100 000 for asthma, allergic rhinitis and eczema, respectively (Table 3).

Over 66.5 million community prescriptions were dispensed for asthma and other allergic problems in England in 2001, 11% of all such prescriptions given. These were mainly for drugs used for asthma (37.8 million), eczema (22.9 million) and nasal allergy (4.3 million).

There were small social class differences in consulting for allergic diseases (Table 4) with higher rates of patients consulting in classes IV/V compared with classes I/II for asthma, eczema and urticaria in both children (rate ratios (RR) = 1.15, 1.12, and 1.24, respectively) and adults (RR = 1.24, 1.11 and 1.29). This pattern was reversed for allergic rhinitis and conjunctivitis with lower rates in classes IV/V in children (RR = 0.85) and adults (RR = 0.79).

Patients from all recorded ethnic groups consulted for allergies. 'Black' groups consulted twice as frequently as 'White' groups for allergic rhinitis or conjunctivitis (RR = 2.08, 95% confidence interval (CI) 1.78–2.42) as did 'Other non-white' groups (RR = 2.29, 95% CI 1.99–2.62). 'South Asian' and 'Black' groups consulted significantly more than 'White' groups for asthma (RR = 1.21, 95% CI 1.06–1.38 and RR = 1.37, 95% CI 1.16–1.62, respectively). 'South Asian', 'Black' and 'Other non-white' groups also all consulted significantly more than 'White' groups for eczema (RR = 1.69, 95% CI 1.52–1.87; RR = 1.32, 95% CI 1.12–1.54; RR = 1.64, 95% CI 1.43–1.56).

Secondary care There were nearly 70 000 NHS hospital admissions for allergic disorders (92.5 per 100 000) in 2000/2001. Asthma accounted for the majority (87%) of these admissions; there were however in the financial year 2000/2001 over 9000 admissions for other allergic problems (urticaria = 2147; anaphylaxis = 1964; atopic dermatitis = 1528; food allergy = 1388; allergic rhinitis = 1156; angioedema = 819 and conjunctivitis = 90). The highest rates (292 per

Table 4. Patients consulting GPs by social class, rate per 100 000 person years, rate ratio and 95% confidence intervals (CI), England and Wales 1991/1992

	Social class	Children rate	RR	95% CI	95% CI	Adults rate	RR	95% CI	95% CI
Asthma	I/II	7585	1.00			3149	1.00		
	III nm	8219	1.08	1.00	1.18	3419	1.09	1.02	1.16
	III m	8519	1.12	1.06	1.19	3530	1.12	1.07	1.18
	IV/V	8726	1.15	1.08	1.23	3902	1.24	1.17	1.31
Eczema	I/II	9385	1.00			3821	1.00		
	III nm	10415	1.09	1.03	1.19	4482	1.17	1.11	1.24
	III m	10109	1.08	1.02	1.14	4057	1.06	1.01	1.11
	IV/V	10488	1.12	1.05	1.19	4232	1.11	1.05	1.16
Allergic rhinitis and conjunctivitis	I/II	5044	1.00			3504	1.00		
	III nm	5009	0.99	0.89	1.10	3798	1.08	1.02	1.15
	III m	4445	0.88	0.81	0.95	2812	0.80	0.76	0.84
	IV/V	4293	0.85	0.78	0.93	2761	0.79	0.74	0.84
Other (anaphylaxis, angioedema, food allergy, urticaria)	I/II	1760	1.00			1011	1.00		
	III nm	2165	1.23	1.04	1.45	1171	1.16	1.04	1.29
	III m	2016	1.15	1.01	1.30	1209	1.20	1.10	1.31
	IV/V	2183	1.24	1.08	1.42	1301	1.29	1.17	1.41

RR, rate ratios.

Table 5. Hospital admissions for allergic conditions in England (rate per 100 000) in 2000/2001

	Total	Asthma	Allergic rhinitis	Anaphylactic shock	Conjunctivitis	Atopic dermatitis	Food allergy	Urticaria	Angioedema
Total	140	122.9	1.6	3.8	0.2	2.5	2.9	4.2	1.8
Male	137	119.9	1.7	3.4	0.1	2.8	3.2	4.1	1.6
Female	143	125.7	1.5	4.1	0.2	2.2	2.6	4.3	1.9
0–14	334	292.4	3.1	4.1	0.3	8.7	11.8	12.6	1.0
15–44	96	84.2	1.9	3.9	0.1	1.4	1.1	2.5	1.3
45+	93	82.9	0.6	3.5	0.2	0.7	0.5	2.0	2.6

100 000 population) were for asthma in children aged 0–14 years (Table 5) followed by urticaria (12.6) and food allergy (11.8), also in children.

Healthcare costs

Allergic problems are responsible for an estimated 12.5 million GP consultations per year. Using a cost of £18 per 9.36 min consultation [15] this results in an estimated cost of £224 million per annum (Table 6). Using different assumptions about staffing and average consultation times, the cost per consultation could be as little as £17 or as high as £25. These results in estimates to the NHS cost for primary care ranging from £211 to £311 million.

Primary care prescribing costs for all conditions amount to £6.8 billion per annum. Treatments for asthma and other allergic disorders currently account for 11% (£0.7 billion) of this budget, compared with 10% for gastro-intestinal disorders and 23% for cardiovascular diseases [10].

Allergic problems are responsible for over 183 000 bed-days each year. Unit costs per hospital in-patient day were estimated from weighted averages for different procedures for elective, non-elective and day case episodes. These were £1763, £913 and £342, respectively, for asthma, £914, £847 and £382 for skin procedures (intermediate and minor) and £656, £425 and £411 for allergies [14]. This results in an estimated cost of over £68 million per annum (sensitivity analysis limits £56–83 million).

In total, these costs amount to over one billion pounds per annum.

Discussion

The principal strengths of this work are reliance on nationally representative data, wherever possible, permitting a compilation of figures from a variety of sources for a similar geographical area and time period. Availability of 100% of prescriptions, hospital admissions and deaths enabled us include some rarer allergic disorders, such as anaphylaxis, which do not feature in smaller local studies. This is, therefore, the most comprehensive review of allergic disease prevalence, mortality and burden to health services undertaken to-date in the UK.

The main limitations of this work are those generally faced in the context of secondary analyses of data, particularly routinely collected statistics. We were unable to assess the validity of patient recalls of an allergy diagnosis (in relation to Health Survey for England and Scottish Health Survey data) or the accuracy of clinician diagnoses (important in relation to Health Survey for England, Scottish Health Survey, MSGP4, RCGP WRS and HES data). This limitation does not however apply to ISAAC and asthma within ECRHS data as these were based on symptoms of disease rather than diagnostic labels. Accurately assessing healthcare costs is also problematic, as we currently have no reliable measure of the

Table 6. Annual cost of hospital in-patient care, GP consultations and community prescriptions, UK

	Cost estimate (£million)	Sensitivity analyses	
		Lower	Upper
<i>Hospital admissions (2000)</i>			
Asthma			
Elective in patient	3.0	1.8	3.3
Non-elective in patient	54.7	47.2	67.6
Daycases	5.3	3.0	6.1
Other allergy			
Elective in patient	0.7	0.5	0.8
Non-elective in patient	2.7	2.1	3.3
Daycases	1.9	1.4	2.1
Asthma	63.1	52.0	77.0
Other allergy	5.4	4.0	6.2
Total admissions costs	68.5	56.0	83.2
<i>GP consultations (2000)</i>			
Asthma	96.4	91.1	133.9
Other allergy	127.5	120.4	177.1
Total GP costs	223.9	211.5	311.0
<i>Community prescriptions (2002)</i>			
Asthma	594.9		
Other allergy	142.8		
Total	737.7		
Total (admissions, GP, prescriptions)	1030.2	1005.2	1132.0

frequency of GP out-of-hours consultations, accident and emergency room attendances, walk-in centres and out-patient consultations for allergic conditions. There are also currently no reliable measures of hospital-dispensed treatments for allergic problems. The overall estimates of cost presented are therefore likely to under-estimate NHS costs.

Allergic disorders are common in the UK, affecting males and females of all ages, social classes and ethnic groups. Allergic rhinitis, asthma and eczema represent the most commonly experienced conditions. Analyses of data from large national epidemiological surveys show that one in three of the UK population has at some point in their lives experienced symptoms of these disorders. International comparisons reveal that Britain has the highest prevalence of symptoms of allergy in Europe and ranks as amongst the highest in the world.

NHS costs of caring for these patients are substantial, GP prescriptions costs alone estimated at being £0.7 billion/year, this figure representing over 10% of the GP prescribing budget. Other direct costs to the NHS include GP consultation and hospital admissions costs which run at approximately £0.3 billion million per annum giving a total conservative estimate of over one billion pounds per annum. This does not include any indirect, personal or business costs such as school or workdays lost, over-the-counter medications, alternative therapies or quality-of-life lost and future studies should consider assessing patient perspectives on disease burden and associated costs.

Trends in health care utilization have shown very substantial increases in the prevalence of organ-specific allergic disorders (asthma, eczema and hayfever) during the latter half of the 20th century [18]. For asthma, these upward trends

have reversed or stabilized [18, 19] and some prevalence studies also suggest a levelling off [20, 21]. These patterns may reflect either a genuine decline in disease prevalence or better community management of asthma, or both. On the other hand, there is some evidence to suggest that the disease frequencies of the more serious systemic allergic disorders (anaphylaxis, angiodema, food allergy and urticaria) are rapidly increasing [22]. With divergent patterns for different allergic diseases, there is a need for continuing surveillance of time trends in morbidity, healthcare and economic burden to inform planning of health services including both generalist and specialist allergy care in hospitals and in the community.

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Appendix 1 – data sources

Health survey for England

HSE is an annual series of nationally representative interview surveys of private households in England. In 1995, 1996 and 1997, a series of questions about respiratory health were asked of over 40 000 people; these were accompanied with detailed questions on socio-economic circumstances.

Scottish health survey

A series of national surveys of the Scottish population aged between 2 and 74 living in private households. The 1998 survey, in which 9000 adults and 3900 children were interviewed, enquired about respiratory health.

International study of asthma and allergy in children

The ISAAC study, conducted in 155 centres in 55 countries, sought to estimate the prevalence of symptoms of asthma, hayfever and atopic dermatitis (and associated diagnoses) in 6–7-year olds and 13–14-year olds and to assess for evidence of geographical variations in disease prevalence.

European Community Respiratory Health Survey

ECRHS was a survey of adults aged between 22 and 40 years conducted in 17 countries in Europe. Questions were asked

about symptoms of asthma and hayfever and blood tests were performed to assess specific IgE measures to a variety of allergens.

Morbidity Statistics in General Practice

MSGP is a decennial series of surveys of general practice. The Fourth National Survey of General Practice (MSGP4) was a national survey of 60 general practices in England and Wales in 1991/1992 covering a 1% sample of the population (over 500 000 patients). Consultations to GPs were recorded using the Ninth Revision of the International Classifications of Disease (ICD-9) codes and trained interviewers recorded socio-economic data.

Royal College of General Practitioners Weekly Returns Service

RCGP WRS records weekly consultations for selected diseases from 72 general practices in Great Britain. Consultations are classified as being new or on going and reported by disease type.

Prescription Cost Analysis

PCA data are based on information obtained from prescriptions sent to the Prescription Pricing Authority (PPA) for payment. PCA covers all prescriptions dispensed in England, in the community (i.e. by community pharmacists, appliance contractors, dispensing doctors, and items personally administered by doctors).

Hospital Episode Statistics

The HES database contains personal, medical and administrative details on all patients admitted to, and treated in, NHS hospitals in England. HES data is split into years, which run from 1st April to 31st March of the following year. Diagnoses in HES are classified using ICD 10.

National Statistics Population and Mortality

National Statistics produces annual routine statistics on numbers and causes of deaths. These were classified using ICD 9 up to 2000 and will change to ICD-10 for deaths in 2001 onwards. Routine mortality data for asthma and other respiratory diseases are available by age and sex in England, Wales, Scotland and Northern Ireland. Population counts are also available for each region in order to derive rates.

Appendix 2 – ICD codes for allergic conditions

Condition	ICD-9 codes	ICD-10 codes
Allergic rhinitis	477 Allergic rhinitis	J30.1 Allergic rhinitis due to pollen J30.2 Other seasonal allergic rhinitis J30.3 Other allergic rhinitis J30.4 Allergic rhinitis, unspecified
Anaphylaxis	995.0 Anaphylactic shock 999.4 Anaphylactic shock due to serum	T78.0 Anaphylactic shock due to adverse food reaction T78.2 Anaphylactic shock, unspecified

Condition	ICD-9 codes	ICD-10 codes
Asthma	493 Asthma	T80.5 Anaphylaxis due to serum T88.6 Anaphylactic shock due to adverse effect of correctly administered medication J45 Asthma J46 Status asthmaticus
Conjunctivitis	372.1 Chronic conjunctivitis 372.3 Other and unspecified conjunctivitis	H10.1 Acute atopic conjunctivitis
Eczema/dermatitis	691 Atopic dermatitis and related conditions 692 Contact dermatitis and other eczema	L20 Atopic dermatitis L23 Allergic contact dermatitis
Food allergy	693.1 Dermatitis due to food	L27.2 Dermatitis due to food T78.1 Other adverse reactions to food
Urticaria/angioedema	708 Urticaria 995.1 Angioedema	L50 Urticaria T78.3 Angioedema

Appendix 3 – Questions on allergy used in survey data

International Survey of Asthma and Allergies in Childhood (ISAAC)

- Have you had wheeze or whistling in the chest in the last 12 months?
- Have you ever had asthma?
- In the past 12 months, have you had a problem with sneezing, or runny or blocked nose when you DID NOT have a cold? In the last 12 months, has this nose problem been accompanied by itchy-watery eyes?
- Have you ever had hayfever?
- Have you ever had an itchy rash that was coming and going for at least 6 months? Have you had this itchy rash at any time in the last 12 months? Has this itchy rash affect any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?
- Have you ever had eczema?

European Community Respiratory Health Survey

- Have you had wheeze or whistling in the chest at any time in the last 12 months?
- Have you ever had asthma?

- Do you have any nasal allergies including hayfever?
- Have you ever had eczema or any kind of skin allergy?

Health Survey for England 1996 (HSE 1996)

- Have you ever had wheeze or whistling in the chest?
- Have you had wheeze or whistling in the chest in the last 12 months?
- Have you been doctor-diagnosed with asthma?
- Have you ever had sneezing or a blocked nose without a cold?
- Have you had itchy watery eyes with sneezing or a runny or blocked nose without a cold in the last 12 months?
- Have you ever had doctor-diagnosed hayfever?
- Have you ever had an itchy skin condition?
- Have you had an itchy skin condition in the last 12 months?
- Have you ever had a doctor-diagnosis of eczema?

Scottish Health Survey 1998 (SHS 1998)

- Have you ever had wheeze or whistling in the chest in the last 12 months?
- Have you been doctor-diagnosed with asthma?