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Epidemiology and disease burden from allergic disease in Scotland: analyses of national databases

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DECLARATIONS

Competing interests

None declared

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Ethical approval

Not applicable

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CA and AS

Contributorship

CA was the researcher employed on this project and undertook data analysis and led the writing of this report. RG, CS and CF were grant-holders on this project and contributed to data interpretation and

Summary

Background There are ongoing concerns about the quality of care provided to patients with allergic disorders in Scotland, but there are relatively few reliable data on the overall disease burden. We sought to: (1) describe the incidence, prevalence and outcome of allergic disorders; (2) estimate healthcare burden and costs; and (3) investigate ethnic variations in the epidemiology and outcomes from allergic disorders in Scotland.

Methods Data sources: national surveys; primary care data; prescribing and medication data; hospital admissions data and mortality data.

Results Allergic disorders are extremely common in Scotland, affecting about one in three of the population at some time in their lives. Incidence was highest for eczema (10.2 per 1000 registered patients). Over 4% of all GP consultations and 1.5% of hospital admissions were for allergic disorders. There were 100 asthma deaths in 2005 (20 per million people). Direct healthcare costs for allergic disorders were an estimated £130 million per year, the majority of these being incurred in primary care and related to asthma.

Conclusions Allergic disorders are common in Scotland and given the very high proportion of children now affected, the high disease burden associated with these conditions is likely to persist for many decades.

Introduction

In recent decades, there has been a dramatic increase in the prevalence of a number of allergic disorders in the UK, resulting in considerable challenges to an ill-prepared National Health Service (NHS).¹⁻⁴ Concerns regarding the quality of allergy care were particularly highlighted in the Royal College of Physicians report *Allergy: the*

unmet need,⁵ which in turn precipitated parliamentary enquiries into allergy care provision in both England⁶ and Scotland.^{7,8}

Much of the epidemiological work underpinning the Royal College of Physicians report was based on detailed secondary analyses of available healthcare data-sets, with a focus on those data-sets most relevant to England and Wales.¹ Important data-sets of particular relevance to the

commenting on draft versions of this report. AS conceived the study and was the principal investigator for this work overseeing all aspects of the project and contributed to the editing and writing of this report

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None

Scottish context were, because of time and resource constraints, in the main overlooked.⁹

The aim of this study was to describe the epidemiology, morbidity, mortality and economic costs to NHS Scotland of allergic disorders. In seeking to answer these questions, we focused on the following conditions: allergic conjunctivitis; allergic rhinitis; anaphylaxis; angioedema; asthma; drug allergy; eczema/atopic dermatitis; food allergy; urticaria; and allergies not classified elsewhere. Our secondary aim was to investigate ethnic variations in the epidemiology and outcomes from these allergic disorders. In addition, Scotland's position in international allergy rankings was considered.

Methods

Data-sets

Data were collected from routine health information sources and large, high quality national and international surveys. Surveys included the 1995, 1998 and 2003 Scottish Health Surveys (SHS),¹⁰ the 2001 Health Survey for England (HSE) for comparative purposes,¹¹ and the International Study of Allergies and Asthma in Childhood (ISAAC).¹² Appendix 1 shows questions on allergy used in these surveys. Primary care healthcare data were obtained through the Information Services Division (ISD) of NHS National Services Scotland, for the Practice Team Information programme¹³ and the Quality and Outcomes Framework¹⁴ of the General Medical Services contract, from the Primary Care Clinical Informatics Unit, and from the QRESEARCH programme.¹⁵ Data on prescribing were provided by the Prescription Cost Analysis programme¹⁶ (part of ISD) and from over-the-counter sales¹⁷ for prescribing and medication. Data for continuous inpatient stays (the same continuous spell of inpatient treatment) were provided by ISD from the Scottish Morbidity Record (SMR01)¹⁸ and mortality data from the General Register Office for Scotland (GROS).¹⁹ A description of the salient features of these data-sets is given in Appendix 2.

Definitions

Allergic disease definitions were based on those used in the SHS, HSE and ISAAC surveys

(Appendix 1), Read codes for primary care data (Appendix 3) and the World Health Organization's (WHO) International Classification of Diseases (ICD 10) codes for SMR01 (Appendix 4).

Statistical methods

Incidence rates from primary care were calculated as the number of new cases of disease diagnosed in a specific year divided by the total number of patients registered with the study practices for that year (to give person years of exposure). These rates were multiplied by 1000 to give rates per 1000 registered patients per year. Lifetime prevalence was estimated from the number of GP patients with a recorded diagnosis of the disease at any point since being registered with a practice divided by the total number of patients registered with the study practices. These rates were standardized by sex and five-year age bands using the estimated mid-year Scottish population (obtained from GROS population estimates). Rates were multiplied by 1000 to give rates per 1000 registered patients. These rates were also standardized by sex and five-year age bands using the estimated mid-year (2004) English population and multiplied by 1000 to give rates per 1000 registered patients to compare with English primary care (QRESEARCH) data. All analyses were undertaken using SPSS v 13.0.

Assessing costs

The cost of GP consultations, hospital inpatient stay and day cases were calculated using unit costs and national estimates for measures of healthcare utilization.^{20,21} Community prescription costs were estimated using ISD prescription data using the standard Defined Daily Dose (DDD) and Gross Ingredient Cost (GIC). The DDD, as defined by the WHO is the assumed average maintenance dose per day for a drug when used for its main indication in adults.²² The GIC is the cost of an item before any discounts that may be made by the supplier to pharmacies; it does not include dispensing costs or fees. Fees paid by the recipient are also excluded; this equates with the Net Ingredient Cost.²³

Table 1**Incidence of new primary care diagnoses; 95% confidence interval (CI) by gender and diagnosis; rate per 1000 registered patients per year, Scotland 2003–2004 (Source: PCCIU)**

<i>Disease</i>	<i>Incidence in men</i>		<i>Incidence in women</i>		<i>Total incidence</i>	
		<i>(95% CI)</i>		<i>(95% CI)</i>		<i>(95% CI)</i>
All allergy	27	(26–28)	37	(36–38)	32	(31–33)
Allergic rhinitis	5.4	(5.0–5.7)	6.8	(6.5–5.4)	6.1	(5.9–6.3)
Anaphylaxis	0.02	(0.01–0.03)	0.04	(0.01–0.07)	0.02	(0.01–0.04)
Angio-oedema	0.03	(0.00–0.06)	0.05	(0.02–0.08)	0.04	(0.02–0.06)
All asthma	4.2	(3.9–4.5)	5.4	(5.1–5.7)	4.8	(4.6–5.0)
Allergic asthma	0.04	(0.01–0.07)	0.06	(0.03–0.09)	0.05	(0.03–0.07)
Conjunctivitis	0.84	(0.71–0.97)	1.6	(1.5–1.8)	1.2	(1.1–1.4)
Drug allergy	1.7	(1.5–1.9)	3.2	(2.9–3.5)	2.5	(2.3–2.6)
Eczema	8.8	(8.4–9.2)	11.6	(11.1–12.1)	10.2	(9.9–10.6)
Food allergy	0.17	(0.11–0.23)	0.22	(0.15–0.28)	0.19	(0.15–0.24)
Urticaria	2.7	(2.5–2.9)	4.1	(3.8–4.4)	3.4	(3.2–3.6)
Other allergies	1.7	(1.5–1.9)	3.2	(2.9–3.5)	2.5	(2.3–2.6)

Results

Incidence, prevalence and outcomes of allergic disorders

There were 12,210 incident cases of allergy in primary care in 2003–2004. The overall incidence rate of a primary care diagnosis of any allergic disorder was 32 per 1000 registered patients (95% CI 31–33) in 2003–2004 (Table 1). Incidence was higher in women (37 per 1000 registered patients) than men (27 per 1000 registered patients). The highest incidence in 2003–2004 was for eczema at 10.2 per 1000 registered patients (95% CI 9.9–10.5) for people of all ages and for both sexes combined. Incidence of eczema was higher in women (11.6 per 1000 registered patients) than men (8.8 per 1000 registered patients). The lowest incidence in 2003–2004 was for anaphylaxis at 0.02 per 1000 registered patients (95% CI 0.01–0.04) for people of all ages and for both sexes combined and was higher in women (0.04 per 1000 registered patients) than men (0.02 per 1000 registered patients). The recording of ethnicity in primary care was insufficient to permit analysis.

During the 12 months ending in March 2006, 8.3% of men and 10.5% of women consulted their practice with any diagnosis of allergic disease (PCCIU, data not shown). The lifetime prevalence for all allergies in Scotland (in 2004), based on general practice consultations, was substantially

higher at 350 (95% CI 348–352) per 1000 registered patients, compared to 243 (95% CI 243–245) per 1000 registered patients for England (in 2005) (Appendix 5). Prevalence was higher in Scotland when compared to England for allergic rhinitis, asthma and eczema, but not for anaphylaxis (Table 1, Appendix 5).

Asthma posed a particularly high disease burden. The proportion of respondents aged 16 years or over in the 2003 SHS who reported ever having wheezed was 27% in men and 26% in women (Table 2, Appendix 6). Among adult respondents to the 2003 survey, 13% of men and 14% of women reported that they had ever had asthma diagnosed by a doctor.

The lifetime prevalence of doctor-diagnosed asthma among children under 16 years in 2003 was 20% in boys and 12% in girls. The prevalence of wheeze within the last 12 months was 16% in boys and 12% in girls. The corresponding figures for lifetime wheeze were 29% and 20% (Appendix 6). Although ethnic group is recorded in the SHS the number of respondents from ethnic minorities was too small to allow separate analysis.

The 2002 ISAAC survey of 12–14-year-olds in Scotland (based on self-reports) found an overall prevalence of wheezing in the past 12 months of 28% and the lifetime prevalence of asthma was 26%, similar to the rest of the UK (data not shown).¹² The lifetime prevalence of diagnosed asthma increased slightly from 20% in 1995 to 24% in 2002.¹²

Table 2
GP consultation rates per 1000 GP consultations per year, (95% confidence intervals, source, PCCIU) Scotland 2003–2004

<i>Disease</i>	<i>GP consultations per 100,000 per year (95%CI)</i>
All allergic conditions	39 (39–39)
Allergic rhinitis	4.3 (4.3–4.3)
Anaphylaxis	0.03 (0.03–0.003)
Angioedema	0.03 (0.03–0.03)
Asthma	20 (20–20)
Allergic asthma	0.34 (0.34–0.34)
Conjunctivitis	0.53 (0.53–0.53)
Drug allergy	0.72 (0.72–0.73)
Eczema	10 (10–10)
Food allergy	0.16 (0.16–0.17)
Urticaria	1.6 (1.6–1.6)
Other allergy	1.2 (1.2–1.2)

The 2002 ISAAC survey in Scotland showed an overall prevalence of a rhinoconjunctivitis in the previous 12 months of 17%, with a lifetime prevalence of hayfever of 36%, slightly lower than the rest of the UK (data not shown). Between 1995 and 2002 there was a slight decrease in the prevalence of rhinoconjunctivitis in the previous 12 months among 12–14-year-olds in Scotland from 19% to 17%.¹²

The 2002 ISAAC survey in Scotland showed an overall prevalence of a flexural rash in the past 12 months of 13% while the lifetime prevalence of eczema was 24%, similar to the rest of the UK (data not shown). ISAAC data showed that between 1995 and 2002 there was a considerable decrease in the prevalence of flexural rash in the previous 12 months among 12–14-year-olds in Scotland from 17% to 13%.¹² No data on ethnicity were reported for the Scottish ISAAC data.

The only deaths recorded for allergic disease were for asthma. There were 100 asthma deaths (ICD10 J45–J46) in Scotland in 2005, these occurring at a rate of approximately 20 per million of the population. There were no recorded deaths from any other allergic problem.

Health service utilization

Primary care

There were 60,553 GP consultations for allergy in 2003–2004. The consultation rate for all allergies was 39 (95% CI 39–39) per 1000 registered patients

in 2003–2004 (Table 2) which was nearly 4% of all consultations for that year. The allergic conditions for which patients most commonly consulted GPs were asthma (20 [95% CI 20–20] consultations per 1000 registered patients annually, or nearly half of all GP consultations for allergic disease) and eczema (10 [95% CI 10–10] per 1000 registered patients).

Over 7.7 million community prescriptions were dispensed for allergic conditions in Scotland in 2003–2004, 13% of all prescriptions dispensed for that year. These were mainly for eczema (1.8 million) and asthma (1.7 million).

Secondary care

There were 24,189 admissions for all allergic disorders in 2004–2005, accounting for 1.5% of the total admissions for all conditions in that year. Of these, asthma was the commonest reason and accounted for 83% of allergic disease continuous inpatient stays. In the financial year 2004–2005 there were 1455 continuous inpatient stays for other allergic problems (urticaria=286; anaphylaxis=370; atopic dermatitis=245; food allergy=296; allergic rhinitis=93; angioedema=156 and conjunctivitis=9). The highest rates were for asthma in children under 15 (35.5 per 1000, Table 3), followed by eczema (1.83 per 1000) in the same age group. Around 10% of hospital discharges included information on ethnic group, insufficient to allow meaningful analysis.

Healthcare costs

GP consultations for allergic problems in Scotland cost the NHS an estimated £1.5 million per year, hospital admissions £10.2 million per year and community prescribed treatments for allergic conditions nearly £120 million (Table 4). Overall, allergic disease costs the NHS over £130 million per year in direct costs. Asthma was the major contributor across all cost domains (Table 4).

Primary care prescribing costs for all conditions amounted to nearly £1 billion, of which prescriptions for all allergic problems accounted for 13% (nearly £120 million) of this budget; this compared to 11% for gastrointestinal problems (nearly £104 million).

Table 3
Continuous inpatient stays for allergic conditions in Scotland (rate of admissions per year, per 1000 population) in 2004–2005

Disease	Total	Men	Women	0–14	15–44	45+
All allergic disease	12	10	15	44	15	6
Allergic rhinitis	0.13	0.14	0.12	0.39	0.26	0.3
Anaphylaxis	0.52	0.45	0.60	0.74	0.74	0.39
Angioedema	0.22	0.18	0.27	0.13	0.25	0.22
Asthma	9.9	8.0	12.2	35.5	12.1	0.47
Conjunctivitis	0.01	0.02	0.00	0.07	0.01	0.00
Eczema	0.34	0.35	0.34	1.83	0.36	0.09
Food allergy	0.42	0.42	0.42	0.258	0.26	0.12
Urticaria	0.40	0.36	0.45	1.37	0.53	0.18

Discussion

Main findings of this study

This is the most comprehensive and detailed review of the disease burden posed by allergic disorders in Scotland ever undertaken. We have found that allergic disorders are extremely common, affecting over one in three of the Scottish population at some point in their lives. The majority of these individuals are affected by one or more of the organ-specific allergic disorders, namely eczema, allergic rhinitis and/or asthma. Also, the lifetime prevalence for all allergic disease was higher in Scotland than England, namely for allergic rhinitis, asthma and eczema, but not for anaphylaxis. This analysis also reveals that these conditions are associated with significant costs to NHS Scotland (over £130 million), which are predominantly associated with the provision of asthma care and community-based prescribing.

Strengths and limitations of this work

The main strengths of this work include the use of data from a number of large and representative data-sets, the inclusion of a broad range of allergic conditions enabling us to include possible diagnostic transfer (for example, between angioedema and urticaria), and the use of a range of relevant epidemiological, health services utilization and cost-related outcomes. In addition, we were able to draw on our collective understanding and experience of working with these data-sets, and, more

specifically, data relating to allergic disorders, in order to interpret findings.

This work does however have a number of important potential limitations, these in the main relating to the available data sources. These include, most notably, the fact that we were dependent on recorded clinical diagnoses in both primary and secondary care, and also in relation to coding of deaths. This latter issue is, for example, known to be a potential problem in relation to the underestimate of deaths from anaphylaxis, which are often coded as asthma deaths.²⁴ In addition, the discordant time periods of each data-set made comparisons between data-sets slightly challenging. There are also potential problems in relation to interpreting data on trends as these can be affected by incentives to improve quality of care (for example, the Quality and Outcomes Framework),¹⁴ healthcare changes (for example, bed availability, commissioning priorities and other policy changes), changes in perceptions (for example, greater public awareness of food allergy) and data artefacts.

There are also limitations imposed by information gaps, such as the lack of data on allergic reactions in dentistry, utilization of out-of-hours primary care (NHS24), accident and emergency attendances, outpatient care, inpatient prescribing, some over-the-counter purchases of drugs for eczema and allergic rhinitis in particular, and in many cases regional, socioeconomic and ethnic variations in allergic disease risk and outcomes. As a consequence of this, our estimates of costs to the NHS are likely to be a substantial underestimate.

Table 4
GP consultations, 2003–2004 (source PCCIU), hospital inpatient costs and community prescriptions 2004–2005 (source ISD) for Scotland. Cost in £1000s

<i>Primary/secondary care</i>		<i>Cost (£1000s)</i>
GP	Allergic rhinitis	167
	Anaphylaxis	1
	Angioedema	1
	Asthma	786
	Conjunctivitis	20
	Drug allergy	28
	Eczema	397
	Food allergy	6
	Urticaria	61
	Other allergy	47
	All allergies	1514
Hospital, admissions	Asthma	
	Inpatient	2391
	Day case	122
	All allergy excluding asthma Inpatient	
	Allergic rhinitis	454
	Anaphylaxis	220
	Angioedema	105
	Conjunctivitis	6
	Eczema	223
	Food allergy	167
	Urticaria	223
	Other allergy	4496
	All allergy excluding asthma Day case	
	Allergic rhinitis	175
	Anaphylaxis	2
	Angioedema	1
	Conjunctivitis	1
	Eczema	63
	Food allergy	51
	Urticaria	34
Other allergy	1486	
Total hospital admissions	10,220	
Community prescriptions	Asthma	94,867
	Adrenaline	733
	Topical corticosteroids	6572
	Emollients	5898
	Antihistamines	11,887
	Total community prescriptions	119,9577
	Overall total	131,691

Considering the findings of this work in relation to the wider literature

Prospective cohort studies are needed to allow a more accurate characterization of the epidemiology of allergic disorders in Scotland. In the absence of such studies, which are of necessity time-consuming and expensive to mount, it is important

that secondary analysis of cohorts generated using routine data-sets is undertaken²⁵ and furthermore that in-depth work is undertaken to assess the validity of routine clinical records as has, for example, been undertaken in relation to anaphylaxis records from the General Practice Research Database (GPRD).²⁶ Similar work is now needed for hospital-based data-sets. Consideration also needs to be given to including a much broader range of allergy questions in the SHS.

Given the lack of data on ethnicity, it is important to consider bridging this gap using the data linkage techniques recently developed by Bhopal *et al.*,²⁷ which allow linkage of healthcare records with census ethnicity codes using a probabilistic matching technique. Similarly, to obtain a broader picture of costs to society associated with allergic disorders, it is important to consider, for example, the impact on school and work performance,²⁸ and this should also prove possible with greater investment in data-linkage techniques.⁹

The gaps in recoding of emergency contacts within the NHS – NHS24 and A&E attendance – also need to be filled and this may prove possible in due course when the electronic health record is introduced into NHS Scotland. Outpatient recording by diagnosis has begun but is at an early stage. Given the likely future move to the Systematised Nomenclature of Medicine Clinical Terms (SNOMED-CT) coding system, it is important that serious consideration is given to ways in which allergy codes need to be developed to facilitate secondary analyses of the type undertaken in this study.²⁹

More specifically, given the relatively rapid changing epidemiology of allergic disorders, it is important to continue to monitor allergic disease trends and use the variation discovered therein for hypothesis generation and to provide the data needed to inform assessments of the feasibility of mounting much needed clinical studies of allergic disease prevention and management.

Conclusions

Allergic diseases are extremely common in Scotland and are responsible for substantial morbidity, healthcare utilization and costs to the NHS. Evidence suggests that the previous increases in allergic disorder prevalence reported throughout the latter half of the 20th century may be stabilizing,

but given the very high proportion of children now affected, allergic conditions are likely to represent a major strain on the NHS in Scotland for many years to come. Although Scotland has some excellent data-sets, these are in relation to allergic conditions at present disparate, incomplete and complex to analyse and interpret. Given these limitations, consideration needs to be given to setting up a long-term Working Group to ensure that some of the methodological limitations uncovered by this study can be overcome and maximum use is made from the opportunities associated with introduction of SNOMED-CT and the electronic health record.

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Appendix 1 Questions on allergy used in survey data

Scottish Health Survey 1998 and 2003 1998 and 2003

- Have you ever had wheezing or whistling in the chest at any time, either now or in the past?

- Have you ever had this wheezing or whistling when you did not have a cold?
- Have you ever been at all breathless when the wheezing or whistling noise was present?
- Have you ever had wheezing or whistling in the chest in the last 12 months?
- How many attacks of wheezing/whistling have you had in the last 12 months?
- In the last 12 months, how often on average has your sleep been disturbed due to wheezing/whistling?
- In the last 12 months, has the wheezing/whistling ever been severe enough to limit your speech to only one or two words at a time between breaths?
- In the last 12 months, how much did wheezing/whistling interfere with your normal daily activities?
- When was your most recent attack of wheezing/whistling?
- Did a doctor ever tell you that you had asthma? Exclude: homeopaths, etc.
- When was your most recent attack of asthma?
- Have you received any treatment or advice for your (asthma/wheezing or whistling) from any of the people on this card?
 - Which ones? Any others?
 - A general practitioner (GP)
 - Nurse at GP surgery/Health centre
 - Community, School or District Nurse
 - Hospital casualty/Accident and Emergency department
 - Consultant/Specialist or other doctor at hospital outpatients
 - Consultant/Specialist or other doctor elsewhere
 - Homeopath
 - Acupuncturist
 - Other alternative medicine professional
- How many times were you treated by a general practitioner for your (asthma/wheezing or whistling) in the last 12 months?
- How many times were you treated by a nurse at a GP surgery/Health centre for your (asthma/wheezing or whistling) in the last 12 months?
- How many times were you treated by a Community, School or District nurse for your (asthma/wheezing or whistling) in the last 12 months?

- How many times were you treated at a hospital casualty or Accident and Emergency Department for your (asthma/wheezing or whistling) in the last 12 months?
- How many times were you treated by a Consultant/Specialist or other doctor at hospital outpatients for your (asthma/wheezing or whistling) in the last 12 months?
- How many times were you treated by a Consultant/Specialist or other doctor elsewhere for your (asthma/wheezing or whistling) in the last 12 months?

Health Survey for England 2001

- Have you ever had wheeze or whistling in the chest?
- Have you ever had this wheezing or whistling when you did not have a cold?
- Have you ever been at all breathless when the wheezing or whistling noise was present?
- Have you had wheeze or whistling in the chest in the last 12 months?
- Have you been doctor-diagnosed with asthma?

International Survey of Asthma and Allergies in Childhood (ISAAC), 1995 and 2002, for 12–14-year-olds

- Have you had wheeze or whistling in the chest in the last 12 months?
- How many attacks of wheezing have you had in the last 12 months?
- In the last 12 months, how often, on average, has your sleep been disturbed due to wheezing?
- In the last 12 months, has wheezing ever been severe enough to limit our speech to only one or two words at a time between breaths?
- 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 which 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?

Appendix 2

Data sources

Surveys

Scottish Health Survey

The Scottish Health Survey (SHS) consists of a series of three national surveys of the Scottish population conducted in 1995, 1998 and 2003. The 1995 survey included adults aged 16–64 years. The 1998 survey was extended to include children aged 2–15 years and the upper age limit increased to 74 years. The 2003 survey included infants aged under 2 years, with no upper age limit. The questions from the SHS survey can be found in Appendix 2.

Health Survey for England

The Health Survey for England (HSE) is part of a wider programme of surveys commissioned by the Department of Health and is designed to monitor trends in the nation's health. The survey focuses on different health issues each year. Only certain years cover respiratory and allergic disease; 2001 and 2002 were the last published surveys to do so. Data from the 2001 survey were used in this study as these data were used to compare with SHS data in the SHS report. The questions from the HSE survey can be found in Appendix 2.

International Study of Asthma and Allergy in Children

The International Study of Asthma and Allergy in Children (ISAAC) study, conducted 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 investigate for evidence of geographical variations in disease prevalence. In the Scottish data, Scottish Islands are included in Scottish results. Data are shown for phase I and II surveys (10). Specific Scottish data were not available for phase III (11). The questions used in the ISAAC survey can be found in Appendix 2.

Primary care data

Practice Team Information

Practice Team Information (PTI) collects data on patients' encounters with members of the practice team, including general practitioners (GPs), and practice and community nurses. Data for 2003–2004 to 2005–2006 included 42–45 practices. The programme is part of the Information Services Division (ISD) of NHS National Services Scotland. The system developed from Continuous Morbidity Recording (CMR), which collected data from contacts between GP and patient.

Quality and Outcomes Framework

Since 2004 the General Medical Services contract with GPs has included incentive payments for achieving a set of quality indicators through the Quality and Outcomes Framework (QOF) (12). These include quality indicators for asthma care. Data from the asthma register used for assessing quality outcomes can be used as a measure of prevalence. The number of people on asthma registers is influenced by the quality and completeness of GP recording. The registers exclude people who have not been prescribed asthma-related drugs in the preceding 12 months and those on the chronic obstructive pulmonary disease (COPD) register.

Primary Care Clinical Informatics Unit

In April 2000, the Primary Care Clinical Informatics Unit (PCCIU) was created as part of a national primary care initiative. It provides the informatics support for the Scottish Programme for Improving Clinical Effectiveness (SPICE), part of the Clinical Effectiveness Programme developed by the Royal College of General Practitioners (Scotland). PCCIU's aim is to help GPs understand their clinical information needs through a variety of feedback reports based on data extraction from their practice. As part of the SPICE programme (technically managed by PCCIU), data entry templates were developed for use by clinicians to systematically record data about a number of chronic conditions. From 2003 onwards, these templates were modified to include all information required for the new contract. Diagnostic criteria are not specified. Instead, clinical diagnoses are those recorded through routine practice, which, for major

conditions, is often after investigation and input from hospital-based specialist colleagues.

Anonymized retrospective data from all 310 of the 850 Scottish practices who use the General Practice Administrative Software System (GPASS) and also participate in SPICE were obtained in November 2005. The completeness and accuracy of morbidity and repeat prescribing data in GPASS practices have been reported previously. A subset of 58 SPICE practices, representative of the Scottish population and routinely collecting morbidity data as part of the PTI project in 2004, were used for these analyses. The allergy Read codes used to extract PCCIU data can be found in Appendix 3.

QRESEARCH

The Scottish PCCIU data were compared to data from the QRESEARCH database. This database is one of the largest anonymized aggregated health databases in the world and contains the records of over nine million patients from 525 UK general practices in England (further information can be found at www.qresearch.org).

Prescribing and medication

Prescription Cost Analysis

ISD obtains information from prescriptions dispensed in the community by pharmacists, dispensing doctors and appliance suppliers. Prescription Cost Analysis (PCA) shows details of the number of items and the Gross Ingredient Cost (GIC) of all prescriptions dispensed in the community in Scotland.

Over-the-counter sales

The data from Intercontinental Marketing Services (IMS) include the sales for allergic rhinitis, asthma and eczema products in Scotland. These data are taken from retail pharmacies, but do not include data for Boots and Superdrug; they also do not include data on sales classified as 'groceries'. For further details see <http://www.imshealth.com/ims/portal/pages/homeFlash/europe/0,2768,6025,00.html>.

Hospital admissions

Scottish Morbidity Record

ISD collects information on inpatient and day-case episodes in Scottish hospitals through the Scottish Morbidity Record (SMR01) scheme. Information

includes a principal diagnosis and up to five additional diagnoses for each hospital episode. Patient episodes are linked into continuous hospital stays and also with information on deaths provided by the General Register Office for Scotland (GROS). Inpatient diagnoses are classified using the International Classification of Diseases (ICD); ICD-9 was used up to 1996 and ICD-10 thereafter. The allergy ICD codes used to extract ISD data can be found in Appendix 3.

Mortality

General Register Office for Scotland: Registered deaths

The GROS produces information on deaths and on population estimates that can be used to calculate population-based rates. Deaths are coded using the ICD-9 classification up to 2000 and ICD-10 thereafter. Further details are available at <http://www.gro-scotland.gov.uk/>.

Appendix 3 Read codes for allergic conditions

<i>Clinical term</i>	<i>Read codes (1)</i>
1. Allergic rhinitis allergic rhinitis	H17. and all codes below heading
Vasomotor rhinitis	H18.
Other seasonal allergic rhinitis	Hyu20
Other allergic rhinitis	Hyu21
Other chronic sinusitis	Hyu22
2. Anaphylaxis Anaphylaxis	SN50. and all codes below heading SP34. (due to serum)
Anaphylactic shock	SN50. and all codes below heading
3. Angioneurotic oedema Angioneurotic oedema	SN51
4. Asthma All asthma (for comparison only)	H33. and all codes below heading 173A. (exercise-induced asthma)
Allergic asthma Allergic asthma	H330. and all codes below heading

<i>Clinical term</i>	<i>Read codes (1)</i>
Wheezing	1780. (aspirin-induced asthma) H47y0 (detergent-induced asthma) R0609 ([D] wheezing) 1737 (wheezing)
5. Conjunctivitis Allergic conjunctivitis	F4C14 (chronic) F4C06 (acute atopic) F4C14 (other chronic allergic conjunctivitis)
6. Drug allergy drug allergy	SN52. and all codes below heading
7. Eczema/ dermatitis allergic (intrinsic) eczema	M114 M11z. (atopic dermatitis NOS) M11.
Allergic dermatitis and related Atopic dermatitis/eczema	M111
Infantile eczema	M112
Flexural eczema	M113
Contact or allergic eyelid dermatitis	F4D31
Neurodermatitis – atopic	M117
Allergic contact dermatitis	M128. and all codes below heading
Dermatitis NOS	M12z0
Eczema NOS	M12z1
Infected eczema	M12z2
Hand eczema	M12z3
Erythrodermic eczema	M12z4
8. Food allergy Food allergy	SN58. and all codes below heading
History of food allergy	14M1
9. Urticaria Urticaria	M28. and all codes below heading
10. Other allergy Allergic parotitis	J0720
Allergic gastritis	J1540
Allergic gastroenteritis and colitis	J432. and all codes below heading
Coeliac disease	J690. and all codes below heading
Chronic allergic otitis media	F5130

<i>Clinical term</i>	<i>Read codes (1)</i>
Allergic otitis media NOS	F5140
Allergy	SN53. and all codes below heading
Venom allergy	SN59. and all codes below heading
Allergic arthritis	N062. and all codes below heading
Skin: type 3 delayed reaction	3354
Skin: type 1 immediate reaction	3355
Skin: type 4 late reaction	3356
Allergy skin test positive	3359
Allergy test positive	3368
Allergic purpura	D310. and all codes below heading
Allergic eosinophilia	D4033

Appendix 4 ICD codes for allergic conditions

<i>Condition</i>	<i>ICD-9 Codes</i>	<i>ICD-10 Codes</i>
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 T80.5 Anaphylaxis due to serum

<i>Condition</i>	<i>ICD-9 Codes</i>	<i>ICD-10 Codes</i>	<i>Condition</i>	<i>ICD-9 Codes</i>	<i>ICD-10 Codes</i>
Asthma	493 Asthma	T88.6 Anaphylactic shock due to adverse effect of correctly administered medication J45 Asthma J46 Status asthmaticus	Food allergy	693.1 Dermatitis due to food	L27.2 Dermatitis due to food T78.1 Other adverse reactions to food
Conjunctivitis	372.1 Chronic conjunctivitis 372.3 Other and unspecified conjunctivitis	H10.1 acute atopic conjunctivitis	Urticaria / Angioedema	708 Urticaria	L50 Urticaria
Eczema/ Dermatitis	691 Atopic dermatitis and related conditions 692 Contact dermatitis and other eczema	L20 Atopic dermatitis L23 Allergic contact dermatitis	Other allergy	995.1 Angioedema 995.3 Allergy unspecified not elsewhere classified 989.5 Toxic effect of venom	T78.3 Angioedema T78.4 Allergy, unspecified T63.4 Toxic effect due to venom of other arthropods

Appendix 5

Age–sex standardized lifetime prevalence per 1000 (95% CI) patients in Scotland (2004, PCCIU) and England (2005, QRESEARCH). Both sets of data are standardized to English population (2004)

<i>Country</i>	<i>All allergic disease</i>	<i>Allergic rhinitis</i>	<i>Anaphylaxis</i>	<i>Asthma</i>	<i>Eczema</i>
Scotland	350 (348–352)	89 (88–90)	0.67 (0.58–0.75)	121 (120–122)	161 (160–162)
England	243 (243–245)	66 (66–67)	0.72 (0.72–0.79)	113 (113–113)	115 (115–116)

Appendix 6

Prevalence (%) of wheeze and doctor-diagnosed asthma for men and women (aged 16 years and over) and children (15 years and under), Scotland 2003 (source Scottish Health Survey).

	<i>Lifetime wheeze (%)</i>	<i>Wheezed in last 12 months (%)</i>	<i>Doctor diagnosed asthma ever (%)</i>
Men	27	16	13
Women	26	16	14
Boys	29	16	20
Girls	20	12	12