

Can we manage demand for allergy testing by restricting requests to a small number of prime target allergens?

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Abstract

Background Demand for expensive tests such as allergen-specific IgE is expanding far faster than for cheaper tests: at Burton Hospital the annual growth rate is 24%. Different hospitals have different policies on allergen testing. We report a comparison of the effect of requesting policy on diagnostic yield.

Methods All results from five years of allergen testing were downloaded from the data warehouse at Burton, and a representative sample of recent results was evaluated from Ipswich Hospital. Statistical analysis by χ^2 test and significance tests for differences of proportions were carried out.

Results Ipswich hospital used a standard four-allergen panel for respiratory patients and demonstrated a statistically significantly lower positivity rate for three of those four allergens. No relationship between the number of allergens tested and the probability of a positive result was shown – the probability of a positive result was approximately 0.3. Number of allergen-specific IgE tests requested/patient have remained roughly constant over 5½ years but total demand has increased.

Conclusions Selective requesting for allergen-specific IgE testing may be more effective than use of a standard panel but this cannot be conclusively proven. It is not appropriate to attempt to limit workload by specifying a maximum number of tests that are allowed for any individual patient.

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Introduction

It is well-recognized that demand for pathology services is continually increasing without a matching increase in financial resources. Some laboratories have placed considerable effort into evaluating why test requesting varies between general practitioner (GP) practices and into ensuring that tests are not ordered needlessly.^{1–4} This has now progressed to publication of a series of evidence-based advice papers published in the *Journal of Clinical Pathology*.^{5–14}

Testing for allergen-specific IgE antibodies is defined by Clinical Pathology Accreditation (CPA (UK)) as a test that requires Consultant Immunologist supervision, and given the shortage of these specialists this is impossible for many district general hospitals (DGHs). Consequently, these tests are frequently considered to be 'send away' tests, with samples being referred to a central laboratory. The cost of allergen-specific IgE tests varies depending on allergen but on average is approxi-

mately £15/test. Following an evaluation of the workload in one DGH (Burton), it was recognized that allergen-specific IgE tests constituted a very significant proportion of the referred test costs and the possibility of restricting the number of allergens tested on any one patient's sample was considered.

To determine whether request restriction would be an appropriate mechanism for demand control, the diagnostic yield (that is, proportion of tests indicating identifiable reaction (allergen-specific IgE grade ≥ 1)) was evaluated for two DGHs to identify whether there were significant differences in practice that could inform development of a suitable demand management model.

Methods

At Burton, all allergen-specific IgE results from 1 January 2001 were downloaded from the hospital data warehouse and evaluated in a MS Access[®]

database. At Ipswich all results from February 2006 – July 2006 were printed and manually transferred to an MS Access® database. Source of sample in broad clinical groups (respiratory, paediatric, general medicine, dermatology, ENT, general practice, or other) was recorded.

Workload data were evaluated to identify time trends in numbers of requests/patient and to identify the proportion of positive results for different numbers of allergens tested. A positive result was classed as any result except Grade 0 (no reaction). The probability of a positive result depending on analyte was also analysed.

Results

Table 1 shows the workload by quarter for over 5½ years for Queen’s Hospital. Test requesting grew from 474 tests/year in 2001 to 1119 tests/year in 2005 (136% increase in demand over 4 years). This represents an annual growth rate of 24% (Figure 1).

Table 2 shows the number of allergens requested/patient and the probability of a positive result for the two hospitals. At Ipswich Hospital, there was a peak in

Table 1 The growth in allergen-specific IgE workload at Queen’s Hospital, Burton-on-Trent, over 5½ years

Year	Qtr	Burton		
		Patients	Tests	Tests/patient
2001	1	28	122	4.36
2001	2	39	152	3.90
2001	3	37	162	4.38
2001	4	8	38	4.75
2002	1	31	122	3.93
2002	2	53	221	4.17
2002	3	30	138	4.6
2002	4	19	82	4.32
2003	1	45	139	3.09
2003	2	57	205	3.59
2003	3	50	229	4.58
2003	4	15	52	3.47
2004	1	42	113	2.69
2004	2	72	216	3.00
2004	3	91	237	2.60
2004	4	18	62	3.44
2005	1	72	199	2.76
2005	2	106	376	3.55
2005	3	119	432	3.63
2005	4	31	112	3.61
2006	1	85	287	4.41
2006	2	73	307	4.21
Total		1124	4006	3.56

requesting for four specific allergens (aspergillus, cat dander, grass pollen and house dust mite). Approximately 70% of all requests for these allergens came from respiratory physicians. This difference in requesting patterns between the two hospitals is statistically significant ($\chi^2=113.37$, $df=9$, $P=3.0^{E-20}$). It is also notable that except for single allergen and grand multiple allergen (10 +), the probability of a positive result at Ipswich is lower than at Burton. Overall, 1314 (32.83%) results of 4002 tests at Burton and 211 (25.3%) of 834 tests at Ipswich were positive. A significance test for differences in proportion gives $z=4.490$ (two-sided $P=7.2^{E-6}$).

Table 3 shows the distribution of allergen requesting by broad specialty group at Ipswich. It is clear that the medicine departments (general medicine/care of the

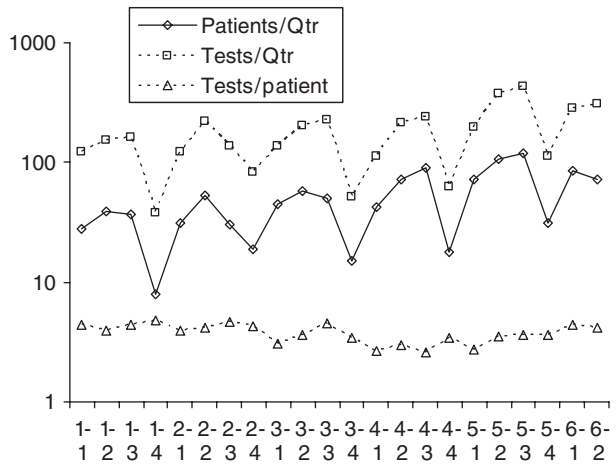


Figure 1 Graph showing the growth in allergen-specific IgE workload at Queen’s Hospital, Burton-on-Trent, over 5½ years. Time axis is year–Qtr (i.e. 1-1 = 2001, Qtr 1)

Table 2 Number of allergens tested/patient and probability of positive allergen-specific IgE result

No. of allergens	Burton		Ipswich	
	P (+ve result)	n	P (+ve result)	n
1	0.206	403	0.326	49
2	0.273	121	0.231	54
3	0.260	118	0.250	32
4	0.301	132	0.208	83
5	0.309	94	0.246	13
6	0.378	60	0.309	7
7	0.283	52	0.163	7
8	0.473	55	0.225	5
9	0.288	17	0.222	1
≥10	0.399	55	0.784	3

The distribution of no. of allergens/patient was evaluated by χ^2 test. ($\chi^2=113.37$, $df=9$, $P=3.0^{E-20}$)

elderly/respiratory) tend to order a greater proportion of a four-allergen/patient request set, almost entirely composed of a standard panel of aspergillus, cat, grass pollen and house dust mite. The probability of a positive result for the four-allergen group was 0.301 ($n=132$) for Burton and 0.208 ($n=83$) for Ipswich. A significance test for differences in proportion gives $z=1.555$ (two-sided $P=0.12$).

Table 4 shows the probability of a positive result by allergen, and the significance test for differences in proportion. In the Ipswich data, the probabilities of a positive result for cat, grass pollen and house dust mite are all statistically significantly lower than the corresponding rate at Burton.

Table 3 Distribution of requests by broad specialty group at Ipswich

No. of allergens	Medicine	GP	Other
1	20	12	17
2	18	5	31
3	9	8	15
4	52	15	16
5	4	2	7
6	0	1	6
7	0	1	7
8	1		4
9	0		1
≥ 10	0		1

Table 4 Probability of a positive result by allergen

Allergen-specific IgE test	Burton		Ipswich		Two-sided P
	n	P (+ve) (%)	n	P (+ve) (%)	
Peanut	322	43.2	39	38.5	0.162821
House dust mite	316	44.9	121	36.4	0.004464
Milk	288	23.6	59	10.2	4.6^{E-07}
Cat dander	265	40.0	92	21.8	1.22^{E-08}
Grass pollen	243	45.7	90	23.3	4.15^{E-11}
Dog dander	240	47.9	23	52.2	0.31838
Egg white	235	34.0	27	29.6	0.254567
Latex	219	16.0	5	40	
Wheat	194	31.4	36	11.1	1.82^{E-08}
Almond	144	21.5	27	14.8	0.085047
Walnut	139	23.7	12	41.7	0.001396
Hazelnut	136	38.2	21	23.8	0.004199
Brazil nut	135	35.6	26	15.4	1.24^{E-05}
Cashew	117	30.8	10	10	5.71^{E-05}
Soya	40	32.5	14	21.4	0.197179
Aspergillus	29	13.8	125	15.2	0.829667

Two-sided P for difference in proportion is calculated for allergens where at least 10 cases have been assessed in both centres
 $P<0.05$ highlighted in bold

Discussion

Despite the increasing availability of allergen-specific IgE testing on routine immunochemistry analysers, the requirements of CPA mean that frequently many DGHs send these tests to a referral laboratory. The growth in demand for allergy testing is insatiable, with a 24% annual percentage increase observed at Burton Hospital. Consequently, mechanisms for demand management need to be considered. The purpose of this study was to determine whether restricting the total number of allergens that could be requested on any one individual might be a way to prevent 'blunderbuss' testing, which one might consider would reduce the likely diagnostic yield.

It was shown that the probability of obtaining a positive result was reasonably constant across a wide range of numbers of allergens tested in both hospitals. This means that where a patient is referred for a large number of tests, the referring clinician has clearly made a careful judgement about the tests required and is not ordering a pan-investogram in the hope of hitting something positive. However, the positivity rates were overall lower at Ipswich, particularly for three commonly ordered allergens that were included as part of a routine panel utilized by respiratory physicians. This suggests that where a standard protocol is applied without asking patients about the specific circumstances of their allergic reaction, diagnostic yield may be reduced and therefore standard protocols in routine allergy screening may not be efficient.

Finally, it could be questioned whether blood testing is an appropriate means of investigating allergy. At Burton from whence the bulk of the data originated, skin patch testing and skin prick testing for allergy are readily available and therefore allergen-specific IgE testing is not carried out for lack of any alternative. Clearly, the most appropriate mechanism for workload management will vary from site to site. If these alternative modalities are not present, it may be more cost-effective to redirect some laboratory budget to funding an allergy-specialist nurse who could carry out skin patch or prick tests.

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