Paediatric food allergy trends in a community-based specialist allergy practice, 1995–2006

Raymond J Mullins

ABSTRACT

Objective: To examine changing demand for specialist food allergy services for children aged 0–5 years over the 12 years from 1995 to 2006 as an index of changing prevalence.

Design, setting and participants: Retrospective analysis of the records of 1489 children aged 0–5 years referred to a community-based specialist allergy practice in the Australian Capital Territory (population, about 0.33 million).

Main outcome measures: Trends in demand for assessment for food allergy, dietary triggers and severity over 12 years, compared with Australian hospital morbidity data.

Results: 47% (697/1489) of 0–5 year-old children seen in private practice had food allergy (175 with food-associated anaphylaxis), most commonly to peanut, egg, cows milk and cashew. Over 12 years, the number of children in this age group evaluated each year increased more than fourfold, from 55 cases in 1995 to 240 in 2006. There was no change in the proportion diagnosed with allergic rhinitis in 1995 and 2006 (14.5% and 13.3%, respectively), urticaria (14.5% and 12.9%) or atopic eczema (54.5% and 57.0%). By contrast, the proportion with asthma dropped from 33.7% in 1995 to 12.5% in 2006 and the number with food allergy increased 12-fold, from 11 to 138 patients (and from 20.0% to 57.5% of children seen) The number with food anaphylaxis increased from five to 37 children (9.0% to 15.4%) over the same period. There were similar trends in age-adjusted Australian hospital admission rates for anaphylaxis in children aged 0–4 years, which increased from 39.3 to 193.8 per million population between the financial years 1993–94 and 2004–05, a substantially greater increase than for older age groups, or for the population as a whole (36.2 to 80.3 per million population).

Conclusions: There is an urgent need for coordinated systematic studies of the epidemiology of food allergy in Australia, to ascertain risk factors and guide public health policy. An increased prevalence of food allergy has implications for public health and medical workforce planning and availability of allergy services in Australia.

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Australia has one of the highest prevalences of allergic disorders in the developed world. Recent decades have seen increases in the prevalences of allergic rhinitis, asthma and atopic eczema (although the proportion of people with asthma has plateaued in the past few years).[1,2] Evidence that food allergy is becoming more common, however, is limited to changes in prevalence of peanut allergy in two separate studies of young children, which showed a doubling of clinical reactivity over 5 years.[3,4]

In the absence of comparable epidemiological studies of food allergy in Australian children, a dramatic increase in the number of young children referred to me for evaluation of food allergy and food-associated anaphylaxis (FAA) prompted me to compare my clinical practice with Australian hospital admissions data to determine whether this was a practice-specific or region-specific phenomenon, or was generalisable to the Australian population.

METHODS

Data were analysed for patients aged 0–5 years who were referred to a community-based specialist immunology/allergy medical practice in the Australian Capital Territory (population about 0.33 million) from 1 January 1995 to 30 December 2006. John James Memorial Hospital Ethics Committee approved the study.

Patient evaluation and diagnostic criteria

Patients were tested with glycerinated allergen extracts (HollisterStier, Spokane, Wash, USA) and histamine (10 mg/mL positive control; HollisterStier). Skin prick testing was performed on the volar aspect of the forearm using metal lancets (Stallergenes, Antony, France) according to standard guidelines.[5] A positive skin prick test was defined as a weal with a diameter at least 3 mm greater than that produced by a negative control solution at 15 minutes.[5]

Food allergy was diagnosed in patients with a history of acute systemic allergic reactions after known food exposure, confirmed by a positive skin prick test to a relevant food. These were classified as: Class I (mild; urticaria/angioedema), II (moderate; dyspnoea, vomiting, abdominal pain) or III (severe; severe hypoxia, hypotension, vascular collapse).[6] The Australasian Society of Clinical Immunology and Allergy (ASCIA) definition of anaphylaxis ("a rapidly evolving multisystem allergic reaction involving the presence of one of more symptoms or signs of hypotension or respiratory distress, and involvement of other organs such as the skin or gastrointestinal tract")[7] was used. Vomiting was not associated with hypoxia or hypotension in the children in this study, so patients were further classified into Classes IIa (vomiting and/or abdominal pain without dyspnoea) and IIb (dyspnoea as a prerequisite), as only Classes IIb and III meet the current ASCIA definition.[7] Asthma, allergic rhinitis and atopic eczema were defined as has been previously described.[1]

Australian population and hospital morbidity data

Australian historical population statistics were obtained from the Australian Bureau of Statistics (ABS).[8] Census data were available for 1996 and 2001; demographic data for other years were ABS estimates.

Australian national hospital morbidity database principal diagnosis cube data were obtained from the Australian Institute of Health and Welfare (AIHW) for the financial years 1993–94 to 2004–05.[9] These record primary (and important secondary) discharge hospital diagnoses based on the ninth and 10th revisions of the International classification of diseases (ICD-9 and ICD-10) for each financial year (July–June), with ICD-9 used to June 1998, and ICD-10 thereafter. Admissions and deaths associated

with FAA (ICD-9/ICD-10 codes, 995.6/T78), serum-related anaphylaxis (999.4/T80.5), anaphylaxis otherwise unclassified (995.0/T78.2), urticaria (708/L50), angioedema (995.1/T78.3), allergic rhinitis (477/J30.1–30.4), asthma (493/J45) and atopic eczema (691/L20) were examined. Anaphylaxis related to medication (ICD-10 code, T88.6) was excluded from the analysis, as data could not be clearly defined based on ICD-9 for 1993–94 to 1997–98. Sting anaphylaxis was excluded because it was not possible to distinguish anaphylaxis from other adverse reactions such as toxicity. To facilitate comparison between different age groups (and evaluate time trends), discharge diagnoses were expressed as age-standardised rates per million population (as previously described[10,11]), based on a combination of AIHW and ABS data. Calculations of age-standardised admission rates were based on ABS national population estimates for one calendar year,[8] and the AIHW discharge rates ending in the same calendar year. Because most patients were ACT residents (which has a younger population than other states and territories), ACT population data[8] and data from practice patients who resided in the ACT were combined to derive age-adjusted consultation rates. Data were grouped by patient age (0–4, 5–14, 15–29, and ≥ 30 years) after interim analysis.

Data analysis

Demographic and diagnostic data were entered prospectively into searchable databases (MediMouse, Practice Innovators, Blue Chip Clinical Research Module, Health Communication Network, Sydney, NSW; Microsoft Access, Microsoft Corporation, Redmond, Wash, USA). Data (and accuracy) were analysed and verified retrospectively in 2006. Linear Poisson regression was performed with Stata, version 9 (StataCorp, College Station, Tex, USA) to estimate trends for individual new consultations.

RESULTS

Patient characteristics

A total of 16 610 patients, ranging in age from 0 to 102 years, were referred for assessment. Of these, 1489 were aged 0–5 years (60% male; 65% ACT residents). Comorbidities in these children included atopic eczema (908; 60%), food allergy (697; 47%), urticaria (268; 17%), asthma (260; 17%) and allergic rhinitis (235; 15%).

Diagnostic time trends

From 1995 to 2006, the number of children aged 0–5 years referred for assessment each year increased more than fourfold, from 55 to 240. Over that period, the number with food allergy increased from 11 to 138 and the number with FAA increased from five to 37 (Box 1). Consultations with new patients in the 0–5-years age group increased by 16.6 patients per annum (95% CI, 14.9–18.2), the number with food allergy increased by 10.4 per annum (95% CI, 9.4–11.3), and the number with FAA by 2.2 per annum (95% CI, 1.7–2.8). Increases in the number of 0–5-year-old patients with other atopic disorders were less prominent (Box 1). There was no significant change between 1995 and 2006 in the proportion of 0–5-year-old children diagnosed with allergic rhinitis (14.5% and 13.3%, respectively), urticaria (14.5% and 12.9%) or atopic eczema (54.5% and 57.0%). By contrast, the proportion of those with asthma dropped from 33.7% to 12.5% and of those with food allergy increased from 20.0% to 57.5%. Trends observed in patients resident within and outside the ACT were similar (data not shown).

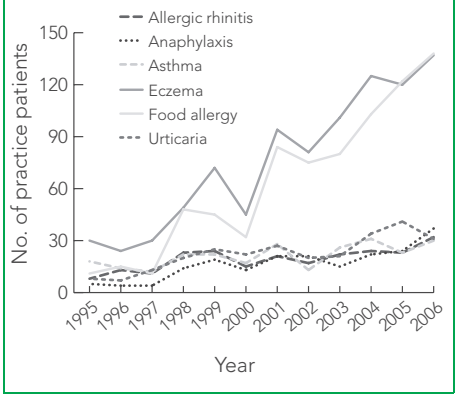
Causes of food allergy and anaphylaxis

Consistent with other studies, the most common triggers of food allergy were peanut, hens egg, dairy products, and tree nuts (358, 345, 211 and 96 patients, respectively). The number of children allergic to foods increased with time, with no discernible change in the proportion of children allergic to any one food (data not shown). Anaphylaxis occurred in 187 children (food allergy, 175; insect stings, seven; idiopathic, four; medication-related, one). There was no discernible difference in the severity of food allergy between patients resident inside and outside the ACT.

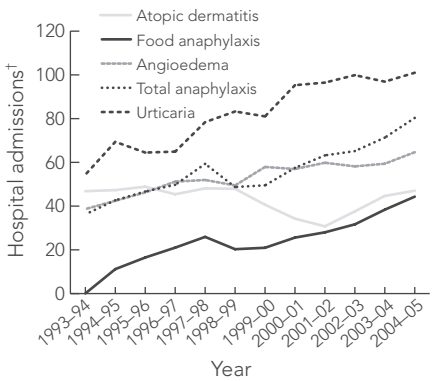
Australian hospital morbidity data

In the financial years 1993–94 to 2004–05, 43 893 admissions coded as representing possible systemic allergic reactions were recorded. These reactions were urticaria (18 788 admissions), angioedema (12 213) and anaphylaxis (12 892). Total admissions for these disorders increased from 2308 in 1993–94 to 5000 in 2004–05 (0.05% and 0.07% of all admissions, respectively). The cause of anaphylaxis was coded as serum (186; 1.4%), food (5469; 42.4%) or unclassified (7237; 56.1%). Seventy-nine per cent of admissions for anaphylaxis in children

1 Time trends in allergy-related disorders in children aged 0–5 years referred to an Australian Capital Territory private practice

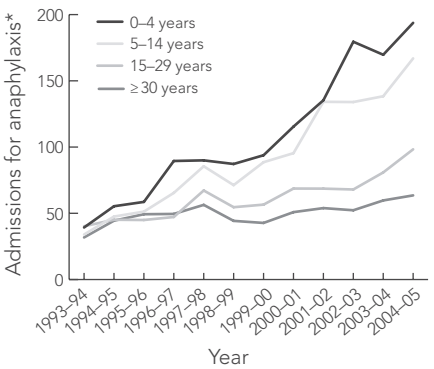


2 Trends in hospital admission rates for selected allergy-related disorders in the financial years 1993–94 to 2004–05*



* From Australian national hospital morbidity data.[9] † Rate per million population. ◆

3 Age-adjusted Australian hospital admission rates for anaphylaxis in the financial years 1993–94 to 2004–05



* Rate per million population. ◆

aged 0–4 years (1318/1665) were attributed to FAA. While the number of admissions for possible systemic allergic reactions increased in all age groups, the largest increases were for anaphylaxis, which increased from 36.2 to 80.3 admissions per million population (Box 2). When expressed as age-adjusted admission rates for FAA and total anaphylaxis, time trends were most pronounced in children aged 0–4 years (an increase from 39.3 to 193.8 per million population) compared with older patients (Box 3). Similar trends were observed for urticaria-related admissions (data not shown). Between 1997 and 2004, 68 anaphylaxis-related deaths were recorded (six food-related, 62 unclassified; six in patients aged 0–29 years). Comparable time trends were observed with age-adjusted consultation rates for food allergy and FAA in ACT residents (data not shown).

DISCUSSION

This study identified a 12-fold increase in demand for consultations related to food allergy (and a sevenfold increase in FAA) in children over a 12-year period in a single private practice providing approximately 50% of specialist allergy-related ambulatory services in the ACT. The number of anaphylaxis-related hospital admissions in Australia also increased over the same period, and this increase was disproportionate in children with FAA.

I studied children aged 0–5 years because of a disproportionate increase in demand for assessment for food allergy in this age group. Time trends were not an artefact of practice expansion, triaging, change in local medical services or ACT demographic changes. The practice casemix (not total workload) changed — there was no triaging, relevant ACT medical services actually expanded, and ACT birth rates and the number of children aged 0–5 years fell about 10% during the study period (Maureen Bourne, Data Manager, ACT Maternal and Perinatal Data Collection, Canberra Hospital, personal communication). That similar demand for assessment of patients for food allergy has been observed in Canberra Hospital clinics (Dr Carolyn Hawkins, Department of Clinical Immunology, Canberra Hospital, personal communication) suggests that changing demand is not simply a practice-specific phenomenon.

There are limitations to a single-practice study. I was able to examine a subset of patients seeking medical assessment, but not a random selection of the entire population. The effects of the natural evolution of practice casemix with time, practice reputation, referral bias, increased recognition that food allergy could both aggravate and coexist with atopic eczema, and the drift of patients from other subspecialties (eg, paediatrics) must be considered. Furthermore, increased service demand is not equivalent to increased prevalence, which requires confirmatory evidence.

The dramatic increase in hospital admissions for anaphylaxis in Australia (around twice that described in United Kingdom studies[10,11]) is independent of both referral bias and location, and has been interpreted as evidence of a food allergy/FAA "epidemic" in some quarters.[12] Admission rates, however, can be influenced by service availability, lowered threshold to seeking medical assistance (perhaps reflecting parental anxiety or perhaps even anaphylaxis management plans[7]), or changes in medical practice to lower the threshold for admission. Contrary evidence counters these interpretations, showing that emergency management plans reduce anxiety, the risk of relapse and need for medical intervention.[13] Other studies have shown that only a small proportion of children presenting with food allergy/FAA are admitted to hospital,[14] suggesting that patients with relatively minor symptoms are more likely to be coded as having urticaria (and discharged) than having anaphylaxis (and admitted). Even if hospital coding errors occurred, these are likely to have transferred patients between diagnostic categories for manifestations of allergy (eg, anaphylaxis, acute urticaria/angioedema), and the number of patients in all these diagnostic categories increased. Nor are the data a statistical artefact — identical age-specific admission-rate time trends emerged using both ABS estimated population and census data. Overall, the data suggest that changes in admission rates reasonably reflect changing prevalence of FAA in infants.

Measuring demand for allergy-related medication is a less useful measure of changing prevalence. Hypoallergenic infant formula prescriptions increased fourfold in the 5 years ending 2004.[15] Significant regional variation in prescribing rates could also reflect increased awareness, access to specialist services, or inappropriate prescribing. While sales of the EpiPen autoinjector (CSL Limited, Melbourne, Vic), which delivers adrenaline as first aid for severe allergic reactions, have increased substantially in recent years[16] (and well before the introduction of Pharmaceutical Benefits Scheme subsidies in 2003), it is impossible to assess the relative distortions introduced by routinely providing two EpiPens to children, EpiPen-prescribing guidelines introducing asthma as a factor to be considered when evaluating those with food allergy (not necessarily anaphylaxis[8]), inappropriate prescribing and, possibly, medicolegal pressures.

Estimates of disease burden, prevalence and time trends for allergic disorders have been based (in part) on health service use in other studies.[10,11,17] Unfortunately, it is difficult to quantify the effects of factors such as changes in health-seeking behaviour, driven (in part) by increased community awareness or by anxiety induced by recent media reports of fatal FAA,[18] on apparent changes in the prevalence of allergy. The adoption of government policies on food allergy/FAA management in schools and childcare centres (adopted in South Australia in 1998 and the ACT and New South Wales in 2003) may not only reflect community concerns, but also drive demand for children to be assessed for food allergy before enrolment, which might partially explain the greater increase in consultations related to food allergy compared with FAA. Assuming that behavioural factors were the only explanation, however, would presuppose a large cohort of previously unassessed children with food allergies, many with anaphylaxis, and would not explain the similar trends observed in older age groups, both in terms of consultations and hospital admissions.

Rapid increases in disease prevalence over a decade are not unprecedented.[2] Given the documented relationship between food allergy and infantile atopic eczema,[19] it would be surprising if the prevalence of food allergy had not also increased in parallel with the almost doubling of the prevalence of atopic eczema documented between 1993 and 2002 in Australian children.[2] Increases in food allergy/FAA-related consultations and admissions for infants (disproportionate to population size) would not be unexpected if food allergy is becoming even more prevalent in this "sentinel group" in which it is already most common. In the context of Australian and UK admissions data and increased incidence of food allergy in two well conducted population studies,[3,4] it is difficult to escape the conclusion that, while anxiety has probably contributed to service demand, the underlying prevalence of food allergy has also increased in Australian infants over the past decade.

This study was not designed to explain the changing prevalence of food allergy.

Hypotheses (for which there is limited published evidence) include greater exposure to potentially allergenic foods, sensitisation to topical allergens in emollients, increased use of antacid medication in infants, sensitisation through breast milk, prolonged breastfeeding, and increasing maternal age.[20-23] If the data are confirmed to represent an actual increased prevalence of food allergy, long-term implications include: (i) a need for more resources for evaluating and re-evaluating patients; (ii) an eventual increase in the incidence of food allergy in older people in whom mortality is more common; and, possibly, (iii) a need to reassess the risk of fatal outcomes in young children if the underlying problem is more common.[18]

There is an urgent need for coordinated systematic studies of the epidemiology of food allergy in Australia and abroad, to ascertain risk factors and guide public health policy. If such studies confirm an increased prevalence of food allergy, there are important implications for public health, medical workforce planning, costs of care and the availability of public allergy services in Australia, that are currently deficient in some regions such as the Northern Territory, Tasmania and Queensland.

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COMPETING INTERESTS

None identified

AUTHOR DETAILS

Raymond J Mullins, PhD, FRACP, FRCPA,
Clinical Immunology and Allergy Physician
John James Medical Centre, Canberra, ACT.
Correspondence:
rmullins@allergycapital.com.au

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