

## ORIGINAL ARTICLE

# Management of food allergy: A survey of Australian paediatricians

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**Aim:** The prevalence of Immunoglobulin E (IgE)-mediated food allergy in the developed world is increasing, overwhelming tertiary allergy services. Alternative models of care are required. General paediatricians could provide this care but may require further training to do so. We aimed to determine Australian general paediatricians': (i) knowledge and management of IgE-mediated food allergy; (ii) access to and use of diagnostic services; and (iii) interest in further training.

**Methods:** Members of the Australian Paediatric Research Network completed an online survey in 2011/12. A case study elicited paediatrician's knowledge of diagnostic history taking, testing and key management principles. Study-designed questions assessed paediatricians' current practice, access to allergy services and interest in further training.

**Results:** One hundred sixty-eight (43%) of 390 paediatricians responded; 93 paediatricians reported managing food allergy. Diagnostic and management practices varied widely. Paediatricians had high levels of agreement (>90%) for only three of 13 questions pertaining to diagnosis and management. Only 56 (61%) correctly identified that a diagnosis of IgE-mediated food allergy requires a history consistent with a clinical reaction *and* a positive specific serum IgE antibody or skin prick test result. Reported waiting times for tertiary allergy services ranged from 5.4 (private) to 10.6 months (public). Most (91%) paediatricians expressed interest in further training.

**Conclusions:** General paediatricians would benefit from further training if they are to practice allergy care as their diagnosis and management is often inconsistent with international guidelines. Training could be delivered online to maximise reach and uptake. If effective, such a model could relieve some of the burden experienced by Australian tertiary allergy services.

**Key words:** food allergy; paediatrician; survey.

## What is already known on this topic

- 1 The prevalence of IgE-mediated food allergy in the developed world appears to be increasing.
- 2 Tertiary paediatric allergy services are overwhelmed with demand.
- 3 New models of care that shift the burden from tertiary services are needed but will require a workforce outside of tertiary care with adequate, accurate knowledge.

## What this paper adds

- 1 In this first survey of Australian paediatrician's management of IgE-mediated food allergy, practice varies widely and is sometimes at odds with national guidelines.
- 2 A model of care delivered by general paediatricians and based on serum-specific IgE testing appears feasible but will require upskilling of paediatricians.
- 3 Most paediatricians would welcome this upskilling.

The prevalence of Immunoglobulin E (IgE)-mediated food allergy in children in the developed world appears to be increasing,<sup>1,2</sup> with estimates in the USA and UK of 4.2%<sup>3</sup> and 4%,<sup>4</sup> respectively. The prevalence of challenge-proven food allergy to peanut, egg, sesame, cows milk and shellfish in 12-month-old infants in Melbourne, Australia, appears much higher at 10.4%<sup>5</sup> and is the highest reported prevalence of challenge-proven food allergy among Westernised countries.

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This rising prevalence is placing a substantial burden on paediatric allergy services, which in Australia are largely provided by tertiary (i.e. hospital) centres. These services have long waiting times and reduced access for new referrals. The estimated waiting time for a non-anaphylaxis-related food allergy referral for a child older than 1 year is 12–18 months, and some Australian states and territories do not have public paediatric allergy services.

A confirmed diagnosis of IgE-mediated food allergy requires both a history consistent with IgE-mediated food allergy and either a positive skin prick test (SPT) or food specific serum IgE antibody (SsIgE) result. Traditionally, investigation of food allergy has relied upon SPT and/or oral food challenge performed by allergists. In Australia, there is limited access to SPT and oral food challenges outside of tertiary settings, which

places an additional burden on already overextended services. Thus, other models of care are urgently required.

An alternative model of care recommended in the 2011 UK National Institute for Health and Clinical Excellence guideline<sup>6,7</sup> is care provided by general practitioners using SPT or SsIgE testing for all but anaphylaxis, which should be managed in the tertiary setting. However, in Australia, general practitioners are spending less and less time managing children with chronic conditions,<sup>8</sup> with the bulk of their extended care consultations taken up by management of the elderly.

Another model could be to train community-based paediatricians to manage children with suspected food allergy using SsIgE testing. A 2010 systematic review comparing SPT with SsIgE testing found 'no statistically significant differences between the diagnostic tests for specific foods'.<sup>9</sup> Furthermore, studies have identified positive predictive values and specificity thresholds for SsIgE tests, allowing diagnosis of food allergy with 95% confidence intervals for common foods (egg, milk, peanut and wheat) in the setting of a history consistent with IgE-mediated food allergy. Given paediatricians are able to conduct longer consultations than their general practitioner counterparts, shifting uncomplicated food allergy care to general paediatricians could be a viable option. However, before doing so we need to know how Australian paediatricians diagnose and manage children with suspected food allergy and determine whether paediatricians need upskilling in this area.

We therefore aimed to determine, in a sample of Australian general paediatricians, their: (i) knowledge of diagnosis and management of IgE-mediated food allergy; (ii) access to and use of diagnostic services; and (iii) interest in further education and training. We hypothesised that: (i) knowledge of IgE-mediated food allergy diagnosis and management would be variable, and that many general paediatricians would manage food allergy only *after* the diagnosis had been made in a tertiary service; (ii) waiting time to see a paediatric allergist would be longer in regional and rural than metropolitan settings; and (iii) most paediatricians would be interested in further education.

## Methods

### Design, setting and participants

The Australian Paediatric Research Network (APRN) facilitates multi-site research in secondary care paediatric outpatient settings.<sup>10</sup> APRN members were recruited from the 1006 general paediatricians registered in 2007 with the Royal Australasian College of Physicians (RACP). Newly graduated paediatricians are invited to join upon admission to fellowship, and all Australian states and territories are proportionally represented.<sup>11,12</sup>

In late 2011, we invited members to answer questions on food allergy as part of the annual APRN online survey. The survey was piloted with six general paediatricians prior to circulation and modified in response to feedback to ensure readability and ease of completion. The survey was administered via Research Electronic Data Capture (REDCap) over a 4-month period from November 2011 to February 2012. Two reminder emails were sent to encourage participation. Ethics approval was obtained by The Royal Children's Hospital Human Research Ethics Committee (31245A).

### Main outcome measures

The survey included questions designed by the study authors (an allergist, two general paediatricians and a paediatric trainee) to assess knowledge of the management of IgE-mediated food allergy via a case scenario, with correct responses based on the Australasian Society for Clinical Immunology and Allergy (ASCIA) recommendations for diagnosing and managing food allergy.<sup>13</sup> Paediatricians also reported on allergy-related presentations (eczema; mild allergy symptoms (i.e. one of facial or body urticaria, facial angioedema, lip tingling, itchy mouth, vomiting, diarrhoea, eczema flare); moderate symptoms (two or more of preceding symptoms); and severe symptoms, i.e. anaphylaxis) in their practice; use of testing including barriers to the uptake of SPT and SsIgE testing (cost, accessibility, invasiveness and utility); waiting times to access tertiary allergy services; and interest in further education in allergy. Wait time was estimated by the responder. Paediatrician demographic characteristics (including Socioeconomic Index for Advantage (SEIFA)<sup>14</sup> based on main practice postcode) were drawn from the APRN database.

### Statistical analysis

We used proportions, means and standard deviation (SD) to describe the data. We used Pearson  $\chi^2$  tests to compare responders and non-responders for (i) the entire Multi-Topic Survey; and (ii) those who responded to the food allergy questions. We regarded paediatricians who reported seeing >100 children with food allergy per year ( $n = 6$ ) as outliers for the analysis regarding number and type of allergy consultations because the mean number of consultations fell from 108 to 19 per year when they were excluded. These respondents were included in all remaining analyses. Data were exported from REDCap into Excel and then into STATA version 12 (Stata, College Station, TX, USA) for all statistical analysis.

## Results

One hundred sixty-eight (43%) of 390 paediatricians responded of whom half were male (86 (51%) of 168) and worked full time (84 (53%) of 158). Over two-thirds of paediatricians worked in public practice and a third worked in private practice alone or in combination with public practice; only 13 (8%) of 168 worked in a community health setting. Non-responders were more likely to work part-time than responders but otherwise did not differ (see Table 1).

Sixty-six per cent of paediatricians (93 of 168) reported they managed children with proven IgE-mediated food allergy. This included all rural (10 (100%) of 10), 28 (80%) of 35 regional and 52 (59%) of 88 metropolitan paediatricians. There was great variability in the number and type of allergy-related consultations seen per year with a mean of 18.8 (SD 19.9; range 0–100, excluding outliers). Paediatricians saw children with eczema flares (mean number of children seen per year 5.2 (SD 5.5)) and food allergy-related symptoms ranging from mild through to moderate and severe symptoms (mean number 5.4 (SD 6.0), 4.8 (SD 6.1) and 2.8 (SD 3.2), respectively).

**Table 1** Characteristics of survey (i) responders versus non-responders and (ii) responders to topic, i.e. paediatricians who do versus do not see children with IgE-mediated food allergy

| Characteristic (%)                                     | Whole sample   |                |          | See IgE-mediated food allergy |               |          |
|--------------------------------------------------------|----------------|----------------|----------|-------------------------------|---------------|----------|
|                                                        | Non-responders | Responders     | <i>P</i> | Yes                           | No            | <i>P</i> |
|                                                        | <i>n</i> = 222 | <i>n</i> = 168 |          | <i>n</i> = 93                 | <i>n</i> = 47 |          |
| <i>Paediatrician</i>                                   |                |                |          |                               |               |          |
| Male                                                   | 55             | 51             | 0.5      | 56                            | 43            | 0.14     |
| Age (years)                                            |                |                |          |                               |               |          |
| 25–34                                                  | 4.6            | 3              | 0.31     | 4.4                           | 2.1           | –        |
| 35–44                                                  | 38.5           | 40.6           |          | 38.0                          | 44.7          | –        |
| 45–54                                                  | 35.8           | 30.3           |          | 30.4                          | 34.0          | 0.69     |
| 55–64                                                  | 17.4           | 24.2           |          | 26.1                          | 17.0          | –        |
| 65+                                                    | 3.7            | 1.8            |          | 1.1                           | 2.1           | –        |
| Part-time work                                         | 58.2           | 46.8           | 0.03     | 39.3                          | 55.8          | 0.07     |
| Research active                                        | 49.1           | 43.8           | 0.32     | 39.6                          | 51.1          | 0.20     |
| <i>Main practice</i>                                   |                |                |          |                               |               |          |
| Location                                               |                |                |          |                               |               |          |
| Metropolitan                                           | 69.5           | 67.9           | 0.12     | 57.8                          | 83.7          | –        |
| Regional                                               | 27.1           | 23.9           |          | 31.1                          | 16.3          | 0.01     |
| Rural                                                  | 3.3            | 8.2            |          | 11.1                          | 0.0           | –        |
| Type                                                   |                |                |          |                               |               |          |
| Academic                                               | 17.6           | 14.9           | 0.48     | 15.1                          | 12.8          | 0.72     |
| Community health                                       | 6.3            | 7.7            | 0.58     | 4.3                           | 95.7          | 0.07     |
| Private practice                                       | 36.5           | 33.3           | 0.52     | 45.2                          | 17.0          | 0.00     |
| Public hospital                                        | 73.4           | 73.2           | 0.96     | 74.2                          | 25.8          | 0.62     |
| SEIFA (Socioeconomic Index for Advantage) disadvantage |                |                |          |                               |               |          |
| High                                                   | 34.3           | 34.4           | 0.99     | 42.2                          | 29.8          | –        |
| Medium                                                 | 33.8           | 34.4           |          | 32.2                          | 29.8          | 0.17     |
| Low                                                    | 31.8           | 31.3           |          | 25.6                          | 40.4          | –        |

## Knowledge and management of IgE-mediated food allergy

Table 2 details responses to the case scenario of a 2-year-old girl with a history consistent with an IgE-mediated reaction to peanut. The responses to the knowledge questions varied greatly with paediatricians having a high level of agreement (i.e. 90% or higher) for only three of 13 questions. Just over half (53 (58%) of 92) of respondents correctly identified that one cannot confirm IgE-mediated allergy to peanut on history alone and 56 (61%) correctly identified that a diagnosis of IgE-mediated food allergy requires a history consistent with a clinical reaction and a positive SsIgE or SPT result. However, 30% of paediatricians interpreted that a negative SPT or SsIgE test in the context of a positive clinical history meant that peanuts could be carefully introduced into the diet. Many paediatricians (78%) appropriately considered the prescription of an adrenaline autoinjector (as per ASCIA guidelines) for this child.

Many (78%) paediatricians correctly identified that not all children with nut allergy should be prescribed an adrenaline autoinjector. However, knowledge of the ASCIA guidelines for the prescription of an adrenaline autoinjector<sup>13</sup> was variable (see Table 3) with less than half of paediatricians nominating child age and use of beta blocker medication as factors that should be considered when prescribing an adrenaline autoinjector.

## Diagnostic testing and access to services

When diagnosing food allergy, 75 (82%) of 92 paediatricians used SPT (10 (100%) of 10 rural; 18 (64%) of 28 regional; 44 (88%) of 50 metropolitan). Paediatricians accessed SPT through public and private paediatric allergy clinics. Only two respondents used adult allergy services. Barriers to the use of SPT included not having access to the test (6%), too long a wait to access it (3%) and the test adding no value to assessment (3%). Only two paediatricians reported that they were unsure how to interpret the result.

Fewer paediatricians (65 (74%) of the 88 who responded to this question) used SsIgE testing in their assessment (8 (80%) of 10 rural; 20 (71%) of 28 regional and 37 (74%) of 50 metropolitan). Of the 23 respondents who did not use SsIgE testing, 11 stated that it added no value to the assessment, seven were unsure of how to interpret the result and 5 stated it was too invasive.

The mean reported waiting time to see a public paediatric allergist was 10.6 months (SD 6.0; range 1–24 months). The metropolitan, regional and rural mean reported waiting times were 10.4 (SD 5.7; range 1–24), 10.6 (SD 6.6; range 3–24) and 12.0 (SD 7.0; range 2–24) months, respectively. Access to private allergy services was considerably better with a mean reported waiting time of 5.4 months (SD 4.1; range 0–24 months).

**Table 2** Scenario 1: IgE-mediated food allergy to peanut

A 2-year-old child presents to you with a recent history consistent with IgE-mediated food allergy to peanut (e.g. generalised urticaria and vomiting within minutes of ingesting a food that contained peanuts). Thinking of this child for each statement, please mark 'true', 'false' or 'do not know' to reflect what you do in practice

| Statement                                                                                                                                                     | % Reporting (n = 92) |           |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------|-------------|
|                                                                                                                                                               | True                 | False     | Do not know |
| 1. IgE-mediated food allergy can be confirmed by history alone.                                                                                               | 41                   | <b>58</b> | 1           |
| 2. IgE-mediated food allergy requires a history of ingestion reaction in the context of a positive SPT or SsIgE test.                                         | <b>61</b>            | 37        | 2           |
| 3. Allergen avoidance and an allergy action plan is the mainstay of treatment.                                                                                | <b>98</b>            | 2         | 0           |
| 4. This patient needs referral to an allergy specialist to confirm the diagnosis.                                                                             | 23                   | <b>72</b> | 5           |
| 5. Prescription of an adrenaline autoinjector should be considered.                                                                                           | <b>78</b>            | 22        | 0           |
| 6. A negative SPT or SsIgE test to peanut suggests that the patient is unlikely to have peanut allergy and peanuts can be carefully introduced into the diet. | 30                   | <b>58</b> | 12          |

Note: Correct answer in bold.

**Table 3** Scenario 2: Use of adrenaline autoinjector prescription

The above patient's mother requests prescription of an adrenaline autoinjector (Epipen or Anapen). Thinking about this child for each statement, please mark 'true', 'false' or 'do not know' to reflect what you do in practice

| Statement                                                                                                          | % Reporting (n = 92) |           |             |
|--------------------------------------------------------------------------------------------------------------------|----------------------|-----------|-------------|
|                                                                                                                    | True                 | False     | Do not know |
| 1. General paediatricians are not authorised to prescribe an adrenaline autoinjector.                              | 4                    | <b>95</b> | 1           |
| 2. Only patients with a history of anaphylaxis should be prescribed an adrenaline autoinjector.                    | 38                   | <b>59</b> | 3           |
| 3. All children with a nut allergy should be prescribed an adrenaline autoinjector.                                | 15                   | <b>78</b> | 7           |
| <i>The following extra factors are useful in deciding whether an adrenaline autoinjector should be prescribed:</i> |                      |           |             |
| a) Whether the child is older or younger than 5 years.                                                             | <b>41</b>            | 52        | 7           |
| b) Coexistent poorly controlled asthma.                                                                            | <b>66</b>            | 28        | 7           |
| c) Remote location.                                                                                                | <b>95</b>            | 4         | 1           |
| d) Beta-blocker usage.                                                                                             | <b>34</b>            | 27        | 39          |
| e) Parental anxiety.                                                                                               | 45                   | <b>52</b> | 3           |

Note: Correct answer in bold.

## Interest in further education

Most paediatricians (82 (91%) of 90), regardless of their geographic location, were interested in further education in food allergy management, including face-to-face seminars and online training. The latter was of more interest to rural and regional paediatricians than metropolitan paediatricians (55% vs. 34%).

## Discussion

This is the first survey to evaluate how Australian general paediatricians diagnose and manage IgE-mediated food allergy. Paediatricians had significant gaps in their knowledge of diagnosis and management and relatively poor knowledge of the ASCIA guidelines for prescribing autoinjector pens. These guidelines are easily accessible via the ASCIA website, suggesting that

further education is needed to improve awareness of such resources. Paediatricians saw on average only two children per month with IgE-mediated food allergy, which supports our observation that tertiary services are bearing the bulk of food allergy care.

Both SPT and SsIgE testing were widely used, but tests were mainly accessed via public or private paediatric allergy clinics, i.e. the general paediatricians did not perform the tests themselves. This may reflect a lack of training in use and interpretation of these tests. Of those who did not use SsIgE testing, three quarters believed that they either added no value to the assessment or were unsure of how to interpret the result. This suggests that more education in the use of SsIgE testing and reassurance that the newer tests have comparable sensitivity and specificity to SPTs in the setting of a positive history is needed.<sup>15–17</sup>

As expected, the reported waiting times to see a public paediatric allergist were longer than those for a private allergist, but the mean waiting time for a public service was shorter than expected. This may be because some tertiary services prioritise appointments for children with anaphylaxis and children aged less than 12 months.

Several American studies have examined health-care professionals' assessment and management of IgE-mediated food allergy and similarly identified a need for further education. A survey of participants at a paediatric and internal medicine grand round in the USA (response rate 52%, 61 paediatric participants) found that residents and fellows were more likely to correctly recognise anaphylaxis and treat with adrenaline than attending physicians.<sup>18</sup> Another study examining paediatricians' diagnosis and management of anaphylaxis in the USA (response rate 42.6%) found that paediatricians were only partially equipped to recognise and treat anaphylaxis.<sup>19</sup> The authors suggested that the diminishing opportunity for subspecialty rotations during residency was likely impacting on allergy knowledge in more recent graduates. A further study undertaken by Gupta *et al.* addressed food allergy knowledge in 407 paediatricians and primary care physicians in the USA (response rate not reported).<sup>20</sup> They too concluded that health-care professionals' knowledge was fair but that significant knowledge gaps needed to be addressed.

Our study has several strengths. This is the first survey of its kind to be undertaken in Australia. APRN responders were similar to non-responders, improving the generalisability of our results within the APRN membership.<sup>11</sup> However, it is difficult to estimate how well our findings generalise to all Australian general paediatricians. This is because we have limited comparable data regarding the Australian general paediatric workforce. The most recent RACP workforce survey (2008) responders had a similar gender to APRN responders (60% vs. 51%) but were less likely to work part time (28% vs. 47%).<sup>12</sup> However, the RACP workforce survey does not differentiate between general and subspecialist paediatricians and had a low response rate (22%) thus making comparisons questionable. Further limitations include the moderate response rate, use of study-designed questions to assess diagnosis and management and physician report of allergy service waiting times. While APRN members are proportionally representative of every state and territory, they more likely to be interested in research, and this may have biased responses regarding interest in further education and training. The response rate of 43% is not unusual for a survey of busy practicing paediatricians and is similar to those reported in US surveys. Using one scenario to assess knowledge of management of IgE food allergy is not comprehensive but covers the basic principle of requiring both a positive history and a positive SsIgE or SPT result to confirm a diagnosis of food allergy, as well as identifying important considerations when prescribing an adrenaline autoinjector.

The results of this survey suggest that an allergy training programme for general paediatricians would be welcomed, could be based on easily accessible SsIgE tests and which could be delivered on-line to maximise reach and uptake. Consideration of online training for physician education in allergy has only recently been explored. In 2012,<sup>21</sup> US paediatricians

( $n = 61$ ) who took part in a case-based online educational tool reported improved knowledge regarding anaphylaxis risk factors and signs of food allergy and increased comfort in managing food allergy. However, knowledge was only assessed immediately before and after the intervention so longer term impacts are unknown. The Australian Society of Clinical Immunology and Allergy has recently launched a free online training programme for health-care professionals with modules in both food allergy and anaphylaxis,<sup>22</sup> but the impact of these models on knowledge and practice has not been evaluated.

While Australian general paediatricians do manage children with food allergy, their knowledge and practice varies widely, and there is a clear need for further education. The impact of any such education should be rigorously evaluated to ensure safety and effectiveness. This upskilling of community paediatricians may allow for the shifting of simple food allergy care away from tertiary settings thereby relieving some of the burden on Australian paediatric allergy services.

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## Authorship and contributions

All authors contributed to the design, methodology, ethics application, data interpretation and drafting of the study. DM and SD were responsible for the data manipulation. All authors have read and approved the final manuscript.

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