

Childhood Allergies



In the UK, 40-50% of children have at least one diagnosed allergy.^{1,2} The increased prevalence of allergies negatively impacts affected children's quality of life and puts pressure on health services. This note discusses the causes and extent of allergic disease in childhood, examines the links between allergy, genetics and the environment, and summarises current research.

Background

Allergies result from an immune response to normally innocuous substances called allergens (including pollen, dust mites, milk, egg, tree nuts, animal dander and insect venom). The development of allergy is complex and not well understood, but is likely to be due to complex interactions between genes and the environment. Allergic disease is a multi-systemic disorder that can result in one or more conditions (Box 1). Reaction severity ranges from a mild response to the life-threatening condition anaphylaxis. Allergies cause discomfort and can contribute to the development of anxiety and depression.

In the UK, £900m per year is spent on allergies in primary care and £68m on allergy-related hospital admissions.² A large proportion of these costs are considered avoidable.³ There are no data on the proportion spent on paediatric care or the indirect costs of lost productivity, such as parents' absence from work to care for children.

The Impacts of Allergies on Children and Families

Having a child with allergies often affects the whole family. There are significant negative psychological effects on parents whose children have experienced anaphylaxis. Families of children with severe food allergies usually eat a modified diet and children often avoid social occasions to

Overview

- Allergies are the most common chronic disorder in children and prevalence has dramatically increased in the last 25 years.
- The UK has one of the highest prevalence's of asthma, rhinitis and eczema in the world.
- Several reports have highlighted the need for improved allergy services, awareness and education in the UK.
- There is no national allergy strategy, but NICE has published guidance on how allergy should be diagnosed and managed.
- Despite the UK position as a world leader in allergy research, the provision of care is widely criticised.
- Further research into the mechanisms underlying allergy development would improve diagnosis and treatment and inform policy development.

reduce the risk of a reaction. Social exclusion is also reported in children with allergic rhinitis (hayfever). Allergies account for a large proportion of school absences, limiting educational attainment and participation in sport. Asthma symptoms (wheezing and sleep disturbance) are highest in UK children (twice the European average). Children with allergic rhinitis symptoms during summer exams (the pollen season peak) are twice as likely to drop a grade from winter mocks.⁴

Diagnosing Allergy

Allergic reactions result in a range of conditions of varied severity. There are two types of immune reaction:

- immediate reactions, producing antibodies called IgE
- delayed non-IgE reactions caused by other mechanisms.

To determine which allergen a person reacts to, the levels of specific IgE antibodies can be measured in the blood, or allergens can be tested on the skin (a skin-prick test). Diagnosis is not straightforward and requires careful interpretation of a patient's history, since tests can give false positive results. There are no non-IgE allergy tests. The National Institute for health and Care Excellence (NICE) advises against self-diagnosis using other unregulated allergy tests (such as hair analysis).

Box 1. Conditions Resulting from Allergies and their Diagnosis

- **Food allergies** result in gastrointestinal symptoms, rashes and wheezing. They are caused by an immune reaction to a food protein. The best way to confirm IgE and non-IgE food allergies is to remove potential dietary allergens and test responses to foods under clinical supervision. Limiting a child's diet can affect development so must be overseen by a dietician.
- **Allergic rhinitis** is inflammation of the eyes, nose and throat, and can be seasonal or perennial if the patient is allergic to multiple or indoor allergens. Aeroallergens usually provoke an IgE-mediated response and are diagnosed via skin prick testing and blood tests.
- **Other less common childhood allergies** include latex and venom allergies. There are other disorders with underlying allergic mechanisms, such as eosinophilic disease.

Several conditions can be caused via an allergic mechanism, but may also result from other factors.

- **Allergic asthma** is inflammation of the airways, causing wheezing and breathlessness. Asthma affects 1 in 11 children and is an allergy-driven condition in ~70% of children. Guidance recommends that diagnosis includes taking an allergy history and IgE testing, although this rarely occurs in practice.
- **Atopic eczema/allergic dermatitis** results in dry, itchy and inflamed skin. It affects 5-15% of children, presents early, and is often seen prior to the start of other allergic conditions.
- **Urticaria and angioedema** are inflamed wheals of skin and generalised swelling. Allergy-driven cases are often undiagnosed because of the limitations of skin tests.

Recent Trends in Allergic Disease

Allergies and asthma are the most prevalent chronic childhood illnesses in Europe and incidence is not linked to sex, ethnicity, geography or socioeconomic status. Although prevalence has dramatically increased in affluent countries in the last 20 years, rates of some conditions are stabilising. Prevalence is rising in low to middle income countries. Trend analysis is limited by a lack of standardised data; many estimates are based on self-reporting (which can be unreliable). There are no comprehensive national data held by the NHS, partly because of inconsistent coding in hospitals and primary care, whereas data from private care are not collected. Mild allergies are not reflected in data since they often go undiagnosed and are self-managed with non-prescription drugs. There are major gaps in prevalence data for venom, latex and chemical allergies as well as non-IgE food allergies. Finally, allergic asthma prevalence is unknown because of inadequate testing and the difficulties of diagnosis in under 5s.

National Trends

The Royal College of Physicians (RCP) has described allergy in the UK as 'epidemic'.⁵ Evidence shows that asthma, allergic rhinitis and eczema rates have stabilised, but reported symptoms in UK children are the highest internationally. Food allergies are increasing; 6-8% of children currently have at least one IgE-mediated food allergy. The most common allergens are egg and cow's milk affecting 2% and 15% of infants respectively. Many infants develop tolerance to these allergens. However, allergies to peanuts (affecting 1 in 50) and tree nuts are the most common beyond infancy, as children do not develop tolerance.

Hospitalisation, Anaphylaxis and Mortality

Asthma causes most childhood hospitalisations, with 25,073 emergency admissions in the UK in 2011-12. This exceeds the European average and varies 6.6-fold between local authorities. There are no data on the proportion due to allergic asthma, as patients and doctors are often unaware of the triggers. Since 1990, unplanned hospital admissions from allergic rhinitis, asthma and eczema have been stable, whereas other allergy admissions have disproportionately increased (food allergy by 500%, urticaria by 100% and anaphylaxis by 700%). Anaphylaxis is most often caused by food allergies, especially peanuts, but reactions to other allergens can also be life-threatening. Anaphylaxis fatalities are low, the risk factors include being asthmatic or incorrect adrenaline use. The Anaphylaxis Campaign argues that allergy-related mortality is under-estimated because of misdiagnosis and misreporting. 28 children died from asthma in the UK in 2012⁶ (one of the highest rates in Europe), but it is unknown how many had allergic asthma. Many deaths from allergic conditions are widely perceived to result from poor care and are considered preventable.³

Multiple Allergies

Multiple and complex allergies are becoming more common. One UK study found that 16% of children had two diagnosed allergies and 2.5% had eczema, asthma and rhinitis.¹ The younger the child is when the first allergic condition appears, the more likely it is that he or she will develop multiple conditions. Cross-reactivity, where a reaction occurs against similar allergens (such as cow's and goat's milk), is also common. Others have an underlying predisposition to be sensitised to many allergens and thus react to multiple unrelated allergens; for example 60% of children with cow's milk allergy also react to soya, and individuals with pollen allergies are often allergic to fruit. The increase in severe complex allergies affects quality of life and is likely to have consequences on adult allergy clinics.

**Factors in the Development of Allergies
Genetics, Pre-Natal Development and Early Life**

Genes are one factor that can predispose individuals to allergies, as changes to the genetic code can alter the function of immune cells or certain tissues (such as the skin). The recent increase in allergy prevalence has been linked to epigenetics (heritable changes to the genome not caused by alterations to DNA sequences) which may make individuals more susceptible to allergies. The role of allergen and micro-organism exposure during development and infancy is poorly understood and a topic of current research. Early antibiotic use can change the gut flora and affect immune system development. Breastfeeding gives some protection from asthma and other allergies by stimulating development of the immune system, but research is needed to understand how maternal diet affects breast milk and its capacity to offer protection.

Environmental

Several lifestyle factors are associated with increased allergy prevalence, although these are not linked to specific

allergies. They include high birth weight, diet (not being breastfed and eating foods high in fat, sugar and salt), obesity and a sedentary lifestyle. One theory is that limited childhood exposure to micro-organisms has increased allergy prevalence, as the immune system does not fully develop and over-reacts to substances. Respiratory allergy symptoms are exacerbated by environmental irritants such as tobacco smoke and air pollutants (see POSTnote 458, Air Quality), and so have been linked to urbanisation.

Allergy Policy

The World Allergy Organisation suggests that policymakers may improve allergy care by taking measures to limit the impacts of allergies, increase awareness and reduce drug costs. Evidence shows that national allergy policy can be effective through better diagnosis and management in primary care, and reduce hospital admissions and unnecessary referrals (Box 2), where costs to implement it are met. Despite calls by the RCP and the House of Lords and Commons Science and Technology Select Committees, the UK has no national strategy, in contrast to other chronic disease areas (Box 2). This may be due to the lack of a unified allergy voice, the many medical specialities involved and NHS structures. Delivering specialist allergy care is NHS England's responsibility, but most patients are seen in primary care.

Food Labelling

Parents of children with food allergies have limited choice, and often buy allergenic items because of inconsistent labelling. The Food Standards Agency (FSA) will implement new EU legislation in 2014 to standardise labelling of 14 food allergens on non-pre-packed and packaged foods. Caterers will also be required to inform customers of the presence of allergens. Allergen labelling is not required for non-food products such as creams, clothing and the use of milk in the manufacturing process. The Elliott Review, an independent report for the FSA on food networks (including undeclared allergen contamination), is expected shortly.

Allergy Treatment and Management

Allergies are often life-long conditions, with no cure. However, immunotherapy treatment can alleviate some conditions (Box 3). Managing allergic conditions includes understanding triggers, avoiding allergens and treating symptoms with inhalers, steroids and anti-histamines, especially when the allergen cannot be avoided (such as pollen). Adrenaline injectors should be carried by those at risk of anaphylaxis. Good care requires co-ordination between consultants, GPs, nurses, dieticians and pharmacists. Regional inequalities in access and quality of allergy services, a lack of both training and expertise in all care settings have been criticised by RCP⁵ and parliamentary science and technology committees. In response, several care standards and guidance notes have been produced by charities, medical bodies and NICE to improve outcomes. However, it is difficult to know whether and how health professionals use them. An account

Box 2. Approaches to Asthma and Allergy Policy

The Finnish Asthma and Allergy Programs (all ages)

Finland has similar levels of asthma and allergy to the UK. From 2008-2018 the national Finnish Allergy Program aims to reduce the burden of allergic disease. This follows the national asthma strategy 1994-2004, which standardised primary care knowledge and management of asthma. Although prevalence did not decrease it achieved:

- 70% reduction in asthma associated hospitalisations
- 76% reduction of individuals receiving disability pensions
- a reduction in healthcare costs.

Asthma Policy in the UK

The Department of Health has a national strategy for respiratory disease that aims to reduce prevalence, improve diagnosis time, quality of life and NHS care. The Interactive Health Atlas for Lung conditions in England (INHALE) is intended to help commissioners identify the prevalence and impact of asthma, regional service inequalities and local needs. Public Health England monitors air quality as this relates to asthma symptoms.

of patients' experiences will soon be published by the National Allergy Strategy Group (NASG).

Primary Care

GPs are often the first point of contact for patients, so their role is important for accurate diagnosis and appropriate care. An NASG survey found that 74% of GPs did not think they knew enough about allergies and that many areas do not have local allergy clinics to perform diagnostic tests and offer practical advice on diet, allergen avoidance and adrenaline injector use. Allergy follow-up consultations are required as children may develop tolerance to some food allergens. One approach to improve care is by financially rewarding GPs that offer best-practice. The British Society for Allergy and Clinical Immunology (BSACI) is developing a framework for GPs with a special interest in allergy to improve local expertise and to train colleagues, reducing strain on specialist centres.

Specialist Care in Hospitals

Patients may be referred for specialist care from allergists, immunologists and system-specific consultants. Poor allergy care in primary clinics means that specialist centres have long waiting lists. The provision of allergy services in the UK falls below many European countries, with only 26 consultant allergists³, a quarter of whom reach retirement age in the period 2011-16. Children aged 0-18 years are treated in paediatric clinics, although many transfer to adult clinics earlier. This period is associated with an increased risk of allergy-associated hospital admissions and mortality, because of a lack of information and risk awareness.

Enabling Self-Management

Patients can self-manage mild allergies if given information and training. Research shows that educating asthmatic children to self-manage improves lung function and reduces school absences, physical inactivity and hospitalisation. Allergy charities produce guidance and tools for the general public (such as Allergywise and an iPhone app) and campaign to improve public awareness.

Box 3. Treating Allergy with Immunotherapy (desensitisation)

In immunotherapy, patients are exposed to increasing doses of a specific allergen to induce immune tolerance and relieve symptoms. Allergens are given subcutaneously (by injection into the skin) or sublingually (under the tongue). This is the only therapy that improves allergen tolerance and reduces symptoms, although it is currently only clinically available for aeroallergens and venom. Desensitisation improves quality of life and reduces rates of hospitalisation in children. Immunotherapy in the UK is reserved for severe allergy cases, in contrast with Europe and the US where it is widely used, partly because of a lack of qualified UK doctors who can perform it.

Schools and Pre-School Environments

Many allergic children have reactions (often for the first time) in school or pre-school. One study found that 15% of reported reactions in school were severe, requiring adrenaline. Schools have a duty of care to support children with medical conditions and guidance for local authorities is available from BSACI. Staff are trained in allergy care by health visitors or school nurses, but many feel under-trained. The Government is consulting on having asthma inhalers in schools for emergencies.

Allergy Service Commissioning

Several reports have called for more consultant allergist posts (at least two paediatric and two adult allergists per NHS region) and trainees to meet demand.^{3,5,6} Since there has been little evidence of national improvements to care in the last decade,⁵ recommendations were made to establish regional allergy networks (Box 4). Although some regions are well-served, there is agreement that allergy services are often overlooked, that local NHS service commissioning makes it less likely that new allergy networks will be created, and that future improvement will require a national strategy. NHS England has produced a specification for specialist allergy services to recognise centres of excellence and provide funding.

Future Directions in Research and Care

There is consensus that more research is required to reduce the burden of allergic conditions and improve care. European allergy bodies argue that there is an urgent need for more basic science, epidemiological and clinical studies to improve allergy diagnosis, care and treatment.⁷

Basic Science and Clinical Studies

The Medical Research Council (MRC) and Asthma UK-funded Centre in Allergic Mechanisms of Asthma is researching various topics including the role of IgE antibodies and risk factors for those with multiple allergies.

Determining Allergen Thresholds and Guidance on Nutrition

A threshold is the amount of allergen required to trigger an immune response, and can be altered by exercise, infection and other factors. The FSA is funding research to determine average thresholds and how they vary, including the TRACE peanut trial. The Scientific Advisory Committee on Nutrition is reviewing how dietary factors affect allergic sensitisation, which will inform government advice on childhood nutrition.

**Box 4. The Hub-and-Spoke Model in the UK
The North West Allergy Network**

The DH piloted a two year project in North West England for multi-disciplinary paediatric allergy services, funded by NHS North West. The project involved two specialist centres (hubs) and local centres (spokes) and improved education and training of staff and patients and reduced hospital admissions. Because of its success, it is still in use and the model is used elsewhere, including Northern Ireland.

The Itchy Sneezey Wheezy Program

The Itchy Sneezey Wheezy Program for Integrated Respiratory and Allergy Care Pathways is a project to improve diagnosis and care for children. Developed by Imperial College and funded by the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care, the program was implemented in three London regions. A report on the program is due this year.

Children and Young Peoples Allergy Network Scotland (CYANS)

A Scottish review found that services failed to meet patient demand and had not improved since 2000. In response, CYANS was developed to examine paediatric allergy service need and collect baseline data, focussing on food allergies and anaphylaxis. It also provides training events and forums for patients and HCPs. The success of CYANS led to its approval by the Scottish government. However, this has not led to increased funding of services.

Reducing Allergen Sensitisation/Increasing Tolerance

The MRC and FSA-funded clinical trials at St Thomas' Hospital will determine whether introducing allergic foods induces tolerance in infants. LEAP (Learning Early About Peanuts) focusses on peanut consumption by 'high-risk' infants, and EAT (Enquiring About Tolerance) will include the consumption of several allergenic foods from weaning. Immunotherapy is the best way to increase immune tolerance but it is only clinically available for inhaled and venom allergens. A recent clinical trial at Addenbrooke's Hospital found that children with peanut allergies could be successfully desensitised to peanut protein over six months.

Improving Allergy Management and Care

Improved diagnostics are required to target therapies to sub-types of allergies. The PLESANT trial aims to measure if GP interventions in September reduce asthma consultations in school-age children throughout the year. Allergy UK's Nurses Appeal will employ specialist allergy nurses in the community to determine whether rapid diagnosis and specialist nurse-led care improves patient satisfaction and hospital admission rates. The University of Manchester is part of an EU-funded (€9m) international collaboration to develop food allergy management tools and advice. This includes the effect of maternal diet on infants. The study will be completed in 2017. Research into the natural history of allergic reactions over time could identify predictive factors for patient outcomes. MRC is also funding the ADAPT clinical trial for a new eczema treatment.

Endnotes

- 1 Sheikh & Punekar, Establishing incidence and prevalence using routine collected data from general practices, *Clin Exp Allergy* 39(8), 2009
- 2 Gupta et al, Burden of allergic disease in the UK, *Clin Exp Allergy* 34(4), 2004
- 3 A Review of Services for Allergy, Department of Health, 2006
- 4 Walker et al, Seasonal allergic rhinitis is associated with a detrimental effect on examination performance in UK teenagers *J Allergy Clin Imm* 2007
- 5 Allergy care: still not meeting the unmet need, Royal College of Physicians 2010
- 6 Royal College of Physicians. *Why Asthma Still Kills*, 2014
- 7 Research needs in allergy: an EAACI position paper, with EFA, 2012