**Title:** Upskilling healthcare professionals to manage clinical allergy.

**Short running title:** Upskilling healthcare professionals to manage clinical allergy

**Authors:** Louise J Michaelis1, Isabel J Skypala2,3, James Gardner1, Aziz Sheikh4, Adam T Fox5, Judith A Holloway6,7

**Word Count:** Abstract157 words,Manuscript 3256, Table count 1, Figure count 1

**Affiliations:** 1Department of Immunology, Infectious Diseases and Allergy, Great North Children Hospital, Newcastle, UK, 2Department of Allergy and Clinical Immunology, Imperial College, London UK. 3Royal Brompton and Harefield NHS Foundation Trust, London, UK, 4Asthma UK Centre for Applied Research, Usher Institute of Population Health Sciences and Informatics, University of Edinburgh, Edinburgh, United Kingdom, 5Department of Paediatric Allergy, Guy's & St Thomas' Hospitals NHS Foundation Trust and King’s College, London, UK, 6MSc Allergy, Faculty of Medicine, University of Southampton, Southampton, UK, 7Clinical and Experimental Sciences, Faculty of Medicine, University of Southampton, Southampton, UK

**Correspondence to:**

**Name:** Judith Holloway

**Address:** MSc Allergy, Mailpoint 810, Level F South Block, Southampton General Hospital, Southampton, SO16 6YD

**Tel:** 02381206941

**Email:** j.holloway@southampton.ac.uk

**Conflict of Interest Statement:** LJM reports commercial research grants from Danone, lectured for Mead Johnson and Allergy Therapeutics. ATF has received research funding from ALK-Abello and Danone and consultancy and/or educational lecture fees from Stallergenes, Allergy Therapeutics, Mylan, Thermofisher, Bausch & Lomb, DBV, Aimmune, Mead Johnson, Nestle, Danone and Abbott. He is director of KCL Allergy Academy and Trustee of British Society of Allergy & Clinical Immunology and Allergy UK, which have received corporate sponsorship. AS is Director of the Scottish Allergy and Respiratory Academy, a not-for-profit training initiative, which receives funding from a range of commercial partners. IS has received lecture fees from ThermoFisher. JG has received lecture fees from Mead Johnson, Thermofisher, ALK Abello. JAH is programme lead of the MSc Allergy at the University of Southampton, which has received corporate sponsorship for student bursaries, and reports grants from Danone plus non-financial support from ThermoFisher, both ouside the submitted work.

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

**Abstract**

It has long been recognised that given the high prevalence and considerable impact of allergic disease globally, there needs to be a focus on appropriate educational training for clinical professionals at all stages of training in all continents. The health-economic consequences of allergic disease are significant, with both direct healthcare costs (doctor, nurse and dietitian consultations, hospital admissions and prescribed medications) and indirect costs (lost school and work time, reduced productivity and over-the-counter medications). There is also a well recognised impairment of quality of life, with less tangible costs including anxiety, distress, discomfort, disability and, occasionally, death. We need to provide solutions that upskill clinical and allied health professionals at all levels through appropriate, accessible education, and in so doing, equips those those trained with the skills to become future healthcare professional trainers within successful seamless models of allergy care. A coordinated approach to educating the workforce is needed, starting from the grass-roots of undergraduate study, and continuing within the national societies and colleges in Medical, Nursing and Allied Health Professionals (AHP) where allergy is embedded in the curricula through the entirety of training and from the community to senior consultant levels. In working together to support pathways and care theycould have a major beneficial impact on the patient and their families, lead to a reduction in emergency use of clinical service, and help increase economic productivity.

**What is the problem?**

Allergy is well established as one of the major causes of chronic disease with global sensitisation rates to one or more allergens in school children approaching 40% with an estimated 150 million people in Europe alone suffering from a chronic allergic condition.(1) The prevalence of allergic disease is predicted to continue to increase in the United Kingdom (UK)(2) given that around one in three of the UK adult population has been diagnosed with one or more allergic conditions (3-5) and that this proportion rises to approximately 50% in children.(2) The rise of life-threatening allergic disease in the UK is particularly marked, with a 615% increase in the rate of hospital admissions for anaphylaxis in the 20 years up to 2012.(6) There remains two reasons as to why we have a problem: (1) The lack of allergy education and (2) The need to deliver allergy care differently. Both are required to be tackled to make change and improve outcomes. The current provision of services within the National Health Service (NHS) for allergic disease has been described as lacking in numerous reports. In 2003, the Royal College of Physicians (RCP)(2) recognised a *“gulf between the need for effective advice and treatment and the lack of appropriate professional services”* in the context of the increasing incidence, severity and complexity of allergic diseases. One of the fundamental contributing issues was a lack of an educational training strategy in the diagnosis and management of allergic diseases available as part of either undergraduate or postgraduate training. In response the RCPCH devised ‘RCPCH NICE guidance pathways in allergy care’(7) as many areas of allergic disease, such as food or drug allergy, do not fit neatly into any of the traditional organ-based medical specialities and hence have failed to gain a foothold in the medical and AHP curricula. Another issue recognised by the RCP was a marked disparity in the number of allergy specialists per patient in the UK compared to other economically-developed countries and indeed a recent comparison of training, clinical provision and training in Europe was outlined.(8)Unfortunately a decade on from a report published in 2010(9) that continued to *“emphasise the need for better allergy services and more allergy specialists”*, the recent roadmap(8) clearly states that “*more harmonization should be achieved in training of allergologists and subspecialists with investment in young doctors, creating new opportunities and lobbying for the full specialty in addition to free movement of allergologists*”. There has been some progresss, particularly in Paediatrics, in the intervening years, but the scale of any expansion still falls far short of the aspirations of the original 2003 report. Although most allergy sufferers have mild-to-moderate symptoms and can be well managed by competent primary care teams,(10) these teams still need support and guidance from specialists. As we enter into a period where investment in the NHS has slowed and not kept pace with increasing needs resulting from changing demographics, the likelihood of a significant expansion in specialist numbers is unlikely, especially when allergy is not considered a priority area by the Department of Health and Social Care (DHSC) in England. Within the UK, the role of CCGs is reducing and the responsibilities are now being transferred to primary care networks with increasing population health models demanding commissioning guidance as part of an integrated care system. Instead, we need to consider how new models of care in Allergy can align with the wider vision of the future of the NHS and other health care systems, such as are articulated in the NHS Long Term Plan, with better out of hospital care and use of digital technology to improve the effectiveness with which we manage chronic allergic conditions. In practice, this means an ever greater need for leadership from specialists, community healthcare workers and their representative societies and colleges to ensure that the general primary, secondary and organ-based tertiary care workforce is adequately equipped to diagnose and manage all but the most severe or complex forms of allergy, which will still require referral to specialist allery services. There are a variety of models of care that could facilitate more seamless collaboration between primary and secondary care and most models would incorporate integration at least to some degree, re-thinking the way that these sectors interact as part of joined-up network, as opposed to distant and unconnected silos. Developing more integrated models of care is a challenge across all specialities and requires leadership, informed by evidence, (11) to ensure that patients receive the right care, when they need it, in the best place. A recent editorial(12) highlights examples of integrated models of allergy care for all healthcare professionals working in any healthcare system stating “*service delivery is about what we do but also how we do it*”. The question to continually ask is “*How do we know we are doing a good job*?” with the answer being “*Currently, as an allergy community together, we can do better”*. A central pillar of integration of care is the need for appropriate upskilling of the professionals who will be delivering front-line care and with only a small number of specialists, the scale of this challenge is significant.

**Current state of play**

There remains two means to tackle “the problem” currently: (1) the need to develop new and novel “models of allergy care” and (2) to raise awareness of the lack of allergy education. With regards to education and models of care in Europe, both issues have recently been highlighted in a publication outlining the need for collboartaion and a united educational platform for allergy specialists.(8) The first problem addressing models of care: the DHSC, as England’s governing body, supports ministers in leading the nation’s health and social care for our allergic population to *“live independent, healthier lives for longer”*.(13) Seamless care for the prevention of allergic disease aligns with both worldwide and UK Government’s objectives and commitments as guardians to NHS England (NHSE) supports its framework for Children and Young People.(8, 14) In the UK as of 2018, despite these priorities, statistical data relating to allergy remains poorly represented with only nine accessible articles on the DHSC website related directly to allergy with limited reference to the 53 recommendations made to Parliament by NHSE on Allergy Services.(2, 15, 16) In addition the NHSE ‘*My NHS’* website (17) discloses data to the public on which clinical services are available with neither paediatrics nor allergy featuring in the specialty list.(17) Furthermore, NHSE shares out over £100bn in funds to the Commissioning Board Organisations who are accountable for commissioning their services to 211 Clinical Commissioning Groups (CCGs) and subsequently to General Practioners (GPs) and AHPs on behalf of patients. Allergy as a specialty remains poorly supported and understood by the CCGs as there is no community orientated commissioning guidance and warrants specialised collaboration across all tiers of service delivery.

The National Programme for Care and Clinical Reference Groups (CRGs) in Immunology and Allergy (F06) outlines the Allergy Service Specification (ASS),(18) including the scope, its expert professional and public health membership, and the policies for guidance in the role of adult allergy and immunology with paediatric allergy aligned with the Specialist Children’s Medicine CRG.(2, 9, 19) Alongside, they propose Specialist Allergy Centres (SACs), which aim to improve the quality of clinical allergy diagnosis, prevention, management and resolution strategies to their region and deliver specialised allergy services as part of a provider network used by the 10 Hub Commissioning Teams (HCTs), to contract services funded by NHSE to demonstrate and deliver excellence in the field. There are a limited number of SACs in the UK which provide specialist services to 50 other CCG-led health jurisdictions. There are 31 adult allergy centres in England and Wales (17 staffed by immunologists) and 19 paediatric centres (7 paediatric immunology specialists and 12 allergy specialists) of which some are co-located with the adult service (figure 1).(9)

To ensure services are aligned to national standards for clinical governance, adult SACs in the UK are registered with a UK Accreditation Scheme, *’Improving Quality of Allergy Services’* (IQAS), administered by the RCP.(20) They register patients on a national database for rare International Classification of Diseases 10 (ICD-10) coded allergic diseases and complex treatments (such as immunotherapy, biologicals and drug desensitisation) via a national or local specialist workload monitoring tool (a web-based database).(20) The Systematized Nomenclature of Medicine-Clinical Terms (SNOMED-CT) system is an electronic health record that that will be adopted by several countries including the UK(21, 22) and is currently being deployed in the NHS, starting with primary care (23). As information technology (IT) systems evolve, collection of routine activity and performance data related to patients treated in the community and at home continues to develop, with participation in the scheme increasing.

Two British Society of Allergy and Clinical Immunology (BSACI) documents, *‘The Patient Journey for Allergic Disease and A Model of Allergy Service within the NHS’(24)* both outlined the need for models of care in allergy. A recent systematic review on pathways of delivery of allergy services(11) highlighted the many models of care trialed and tested within the NHS along with their success, challenges and downfalls. To date, ‘Models of Care’, outlined by DHSC, remains hindered by the lack of allergy education awareness hence most professionals are turning for leadership and guidance to national and international professional organisations.(12) Within the UK the well respected North West of England model of allergy care remains successful within its pilot stage.(25) The influence of reach of such professionals organisations will increase if subscriptions, which are self funded, are reduced. This has already been achieved nationally and internationally through collaborative membership schemes such as the one between the BSACI and Europe Academy of Allergy Clinical Immunology (EAACI)(26). EAACI has also taken one step further by creating a Section of alliance between AHP and primary care, ratified by the EAACI General Assembly in June 2019.

Finally with regards to the second problem on “lack of education”, despite attempts to address the concerns regarding a lack of education raised by the ‘House of Lords Science and Technology Committee report’(15), organisations such as the King’s College London Allergy Academy (AA), SARA, and RCPCH Paediatric Allergy Training (PAT)(27) level 1-3 courses can only go so far to train healthcare professionals. Whilst the RCGP have now introduced a module of allergy and immunology into their curriculum, their support of an allergy focused GPs with Extended Roles (GPwER) program in allergy is yet to be developed.(28) These are local initiatives, dependent often on commercial sponsorship and with no accountability around educational outcomes in defined geographical areas. However much they try, they will not be able to plug the gap left from a lack of centrally funded, nationally co-ordinated, formal education.

**What is offered?**

Education in allergic disease must start at the root of the problem which is within undergraduate medical, nursing and AHP training programmes. Whilst traditional topics in immunology are common place in undergraduate curriculums and very much disease based, an overview of multi-system organ based allergy competencies are ill defined if not non-existent. If there is a limited platform for training in undergraduate curricula, there will remain a deficit in General Practice as well as in General Paediatrics and Medicine. The RCP, RCGP and the Royal College of Paediatrics and Child Health (RCPCH) all facilitate either web based or face-to-face training programmes in Immunology and Allergy for interested undergraduates with the RCGPevolving a program for an Extended Role (GPwER),(28) Paediatricians with a Specialist Interest (SPIN) and those training to be a specialist (GRID) with Certificate of Completion of Training (CCT).(29) A recent systematic review(11) reported that there is scope for better training of AHP working in allergy and concluded that the development of better training and competencies could support this.(30, 31)

Many organisations supporting AHPs have published allergy competencies, but a very useful adjunct to such training is available on the AAAAI website(32) and the the EAACI ‘Competencies for Allied Health Professionals working in Allergy’ published in 2018.(33) These competencies provide a benchmark for the required knowledge and skills of AHPs and others working in allergy and as such are useful for organisations designing study days and courses. The Food Allergy Interest Group of the British Dietetic Association (BDA) is one of the largest specialist groups of the Association and in addition to developing specialist dietary information sheets, the group runs two study days a year for both those practising in or new to food allergy. Members of the group designed and implemented a training package for dietitians on cow’s milk protein allergy, based on allergy competencies published by the UK RCPCH.(34) In a similar fashion, the BSACI publish competencies specifically for nurses new to allergy which are available on the BSACI website.(35) Despite these competency driven forums, it remains clear that some professionals already practising in allergy are not up-to-date and need a refresher, or feel their proficiency in allergy management is not of a sufficiently high standard to practice independently or up to international standards and thus regular attendance at National and International Conferences remains important.(30)

Educational opportunities in the UK vary from Continuing Professional Development (CPD) events from AA(36) and world wide screening on YouTube from SARA(37), to substantive courses leading to postgraduate qualifications from the MSc Allergy Programmes at both Imperial College(38) and the University of Southampton,(39) plus a competency based e-module at Newcastle University.(40) To date, there have been over 400 graduates from the Southampton MSc Allergy programmes, with numerous examples of impact on clinical practice from alumni, such as(34, 41-43). There are also a large number of regional allergy networks, established either by geographical co-location or through the BSACI, which provide valuable additional means of informal education through the use of shared protocols and policies and teaching sessions.(44, 45) This can be especially helpful where local CCGs are also involved. Allergy charities such as Allergy UK and the Anaphylaxis Campaign also work very closely with institutions such as the BSACI to provide general information leaflets on a variety of topics which are designed for the general public, but may also help to inform non-specialist practitioners.

In addition to UK educational opportunities, EAACI has held the European Examination in Allergology and Clinical Immunology annually since 2008. This initiative was one of the outcomes from the Union Européenne des Médecines Spécialistes (UEMS) aim to standardise the training curriculum of allergologists/clinical immunologists in Europe.(46) This joint EAACI/UEMS exam, with both paediatric and adult tracks, takes place at the annual EAACI conference, and is supervised and evaluated by the Institute of Medical Education or IML, University of Bern, Switzerland.

**Where are the gaps?**

The vision of the National Programme for the CCGs has proven difficult to deliver. Currently primary care networks oversee the care of of 30-50,000 patient populations looking at population health models and the CCG commissioning roles will decline as they develop support and networks to establish the development into integrated allergy care systems.(12) This vision is a network of SACs based in teaching hospitals with a hub-and-spoke structure involving the specialist allergist and their nursing, dietetic and administrative support services linked to organ-based specialists and immunology laboratories integrated with primary care services. The strategies to fund and educate such seamless collaborative care inititives have limitations. Howeverinititives (including Advice and Guidance telephone consultations) and new models of care seem difficult to implement.(41, 47) The plan for each SAC, together with their allergy specialists, is to review complex conditions referred for expert guidance or failure of treatment, whilst primary and secondary care continue to assess and manage simpler allergy cases.(48). All hubs would have strategic and clinical governance objectives delivered in accordance with those outlined by the DHSC, NHSE, RCPCH and the National Institute for Health and Care Excellence (NICE).(14, 49, 50) There are similar challenges in the devolved nations. For example, in NHS Scotland there is a lack of allergy expertise in primary care and this is compounded by the dearth of paediatric and adult allergy specialist services.

Whilst DHSC and NHSE set the priorities and strive to allow a public voice within the allergy field, this compassionate and inclusive network is yet to deliver better support for patients. The NHSE’s recent *“The NHS Longer Term Plan”*(51) focuses on seamless collaborative care in an increasing, ageing population, using new technology with finite resources. As the diagnosis and management of patients predominantly takes place within primary care,(2) there remains a continued concern that training and education, and subsequent quality of allergy care, throughout all tiers of UK care provision remains suboptimal.(2, 16, 19, 52, 53) In 2004, only 50% of GPs received training in allergy(52) with subsequent UK government reports highlighting the need for improvement in allergy training for primary healthcare professionals. Despite this, a 2009 follow-up survey, supported by the RCGP, reported that only 29% of responding GPs had received any formal allergy training.(54) Under the auspices of the RCGP, a nationwide survey of GPST (General Practioner Specialist Training) programme directors was undertaken and, informed by the contents of the RCGP curriculum, a number of core competencies relating to the diagnosis and care of patients with allergic problems were identified. It was concluded that good practice and support for allergy training was required to expand allergy education for trainees.

However, a decade later, there are ongoing concerns that the quality of care provision for allergy in primary and secondary care remains suboptimal. In 2012, Ellis et al identified lack of training provision in allergy for GP trainees and sought to understand the deficit.(55) A cross-sectional survey of GPST programme directors indicated that two-thirds of programmes were providing some allergy training, with the remaining one-third either providing no training or were unsure. Overall, only one-third of programme directors believed that all the relevant allergy-related curriculum requirements were being met, this mainly being in the context of organ-specific allergic disorders.

The reasons underpinning poor allergy care in the workforce remain multifactorial and include: (i) shortage of allergy specialists at all levels of care, (ii) paucity of allergy education in the UK medical undergraduate and primary care curriculum, (iii) lack of allergy knowledge, (iv) poor availability of diagnostic testing and (v) suboptimal management and treatment, especially for complex disease.(16)

There is also a gap at grass-roots level in the education of the patients themselves.(56) As mentioned, Allergy charities such as Allergy UK and Anaphylaxis Campaign play an important role in providing general allergy information and raising public awareness, but there is very little provided directly in schools and school nurses are now often being taken away from delivering training and education. Upskilling the patients in terms of education could and should begin in school with the education of the individuals, the child and teacher, as good education is important not just for the health care professional. Children are never too young to learn about allergy, so education could be embedded from Key Stage 1 (age 5-7 years) onwards.

**Will upskilling professionals impact on patient outcomes?**

Patient and Public Involvement (PPI) should ensure that the patient’s voice is at the heart of all levels of any care system. Such forums are well established within patient organisations such as Allergy UK, Asthma UK and Anaphylaxis Campaign (AC) and aim to provide written disease-specific information leaflets and provide educational events for patients, schools (AllergyWise) and professionals.(57-59) These forums can contribute to upskilling of the workforce such that it will benefit the patient, the service and the public health. Better patient outcomes through improved education of healthcare professionals have been demonstrated in a number of areas including mental health,(60) self-management(61) and stroke.(62) These outcomes have been demonstrated through better self-management of their disease or problem. Two studies have investigated the benefit of an adult asthma educational programme in the acute care setting. They reported that emergency visits and hospitalisations were reduced following a single educational session.(63, 64) Studies have shown effective treatment will result in cost savings to health providers by reducing emergency attendances and inpatient admissions, and will reduce the burden of illness in the allergic patient in turn improving their overall quality of life.(65, 66) An increase in education level has been associated with decreased mortality with the RN4CAST study of patients undergoing common surgeries, showing a 30% lower mortality in disease where nurses had been educated to a higher level than other centres.(67) A number of studies in inhaler technique and administration of adrenaline auto-injectors (AAI) suggest inferior medical device education of health professionals leads to poor patient outcomes.(67-70) Patients often have poor knowledge as to how and when to use an adrenaline auto-injector.(71, 72) However this is unsurprising when a study by Sicherer et al(71) showed that less than two-thirds of patients remember receiving a demonstration of how to use one and highlighted that many GPs and paediatricians do not know how to use an AAI. Ewan and Clarke(66) reported how a simple education intervention in patients with nut allergy resulted in a significant reduction in the number and severity of subsequent adverse reactions. A UK based study reviewing the added value of an Multi-Disciplinary Team clinic in paediatric allergy, noted a reduction in allergic reactions and improved patient knowledge from the baseline visit and therefore argued that additional medical evaluation will improve parental knowledge.(73)

**What are the solutions and what do we still need to do?**

If patient outcomes are to improve, then clinical staff need to be educated effectively to provide care that is both evidence based and deliverable. Such education needs to be effective at changing practice in a sustainable way and achieving this is challenging, not only due to the resource limitations and limited access to the time of the different professional groups but also because there is very limited data as to which educational modalities are most likely to have the desired impact. Despite the good intentions of the governing professional bodies, DHSC, NHSE, NICE, the Royal Colleges, there remain important gaps in the training of GP and undergraduate trainees in relation to allergy care. Currently, the task of upskilling the workforce falls to the international and national organisations committed to providing direct educational outreach programs, symposia and lectureships in allergy to professionals. These bodies, such as WAO, EAACI, AAAAI, ASCIA, BSACI, regional academies (AA, SARA) and MSc’s are not the ideal organisations for this role as they have limited resources, often provided by commercial interests, limited scope and capacity to deliver education, access only to those who choose to engage with them and importantly, no accountability. There remains a lack of allergy education within most medical schools and universities across the UK, although data relating to this from audits is now outdated.(74, 75) Whilst the majority of training programmes are delivering some allergy education, many programme directors would agree that enhanced attention needs to be paid to the improvement of allergy training for undergraduate, primary, secondary and tertiary healthcare professionals. This training needs to focus on minimum competencies of care and translate and communicate success and outcomes across specialities sectors, and in so doing devise appropriate non-properiary training materials aimed at undergraduates, AHPs in training, and established clinicians, be they in primary, secondary or tertiary care. There also needs to be a plethora of opportunities for informal and experiential learning – through working relationships, placements, and shared models of care. Such collaborations of opportunity would allow the development of Massive Open Online Courses (MOOCs), certificate and diploma level courses to evolve. Such online courses could become an affordable and flexible way to learn new skills, advance professionals careers and deliver high quality educational experiences at scale. Future educational programmes in allergy must extend the tools involved to include smart technology and related educational modalities to maximise their effectiveness, beyond those currently available which focus upon limited clinical areas such as food allergy, asthma and rhinitis and criteria for specialist referral. Once delivered, there is a need to establish whether such training is perceived as being useful by those being trained and, importantly, whether this then translates into the much needed improvements in clinical outcomes for people with allergic disease (table 1). Without careful evaluation of impact, it will not be possible to make informed decisions as to how to allocate future resources for effective education. Publications including position papers and national guidelines from NICE, EAACI, WAO and BSACI provide impetus,(76, 77), alongside the eModule at Newcastle University,(40) and the MSc Allergy and PhD courses at both Imperial College(38) and the University of Southampton(39) are examples of highly valued education which would be useful to understand better in terms of the impact they have on clinicians and the care they deliver.

Any policy on improving allergy care across the world should include education as a core fundamental building block. All of the above suggestions would be best considered together as part of a co-ordinated national strategy, including as a core component, an educational strategy which can bring together all the stakeholders – medical schools, postgraduate trainers, representatives of allied professionals and the bodies responsible for national standards of care. A national strategy would need leadership and resource but would provide an opportunity to perform a comprehensive audit of current provision, identify the most important current gaps, review the evidence of the effectiveness of different possible interventions and consider the models of education in comparator countries and their level of success. With this detailed intelligence, recommendations can then be collaboratively formulated for interventions, alongside processes to measure their impact of patients. Such a strategy would represent the best chance of bringing better care to patients as quickly as possible, within the limited resources available (table 1).



**Figure 1: Allergy Centres across England, Wales, Scotland and Northern Ireland.** Blue = Adult only clinics, Green = Peadiatric only, Orange = Both. NOTE: there are not many orange centres listed as most clinics that take both adult and paediatric patients have separate listings on the website, one for adults and one for paediatrics. (Data sourced from Find an Allergy Clinic, BSACI).(57) **Education Centres in UK.** Yellow denotes face-to-face learning (MSc Allergy Southampton and Imperial, plus Allergy Academy), Purple shows online learning sites (Newcastle, Edinburgh).

|  |  |  |
| --- | --- | --- |
|  | **Where we are currently:** | **What we could achieve:** |
| **Education/ Clinical expertise** | Poor NHS health and allied health professional training | Collaborative seamless care training for primary, secondary and tertiary care |
| Poor undergraduate and postgraduate training | Establish allergy training as part of undergraduate and postgraduate medical syllabus |
| **Finance** | Vast direct health economic NHS burden (consultations, admissions, prescriptions) | Establish seamless care initiatives to reduce burden |
| Vast indirect health economic NHS burden (Reduced school/work attendance, poor exam outcome, reduced productivity) | Trained diagnosis, rapid intervention and treatment, reduced co-modbidities will all improve outcomes and productivitiy |
| **Quality of Life** | Reduced quality of Life (distress, discomfort, disability, death) | Improved Quality of Life |
| **Mulitsystem allergic diseases** | Poor recognition of multisystem allergic diseases with poor resolution of disease and prevention of the allergic march | Improved recognition of multisystem allergic diseases and improved recognition of disease and halting of the allergic march |

Table 1: Upskilling the allergy care workforce and what we could achieve: Enhanced education, subsequent improvement in medical care (diagnosis, management) and quality of Life.

**References**

1. European Academy of Allergy and Clinical Immunology (EAACI). Advocacy Manifesto. Tackling the allergy crisis in Europe – concerted policy action needed 2015 [Available from: <http://www.eaaci.org/documents/EAACI_Advocacy_Manifesto.pdf>.

2. Royal College of Physicians. Allergy: the unmet need. A blueprint for better patient care London: Royal College of Physicians; 2003 [Available from: <https://www.bsaci.org/pdf/allergy_the_unmet_need.pdf>.

3. Gupta R, Sheikh A, Strachan DP, Anderson HR. Burden of allergic disease in the UK: secondary analyses of national databases. Clin Exp Allergy. 2004;34(4):520-6.

4. Anandan C, Gupta R, Simpson CR, Fischbacher C, Sheikh A. Epidemiology and disease burden from allergic disease in Scotland: analyses of national databases. Journal of the Royal Society of Medicine. 2009;102(10):431-42.

5. Punekar YS, Sheikh A. Establishing the incidence and prevalence of clinician-diagnosed allergic conditions in children and adolescents using routinely collected data from general practices. Clin Exp Allergy. 2009;39(8):1209-16.

6. Turner PJ, Gowland MH, Sharma V, Ierodiakonou D, Harper N, Garcez T, et al. Increase in anaphylaxis-related hospitalizations but no increase in fatalities: an analysis of United Kingdom national anaphylaxis data, 1992-2012. The Journal of allergy and clinical immunology. 2015;135(4):956-63 e1.

7. Warner JO, Lloyd K, Science, Research Department RCoP, Child H. Shared learning for chronic conditions: a methodology for developing the Royal College of Paediatrics and Child Health (RCPCH) care pathways for children with allergies. Arch Dis Child. 2011;96 Suppl 2:i1-5.

8. Fyhrquist N, Werfel T, Bilo MB, Mulleneisen N, Gerth van Wijk R. The roadmap for the Allergology specialty and allergy care in Europe and adjacent countries. An EAACI position paper. Clinical and translational allergy. 2019;9:3.

9. Royal College of Physicians. Allergy services: still not meeting the unmet need: Royal College of Physicians; 2010 [Available from: <https://shop.rcplondon.ac.uk/products/allergy-services-still-not-meeting-the-unmet-need?variant=6299280325>.

10. British Society for Allergy and Clinical Immunology. The nature and extent of allergy in the United Kingdom. A report to the Department of Health Review of Allergy Services.; 2006.

11. Diwakar L, Cummins C, Lilford R, Roberts T. Systematic review of pathways for the delivery of allergy services. BMJ Open. 2017;7(2):e012647.

12. Angier L, Jay N. New models of care for allergy. Clin Exp Allergy. 2019;49(5):562-3.

13. Care DoHaS. DHSC single departmental plan 2018 [Available from: <https://www.gov.uk/government/publications/department-of-health-single-departmental-plan/department-of-health-and-social-care-single-departmental-plan>.

14. Department of Health and Social Care. National service framework: children, young people and maternity services 2004 [Available from: <https://www.gov.uk/government/publications/national-service-framework-children-young-people-and-maternity-services>.

15. House of Lords Science and Technology Committee. Sixth Report of 2007 2007 [Available from: <http://www.publications.parliament.uk/pa/ld200607/ldselect/ldsctech/166/16602.htm>.

16. House of Lords Science and Technology Committee. Select Committee on Science and Technology Sixth Report: Chapter 9 Allergy services 2007 [Available from: <https://publications.parliament.uk/pa/ld200607/ldselect/ldsctech/166/16612.htm>.

17. National Health Service. My NHS: Data for better services 2018 [Available from: <https://www.nhs.uk/service-search/performance/search>.

18. National Health Service. F06. Specialised Immunology and Allergy Services [Available from: <https://www.england.nhs.uk/commissioning/spec-services/npc-crg/blood-and-infection-group-f/f06/>.

19. Department of Health. A review of services for allergy London: Department of Health; 2006 [Available from: <https://www.nasguk.org/wp-content/uploads/2016/02/DH_aReviewOfServicesForAllergy.pdf>.

20. Royal College of Physicians. Improving Quality in Allergy Services 2015 [updated 2015-09-21. Available from: <https://www.rcplondon.ac.uk/projects/outputs/improving-quality-allergy-services>.

21. Simpson CR, Anandan C, Fischbacher C, Lefevre K, Sheikh A. Will Systematized Nomenclature of Medicine-Clinical Terms improve our understanding of the disease burden posed by allergic disorders? Clin Exp Allergy. 2007;37(11):1586-93.

22. Mukherjee M, Wyatt JC, Simpson CR, Sheikh A. Usage of allergy codes in primary care electronic health records: a national evaluation in Scotland. Allergy. 2016;71(11):1594-602.

23. NHS Digital. SNOMED CT 2019 [Available from: <https://digital.nhs.uk/services/terminology-and-classifications/snomed-ct>.

24. British Society for Allergy and Clinical Immunology. The Patient Journey for Allergic Disease and a Model of Allergy Service within the NHS 2006 [Available from: <https://www.bsaci.org/pdf/BSACI_Models_paper.pdf>.

25. North West Allergy and Clinical Immunology Network. Developing allergy services in the North West of England: Lessons Learnt 2015 [Available from: <https://allergynorthwest.nhs.uk/wp-content/uploads/2015/12/NWACIN-Allergy-Report_final.pdf>.

26. European Academy of Allergy and Clinical Immunology (EAACI). EAACI Resources 2019 [Available from: <https://www.eaaci.org/resources/>.

27. Royal College of Paediatrics and Child Health. Paediatric allergy, immunology and infectious diseases - sub-specialty 2019 [Available from: <https://www.rcpch.ac.uk/resources/paediatric-allergy-immunology-infectious-diseases-sub-specialty>.

28. Royal College of General Practitioners. General Practitioners with Extended Roles 2019 [Available from: <https://www.rcgp.org.uk/training-exams/practice/general-practitioners-with-extended-roles.aspx>.

29. Royal College of Paediatrics and Child Health. Sub-specialties 2019 [Available from: <https://www.rcpch.ac.uk/education-careers/careers-paediatrics/sub-specialties>.

30. Groetch ME, Christie L, Vargas PA, Jones SM, Sicherer SH. Food allergy educational needs of pediatric dietitians: a survey by the Consortium of Food Allergy Research. J Nutr Educ Behav. 2010;42(4):259-64.

31. Maslin K, Meyer R, Reeves L, Mackenzie H, Swain A, Stuart-Smith W, et al. Food allergy competencies of dietitians in the United Kingdom, Australia and United States of America. Clinical and translational allergy. 2014;4:37.

32. American Academy of Allergy Asthma and Immunology. Education 2019 [Available from: <https://education.aaaai.org/>.

33. Skypala IJ, de Jong NW, Angier E, Gardner J, Kull I, Ryan D, et al. Promoting and achieving excellence in the delivery of Integrated Allergy Care: the European Academy of Allergy & Clinical Immunology competencies for allied health professionals working in allergy. Clinical and translational allergy. 2018;8:31.

34. Reeves L, Meyer R, Holloway J, Venter C. The development and implementation of a training package for dietitians on cow's milk protein allergy in infants and children based on UK RCPCH competencies for food allergies - a pilot study. Clinical and translational allergy. 2015;5(1):4.

35. British Society for Allergy and Clinical Immunology. Allergy Nurse Competency Document [Available from: <https://www.bsaci.org/professionals/nurses-specialising-in-allergies>.

36. Allergy Academy. Continuing Professional Development [Available from: <http://www.allergyacademy.org/home>.

37. Scottish Allergy and Respiratory Academy. Continuing Professional Development [Available from: <https://www.scottishallergyrespiratoryacademy.org/>.

38. Imperial College. MSc Allergy [Available from: <https://www.imperial.ac.uk/study/pg/medicine/allergy/>.

39. University of Southampton. MSc Allergy [Available from: [www.southampton.ac.uk/allergy](file:///\\soton.ac.uk\resource\Medicine%20Research\Private\Schmood\Publications\Reviews\Jude%20CEA%20Upskilling%202018\Response%20to%20reviewers\www.southampton.ac.uk\allergy).

40. Newcastle University. Allergy (E-learning) [Available from: <https://www.ncl.ac.uk/postgraduate/modules/CHS8005/>.

41. El-Shanawany IR, Wade C, Holloway JA. The Impact of a GP-led Community Paediatric Allergy Clinic: A Service Evaluation. Clin Exp Allergy. 2019;49:690-700.

42. Denton SA, Venter C, Holloway J. Making the case for a multi agency children's food allergy clinic. Nursing Children and Young People. 2013;26(4):16-23.

43. Fitzsimons R, Fox AT, Holloway JA, Kane P, Roberts G. Evaluation of a children's pollen immunotherapy service. Current Allergy & Clinical Immunology. 2013;26(3):137-44.

44. British Society for Allergy and Clinical Immunology. Adult Allergy Networks [Available from: <https://www.bsaci.org/professionals/adult-allergy-networks>.

45. British Society for Allergy and Clinical Immunology. Paediatric Allergy Group [Available from: <https://www.bsaci.org/professionals/paediatric-allergy-groups>.

46. Malling HJ, Gayraud J, Papageorgiu-Saxoni P, Hornung B, Rosado-Pinto J, Del Giacco SG. Objectives of training and specialty training core curriculum in allergology and clinical immunology. Allergy. 2004;59(6):579-88.

47. Itchy, Sneezy, Wheezy [Available from: <https://www.itchysneezywheezy.co.uk/>.

48. NHS Confederation. Children and young people’s health and wellbeing review of documents 2012 [Available from: <https://www.nhsconfed.org/-/media/Confederation/Files/Publications/Documents/Children_young_peoples_health_and_wellbeing_review_of_documents>.

49. Royal College of Paediatrics and Child Health. Allergy Care Pathways for Children: Food Allergy. 2011.

50. National Institute for Health and Care Excellence. Food allergy in under 19s: assessment and diagnosis: NICE; 2011 [Available from: <https://www.nice.org.uk/guidance/cg116>.

51. National Health Service. The NHS Long Term Plan 2019 [Available from: <https://www.longtermplan.nhs.uk/>.

52. Scottish Government Health Directorates. Review of allergy services in Scotland: A Report by a Working Group of the Scottish Medical and Scientific Advisory Committee 2009 [Available from: <https://www2.gov.scot/Publications/2009/06/17135245/17>.

53. Levy ML, Price D, Zheng X, Simpson C, Hannaford P, Sheikh A. Inadequacies in UK primary care allergy services: national survey of current provisions and perceptions of need. Clin Exp Allergy. 2004;34(4):518-9.

54. Hazeldine M, Worth A, Levy ML, Sheikh A. Follow-up survey of general practitioners' perceptions of UK allergy services. Prim Care Respir J. 2010;19(1):84-6, 7p following 6.

55. Ellis J, Rafi I, Smith H, Sheikh A. Identifying current training provision and future training needs in allergy available for UK general practice trainees: national cross-sectional survey of General Practitioner Specialist Training programme directors. Prim Care Respir J. 2013;22(1):19-22.

56. Muraro A, Agache I, Clark A, Sheikh A, Roberts G, Akdis CA, et al. EAACI food allergy and anaphylaxis guidelines: managing patients with food allergy in the community. Allergy. 2014;69(8):1046-57.

57. British Society for Allergy and Clinical Immunology. BSACI Website 2019 [Available from: <https://www.bsaci.org/>.

58. Allergy UK. Allergy UK website 2019 [Available from: <https://www.allergyuk.org/>.

59. Anaphylaxis Campaign. Anaphylaxis Campaign website 2019 [Available from: <https://www.anaphylaxis.org.uk/>.

60. Garzonis K, Mann E, Wyrzykowska A, Kanellakis P. Improving Patient Outcomes: Effectively Training Healthcare Staff in Psychological Practice Skills: A Mixed Systematic Literature Review. Eur J Psychol. 2015;11(3):535-56.

61. Rochfort A, Beirne S, Doran G, Patton P, Gensichen J, Kunnamo I, et al. Does patient self-management education of primary care professionals improve patient outcomes: a systematic review. BMC Fam Pract. 2018;19(1):163.

62. Booth J, Hillier VF, Waters KR, Davidson I. Effects of a stroke rehabilitation education programme for nurses. J Adv Nurs. 2005;49(5):465-73.

63. Kelso TM, Self TH, Rumbak MJ, Stephens MA, Garrett W, Arheart KL. Educational and long-term therapeutic intervention in the ED: effect on outcomes in adult indigent minority asthmatics. Am J Emerg Med. 1995;13(6):632-7.

64. Mayo PH, Weinberg BJ, Kramer B, Richman J, Seibert-Choi OS, Rosen MJ. Results of a program to improve the process of inpatient care of adult asthmatics. Chest. 1996;110(1):48-52.

65. Durham SR, Walker SM, Varga EM, Jacobson MR, O'Brien F, Noble W, et al. Long-term clinical efficacy of grass-pollen immunotherapy. N Engl J Med. 1999;341(7):468-75.

66. Ewan PW, Clark AT. Long-term prospective observational study of patients with peanut and nut allergy after participation in a management plan. Lancet. 2001;357(9250):111-5.

67. Aiken LH, Sloane DM, Bruyneel L, Van den Heede K, Griffiths P, Busse R, et al. Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study. Lancet. 2014;383(9931):1824-30.

68. Amirav I, Goren A, Kravitz RM, Pawlowski NA. Physician-targeted program on inhaled therapy for childhood asthma. The Journal of allergy and clinical immunology. 1995;95(4):818-23.

69. Rebuck D, Dzyngel B, Khan K, Kesten RN, Chapman KR. The effect of structured versus conventional inhaler education in medical housestaff. J Asthma. 1996;33(6):385-93.

70. Grouhi M, Alshehri M, Hummel D, Roifman CM. Anaphylaxis and epinephrine auto-injector training: who will teach the teachers? The Journal of allergy and clinical immunology. 1999;104(1):190-3.

71. Sicherer SH, Forman JA, Noone SA. Use assessment of self-administered epinephrine among food-allergic children and pediatricians. Pediatrics. 2000;105(2):359-62.

72. Gold MS, Sainsbury R. First aid anaphylaxis management in children who were prescribed an epinephrine autoinjector device (EpiPen). The Journal of allergy and clinical immunology. 2000;106(1 Pt 1):171-6.

73. Kapoor S, Roberts G, Bynoe Y, Gaughan M, Habibi P, Lack G. Influence of a multidisciplinary paediatric allergy clinic on parental knowledge and rate of subsequent allergic reactions. Allergy. 2004;59(2):185-91.

74. Shehata Y, Ross M, Sheikh A. Undergraduate allergy teaching in a UK medical school: comparison of the described and delivered curriculum. Prim Care Respir J. 2007;16(1):16-21.

75. Shehata Y, Ross M, Sheikh A. Undergraduate allergy teaching in a UK medical school: mapping and assessment of an undergraduate curriculum. Prim Care Respir J. 2006;15(3):173-8.

76. European Academy of Allergy and Clinical Immunology (EAACI). Food Allergy and Anaphylaxis Guidelines 2018 [Available from: <https://www.eaaci.org/resources/guidelines/faa-guidelines.html>.

77. European Academy of Allergy and Clinical Immunology (EAACI). Position Papers 2019 [Available from: <https://www.eaaci.org/resources/position-papers.html>.