Allergy is frequently a life-long immune dysfunction affecting the quality of life and causing a lot of visits to health care, hospitalization days, work disability and use of medication. Allergic diseases are the most common chronic disorders of children and adolescents (1). Similarly to many other western countries, prevalences of allergic diseases in Finland are high (2) (Table 1), and have, except eczema, steadily increased since the 1960s (3). Although some countries have reported that the occurrence of atopy and atopic disease have levelled off, or even decreased (4), such reversing trends have not yet been discernible in Finland. In 2007, 9% of the adults living in Helsinki reported to have doctor-diagnosed asthma (The Finnish-Estonian-Swedish Study, unpublished data). Sensitization rates to common allergens (one or more positive skin prick test result) are approaching 50%; a population study in 2003 showed that 43% of school aged Finnish children were sensitized (5), and in 2006, that was true for 47% of the adults (6).

Unravelling the mechanisms in the development of tolerance has given an impetus for revisiting the current views and dogmas in allergy. Strategies that have been used for years have not been able to halt the allergy epidemic and reduce the burden because of allergies. In Finland, an exception is the benefits gained with the Asthma Programme discussed below. We have to enter a new era, from mere treatment of symptoms to prevention and preventive management. The novel data challenge
many of those action models that have been adopted in the healthcare system and the society to counteract allergies. The need for a change in Finland was recognized already in 1998 in a consensus meeting (Allergic Population – a consensus statement 1998).

In allergy, there is no straightforward trend of worsening; mild symptoms often improve, even without treatment. Mild allergy symptoms are common and resolve often gradually and spontaneously, particularly in children. The available data show that majority of children with food allergies outgrow their disease (7, 8). For mild allergy, guided self-management and follow-up are generally sufficient. Extensive diagnostic examinations should be performed only if the symptoms continue, become more severe and cause disability or marked inconvenience.

Because of the high occurrence of allergic diseases in western countries, even the numbers of patients with severe symptoms are high; the healthcare system should allocate resources to manage these patients. Severe symptoms additionally cause the majority of costs; preventive and good control of the disease can thus considerably reduce these costs (Fig. 1).

**The Finnish Allergy Programme 2008–2018**

Experience from the Asthma Programme 1994–2004 has been used to facilitate also the Allergy Programme. The burden of a chronic disease can be decisively decreased. Although signs of reversing trends in asthma prevalence have not emerged in Finland, the programme has been a major success; hospitalization days because of asthma have decreased by 70% in relation to the number of patients, and the absolute number of individuals with disability pensions caused by asthma has shrunk 76% (9). In spite of increasing prevalence, the overall costs caused by asthma have levelled off and are now decreasing, contrary to what was predicted. Even annual costs per patient attributable to asthma have been reduced by 50%.

The overall costs of asthma in 1993 were €285 million (loss of production also taken into account) and €230 million in 2005. According to prediction, based on the 1993 trends, the 2005 costs would have been around €800 million (Nordic Healthcare Group 2008, unpublished data).

The Finnish Asthma Programme comprised both management guidelines and an action plan with *a priori* defined tools to achieve the goals. The process and outcomes were also evaluated. The Asthma Programme has served as a model for other programmes in Finland (e.g. COPD, tuberculosis, sleep apnoea) aimed at reducing the burden of chronic diseases.

Nonetheless, allergy is a multifaceted and more complex entity than asthma. The goals and foci of the novel Allergy Programme have to target the central problems and be pragmatic as well as achievable. The background of the programme stands, not only on the most recent scientific data, but also on long clinical experience, which are equally important in pursuing a change for the better.

In the programme, strategies are chosen, goals set and tools and evaluation methods defined (Fig. 2). Children and families are brought into focus more than in the Asthma Programme. Allergy Programme also revisits old dogmas and attitudes. In prevention and management, ‘avoidance and fear of all’ is not the right strategy but can lead to isolation, actions that deteriorate daily living and in the worst case, to serious reactions if exposure occurs unexpectedly (e.g. food exposure). Avoidance of allergens will always be important, but it must have justified and precise grounds and better defined time limits. Psychosocial factors should be better addressed as they play an important role in individuals’

![Figure 1. The schematic allergy pyramid. Most of the allergy symptoms are mild and intermittent, but due to the high allergy prevalence, severe symptoms are also common and cause majority of the costs.](image-url)
perception of symptom severity and create also ‘imagined allergy’.

**Implementation and collaboration**

The Allergy Programme is an educational action plan, which takes the advantage of the contact person network created during the Asthma Programme (10). In each municipal healthcare centre there are asthma contact persons (in 2008, 200 physicians and 580 nurses specifically trained in asthma). Similarly in pharmacies, 695 pharmacists have been educated as asthma contact persons (94% coverage of the pharmacies in Finland). These networks will be strengthened and a new one will be created in maternity and child health clinics.

National collaborators in the Allergy Programme are the Ministry of Social Affairs and Health, the National Public Health Institute, the Social Insurance Institution, the Finnish Institute of Occupational Health, the Associations of Finnish Pharmacies, specialist associations, the Finnish Lung Health Association FILHA and the patient organizations, the Allergy and Asthma Federation and the Pulmonary Association HELI. The last three nongovernmental organizations (NGOs) are responsible for the implementation of the programme.

The Finnish initiative joins the Global Alliance of Chronic Respiratory Diseases (GARD), WHO, a voluntary alliance of national and international organizations, institutions and agencies working towards the common goal of improving global lung health (1). The Allergy Programme will also benefit from the co-operation with the European Allergy Network (GA2LEN), and the essential global guidelines and action plans, such as the Global Initiative for Asthma (GINA), and the Allergic Rhinitis and its Impact on Asthma (ARIA) (11–13). The international dimension of the Programme may help others to create better models, while learning from the successes and failures of the Finnish initiative. Preventing the increase in allergies and asthma will be a particularly important topic in areas with developing national economy (14).

**Programme goals**

The general aim is to reduce the burden because of allergy in 2008–2018, and the Programme has six main goals. Baseline will be 2007–2009, depending on survey.

1. To prevent the development of allergy symptoms: Prevalence of asthma, allergic rhinitis, atopic eczema and contact dermatitis is decreased by 20%.
2. To increase tolerance against allergens: Numbers of subjects on elimination diets caused by food allergy are decreased by 50%.
3. To improve allergy diagnostics: All patients are tested in quality certified allergy testing centres.
4. To reduce work-related allergies: Allergic diseases defined as occupational are decreased by 50%.

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<th>Background</th>
<th>Programme</th>
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<tr>
<td>New body of knowledge</td>
<td>National conclusions</td>
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<tr>
<td>• Etiology Decrease of protective factors</td>
<td>• Growing public health problem</td>
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<tr>
<td>• Epidemiology Prevalence</td>
<td>• Support and funding by the Ministry</td>
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<tr>
<td>Morbidity↑</td>
<td>Broad consensus and commitment</td>
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<tr>
<td>Morbidity↑</td>
<td>• Prevention and preventive management</td>
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<td>Economy Costs↑</td>
<td>• Allocation of resources to severe allergies</td>
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<td>Evidence Strengthening of tolerance</td>
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**Figure 2.** The strategic planning of the Finnish Allergy Programme 2008–2018.
5 To allocate resources to manage and prevent exacerbations of severe allergies: ‘Allergy Control Cards’ are in use in the whole country and emergency visits caused by asthma are decreased by 40%.

6 To decrease costs due to allergic diseases: Predefined costs are reduced by 20%.

For each goal, specific tasks, tools and measures for evaluation have been defined. Tasks are the activities or targets in pursuing the goal. Tools are the means by which the tasks are carried out. Measures are the verification sources or methods to evaluate the outcome. In the following, each goal is considered separately and specific tasks, tools and measures are presented in some detail.

**Goal 1. Development of allergy symptoms is prevented**

Allergy health is promoted by various methods

There have been few, if any, methods available for promotion of allergy health. We introduce here the concept of ‘allergy health’ to mean physical, psychological and social well-being irrespective of allergy. An individual can be healthy and functional, although allergic. Allergy is recognized as an individual feature rather than illness when the condition is minor and relative. People must be encouraged to adopt such a way of living that promotes general health and immune balance. This is especially important in children and adolescents, whose development is endorsed by balanced diet, physical activity and a close connection with the natural environment, whether allergic or not. Anti-smoking advice and legislation must be improved. Exposure of children to environmental tobacco smoke is still a problem. Efficacy of asthma medication is poor in smoking patients, and asthma patients smoke as frequently as the population as a whole.

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<tr>
<th>Tasks</th>
<th>Tools</th>
<th>Measures</th>
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<tr>
<td>Allergy health is promoted. Well-being and awareness of protective factors, risk factors, natural history and outcomes of the disease among individuals with allergy are improved.</td>
<td>Knowledge measurement of personnel in the NGOs before-after the Programme. Surveys of the quality of life, awareness and attitudes of allergic individuals before-after the Programme.</td>
<td>Annual survey of smoke exposure at homes and in adults (National Institute of Public Health). Survey from the journals of maternity and child health clinics before--after the Programme.</td>
</tr>
<tr>
<td>Poor air quality increases symptoms Indoor air is in many dwellings and workplaces unacceptably poor. In Finland, indoor temperature is generally too high and air conditioning often defective, functions inadequately or brings pollutants and particles inside. Quality issues concerning buildings remain largely unresolved. There are too many dampness-associated indoor problems, and unacceptable building practices produces such problems ever more. The urban, ambient air in Helsinki and some other cities contains too high concentrations of small particles from increasing traffic and energy production. Small particles gain access deep into the respiratory tract and body increasing the risk of illness and worsening of symptoms.</td>
<td>Information, counselling how to reduce diesel exhausts, improve wood burning, reduce spring dust in cities, affect traffic and air quality politics. Local rules and national legislation.</td>
<td>Annual survey of visible signs of dampness and mouldy smell in dwellings (National Public Health Institute). Ambient air PM2.5 ja PM10 concentrations in bigger cities are monitored and reported.</td>
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**Goal 2. Tolerance against allergens in population is increased**

Tolerance is actively strengthened and avoidance reduced

Accumulating evidence supports the view that allergen avoidance alone does not prevent the development of allergic disease (15, 16), although in single cases it is of importance. Complete avoidance is virtually impossible and cannot provide long-lasting clinical benefits, except in certain specific cases (e.g. anaphylaxis). Even a governmental campaign of food allergen avoidance targeted to atopic pregnant and breast-feeding mothers and their infants has been unable to reduce allergy (17). Instead of allergen avoidance, tolerance to allergens in population must be improved by various means. Allergen avoidance is often necessary in acute occasions of severe symptoms, but as soon as the situation has resolved, other means that strengthen tolerance should be used.
Food allergy problems are reduced

The entity ‘food allergy’ comprises much imagined allergy and unnecessary avoidance of foods. Proportions of children on specific diets are too high, unnecessary avoidance of foods can even be deleterious as it may endanger the child’s intake of important nutrients and distort the child’s image of food and healthy eating.

Goal 3. Diagnostics of allergy is improved

Diagnostic practices vary greatly between different testing centres in the country. Allergy testing with allergens (skin prick tests, patch tests, challenge tests) will be centralized in large hospitals and in those private units which fulfil the quality requirements and in which an allergist is responsible for testing. In Fig. 3, examples of reading keys of skin prick testing are depicted. Skin and Allergy Hospital, Helsinki University Central Hospital, together with the Finnish Dermatological Association, is in the key position in improving the quality of allergy testing.

GA2LEN audit for the Allergy Centre of Excellence was performed 1.2.2008 in Skin and Allergy Hospital and has promoted the quality of work.

Goal 4. Occurrence of work-related allergies is decreased

Exposure to allergens and chemicals that cause rhinitis, asthma and contact dermatitis is still common in workplaces. Exposure, however, can be reduced in many ways. Dampness problems in workplaces cause morbidity and worsening of the work atmosphere. Buildings have been closed and even wrecked because of serious microbial problems (day care centres, schools, offices, etc.). ‘Mouldy house diagnostics’ does not work at the individual level. Occupational diseases need to be redefined medicolegally. Sensitization to chemicals causing contact dermatitis still occurs and exposure must be reduced. Patch tests are interpreted nonuniformly, depending on the tester’s and interpreter’s expertise and education.
Adult asthma and rhinitis

Treatment control of asthma and rhinitis is strengthened

The good results from the Finnish Asthma Programme 1994–2004 are further improved. Early detection, anti-inflammatory intervention and disease control are emphasized. Treatment problems associated with severe asthma are still a major problem and their prevention is the key for reducing both suffering and costs. Majority of asthma patients suffers from concomitant rhinitis, which must be recognized and treated at an early stage. This improves also the control of asthma. Pollen allergy is increasing in young population and new modes of specific immunotherapy (SIT) and sublingual immunotherapy (SLIT) are employed to improve access and adherence to treatment. Diagnosis of asthma in young children needs precision, and both under- and over-diagnostics are watched. The former causes unnecessary suffering and the latter overuse of drugs.

Adult asthma and rhinitis

Proportion of patients with chronic asthma (those entitled special reimbursement for asthma medication) is decreased by 5%.

Childhood asthma and rhinitis

The number of asthma diagnoses in infants and young children does not increase, regional variation is reduced.

When asthma diagnosis is made, rhinitis is diagnosed and treated appropriately.

Exposure of children to tobacco smoke is reduced.
long run what treatment is needed for maintenance, and prevent exacerbations.

Patient and his/her family, even healthcare professionals, do not recognize what is just dry skin and what eczema that should be treated with medication. The patients and their families have only a vague idea of the severity of eczema. Many families have incorrect perception of the causes of atopic eczema. Elimination allergy diets, that have been justified in infancy, are continued without medical need. Foods that do not cause symptoms are avoided unnecessarily. Topical corticosteroids are not used properly; too mild corticosteroids are used, and the courses are too short and stopped abruptly. Many people are afraid of using topical corticosteroids in summer.

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<tr>
<th>Tasks</th>
<th>Tools</th>
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<tr>
<td>Severity and exacerbations of atopic eczema are reduced.</td>
<td>The Finnish Current Care Guidelines.</td>
<td>Use of medication, particularly for children prescribed topical corticosteroids, topical calcineurin inhibitors and emollients (registers).</td>
</tr>
<tr>
<td></td>
<td>‘Atopic Eczema Control Card’.</td>
<td>Numbers of patients that have been allowed financial support for treatment (registers).</td>
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<tr>
<td>70% of the patients and 90% of healthcare personnel adopt the new treatment guidelines.</td>
<td>Education.</td>
<td>Surveys in pharmacies, specialist clinics, and child health clinics, how the new guidelines have been adopted.</td>
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<td></td>
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<td>Surveys to members of the patient organizations.</td>
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</table>
Treatment of anaphylaxis is improved

Anaphylaxis, a serious general allergic reaction, is not either recognized or treated properly.

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<tr>
<th>Tasks</th>
<th>Tools</th>
<th>Measures</th>
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<tr>
<td>Recognition and treatment of anaphylaxis is improved.</td>
<td>Information to all healthcare units. A booklet and a video.</td>
<td>Hospitalization days (registers).</td>
</tr>
<tr>
<td>Guided self-management of patients with anaphylaxis risk is improved.</td>
<td>‘Anaphylaxis Control Card’</td>
<td>Deaths from anaphylaxis (statistics).</td>
</tr>
<tr>
<td>Reporting is improved.</td>
<td>Internet-based notification form.</td>
<td>Numbers of i.m. adrenalin auto-injector prescriptions (industry).</td>
</tr>
<tr>
<td>Co-operation with the National Agency of Medicines (register of drug adverse reactions).</td>
<td>Quality and quantity of notifications to the National Anaphylaxis Register in Skin and Allergy Hospital/HUCH, Helsinki.</td>
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**Goal 6. Costs as a result of allergy are reduced**

Allergies cause relatively little hospital days and long-term work disability, but load strongly maternity and child health clinics, day care centres, schools, garrisons, primary health care and occupational health care. Allergies cause a lot of short absences from work, school and day care. Asthma and allergy drugs are major sectors of medical industry and pharmacies. Allergies affect markedly food industry, hotel and restaurant business, travelling and many authority activities, such as surveillance of medicines (hypersensitivity to drugs) and other products. Allergies are associated with building sector (indoor problems), surveillance of ambient air in communities (traffic exhausts, public sanitation) and with tobacco policy. Costs because of allergies have ramifications widely in the society and are not easily calculated. It must also be borne in mind that allergies benefit considerably different sectors of business (e.g. drugs, cosmetics, building and interior materials, household appliances).

Allergies are a problematic issue from another point of view of cost evaluation; allergies can manifest in the skin, nose, eyes, respiratory tract or gastrointestinal tract, and the symptoms are not always easily differentiated from symptoms caused by other diseases. Because of this, allergies and their treatment are often inaccurately reported. Direct costs due to asthma and allergies were nonetheless recently estimated (Tolerance and its improvement in allergy; National Public Health Institute Publications B 5/2007, in Finnish, English summary). Direct costs in 2005 were €348 million per year (c. 3% of the overall costs of health care). According to the goal 6, direct costs will be reduced by 20% by the end of the year 2018.

**Key messages of the Allergy Programme**

1. Endorse health, not allergy.
2. Strengthen tolerance.
3. Adopt a new attitude to allergy. Avoid allergens only if mandatory.
5. Improve indoor air quality. Stop smoking.

**Implementation of the Programme**

The messages and principles of the Allergy Programme are targeted to the whole population, to patients with allergy and asthma and their families, to public health and patient organizations, to experts, authorities and legislators.

The primary target groups of education and publicity are

1. Healthcare professionals, authorities and persons responsible in day care centres, schools and other educational institutions.
2. Key persons and peer workers in patient organizations and

The Finnish Lung Health Association FILHA, together with the Allergy and Asthma Federation and the Pulmonary Association HELI, is responsible for co-ordinating the implementation. Because of the co-operation between these three NGOs with a common project organization, the programme targets the whole population in a short time and can be implemented cost-effectively in all parts of the country.

Contact person network

There are five university hospital districts and 21 hospital districts in Finland. Primary healthcare services are provided by c. 250 primary care centres or units of
municipal federations, including at least a threefold number of maternity and child health clinics and c. 1000 units of occupational health. One-third of the last-mentioned units are private. The private sector is in general responsible for a growing part of all healthcare services.

In 2008, in hospital based specialist clinics (paediatrics, pulmonary medicine), primary health care, part of the occupational sector and pharmacies there were c. 1500 appointed asthma contact persons (doctors, nurses, pharmacists). For the Asthma Programme this network of skilled contact persons was the key to effective implementation. These contact persons will continue their invaluable work further in the Allergy Programme, and the network is additionally completed by nurses in maternity and child health clinics.

Education of healthcare professionals

Healthcare professionals are regionally educated by the hospital district, with the involvement of provincial governments. The NGO FILHA will co-ordinate this education, which is performed in 2008–2010 covering the whole country. Educators are mainly the specialists in each hospital district (allergists, dermatologists, pulmonologists, rhinolaryngologists, paediatricians and specialists in primary health care as well as nurses specifically trained in the area). Education will take place in own locales of the health care during the normal office hours as part of the regular educational programmes. External experts are used according to need.

Other education

Patient organizations arrange regional education to their key persons and peer workers. This education will be temporally linked to the education of healthcare personnel.

The Allergy and Asthma Federation and the Pulmonary Association HELI will organize annually c. 10 public events in different parts of the country, and educate personnel in regional offices during the first 3 years of the programme. The patient organizations produce the material needed

1 Publicity material for authorities, media and population.
2 Education material to regional offices.
3 Education material to population (general information) and to patients (self-management material).

After this first stage, education continues to gradually target key persons in pharmacies, in day care centres and schools (phase II). During the last tertile of the Programme (phase III), the messages and principles are reinforced, and finally, the process and outcome of the Programme evaluated.

Evaluation

A plan to evaluate both the process and outcome of the Programme has been produced.

Outcome (effectiveness) evaluation

The general and social outcome of the Programme will be evaluated. Understanding and adoption of the messages and principles of the Programme are clarified in health care as well as in organizations. In addition, changes in attitudes of the patients and the general population will be assessed. The focus, however, will be on the goals; how well the goals have been achieved? Have the chosen tools and measures been relevant in this respect?

The main methods to evaluate the outcomes are

1 Surveys before-after (and possibly in the mid of) the Programme targeting different groups, physicians, nurses in maternity clinics and schools, customers in pharmacies, parents of allergic children, etc. The surveys need resources, and not all of the mentioned surveys will be taken, and some others will come in addition or instead. Nevertheless, the list of surveys helps to target actions, which would be helpful while evaluating the progress and results of the Programme.
2 Inquiries of the effectiveness of education and functioning of guidelines targeting the groups in question.
3 Hospitalization days and emergency department visits because of allergy and asthma in 2007–2009 and in 2018 (registers).
4 Costs due to allergy and asthma medication, daily allowances paid by sickness insurance for allergies and asthma, disability pensions and rehabilitation because of allergy and asthma in 2007–2009 and 2018 (registers).
5 Monitoring of treatment costs before-after the programme in randomly chosen units representing different types and sizes of healthcare units.

Process evaluation

Evaluation of the process will be performed by an independent external body (Helsinki University).

Overall evaluation

In the overall evaluation, the results from both process and outcome evaluation are considered. At the beginning of the Programme in 2008–2009, a baseline clarification by interviewing the key persons in the Programme is performed to get a view of their expectations and thoughts concerning the Programme. In 2018, this interview is repeated. Effectiveness of publicity and education targeted to patients and the whole population will be additionally assessed using questionnaires.
Scientific background of the Programme

Tolerance

In allergy, the key issue is the impaired tolerance against allergens and irritants because of defective immune regulatory mechanisms. At the population level, the role of and guidance for allergen avoidance has been debated, and inducing or restoring tolerance to allergens in one way or another has become a hot topic.

To develop normally, the mucosal immune system needs challenges which the modern sedentary lifestyle in urban built environment does not provide. Especially exposure to saprophytic microorganisms/commensals via the skin, respiratory tract and, particularly the gut appears to be decisive for maintaining epithelial homeostasis and tolerance (18). Continuous exposure to saprophytes that have co-existed with man since ancient times does not elicit proinflammatory defence mechanisms, but instead, seems to induce the regulatory network associated with tolerance (19). Impaired function of this regulatory network may then lead to immune-mediated diseases including asthma, allergies, type 1 diabetes and inflammatory bowel disease. The regulatory network comprises most importantly regulatory T (T reg) cells and dendritic cells and the cytokines secreted by them (20–23). Data are accumulating that the balance between T reg cells and T effector cells has stranded in patients with allergies (24–26), or the function of T reg cells may be defective (25), implicating that the T reg cell function and/or T reg/T effector cell balance in these individuals must be restored by using novel innovative methods.

In addition to impaired physiological tolerance, even the psychological tolerance in population has been weakened. Fear of allergy or pseudoallergy, that are common today, must be dispelled.

Strengthening or restoring of tolerance

Tolerance can be strengthened, even restored, as shown by treating allergic individuals with SIT or, more recently, by SLIT, which target the regulatory network and restore the balance between T reg and T effector cells (27, 28).

Crucial factors in the development of tolerance and in the responses produced via TLR activation in general are the dose and frequency of allergen exposure, the nature of allergen, and factors specific to host cells (29). As to the dose of allergen, a large body of data now show that in many cases, the dose–response relationship follows a bell-shaped curve (Fig. 4); increasing exposure at relative low doses is associated with increasing frequency of symptoms/disease, whereas after a plateau, increasing exposure induces tolerance. Such a nonlinear relationship has been found e.g. for bee venom allergen (30), cat, mite, rat, mouse allergens (16, 31–33) and for endotoxin (34), suggesting that this bell-curve is a rather universal phenomenon for different allergens/bioparticles.

Continuous exposure to antigens is necessary

The fundamental role of continuous exposure to commensals and saprophytes in the development and maintenance of tolerance has become increasingly clear. Rakoff-Nahoum et al. (18) were among the first to show that recognition of commensal flora by TLRs is necessary for the development and maintenance of mucosal homeostasis and tolerance, a finding that has been corroborated thereafter by others (35, 36). Most recently, Hedl et al. (37) showed an important role for the breakdown product of peptidoglycan, muramyl dipeptide and its receptor NOD2, in inducing nonspecific tolerance in human intestinal macrophages. Much of the novel experimental data of mucosal homeostasis/tolerance and antigen exposure has indeed been obtained from studies exploring intestinal cells. The findings are evidently relevant also for inhalant allergens, as it has been shown that the majority of allergens after aerosol administration are found in the gut (38).

Other lines of evidence of the importance of continuous antigen stimulation in the development of tolerance come from epidemiology. Numerous studies of farm children consistently show that living in a microbe-rich environment confers protection against allergic disease (39). An analysis of house dusts in Finland and Russia using advanced methods showed that dust samples obtained from Russian Karelia, a microbe-rich area with low occurrence of atopic diseases, contained mostly Gram-positive bacteria, whereas in Finland, majority of the dust bacteria were of the Gram-negative lineage (J. Pakarinen, unpublished data). This is in line with the concept that in soil and natural environment, Gram-positive bacteria predominate (39, 40).

Much attention has during the last few years been devoted to farm milk (41, 42), as it has shown a particularly strong protective effect against allergies. The microbiota in fresh farm milk is similarly predominated by Gram-positive bacteria (43). Moreover, in normal flora of the healthy skin and respiratory mucosa...
In sum, sustained adequate exposure to microbial antigens in terms of quantity, composition and diversity seems to be necessary for the normal development and maintenance of mucosal tolerance. This tolerance is apparently nonspecific via the by-stander effect and actions of regulatory cytokines (22, 51).

Acknowledgments
The NGO, Allergy and Asthma Federation in Finland has funded a half-day secretary for the programme 2007–2008. The Finnish programme is indebted to Professor Gunnar Johansson, who initiated the World Allergy Organization project ‘Prevention of Allergy and Allergic Asthma’ (Int Arch Allergy Immunol 2004; 135:83–92.)

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