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### Allergic diseases in the general population

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## 10.1 Summary

Allergic diseases affect large proportions of civilized populations in many parts of the world. These conditions do not only reduce an individual's quality of life, but also represent a large economic burden on society. Thus, it is important to describe the prevalence of allergic diseases and to unravel factors that influence both the prevalence and incidence.

This thesis comprises results from two epidemiologic studies on allergic diseases, a longitudinal birth cohort study (PIAMA-study) and a cross-sectional study among adults (ELON-study).

**Chapter 3** describes the population distribution of total IgE and specific IgE to five common inhalant allergens. Specific IgE antibodies to common inhalant allergens were detected in about one third of the Dutch general population, aged 20 to 70 years. The prevalence of sensitization as assessed by the presence of specific IgE, fell with increasing age from 46% in the age group 20-29 years to 20% in the age group 60-70 years. This was mainly attributed to a decrease in the prevalence of sensitization to multiple allergens, while sensitization to one single allergen had a similar prevalence in different age groups. Especially the combination of specific IgE to house dust mite (*Dermatophagoides pteronyssinus*) and timothy grass had a high prevalence (20%) in the age group 20-29 years.

Sensitization to house dust mite was associated with higher levels of total IgE than sensitization to the other allergens studied. Besides, the concentration of total IgE in serum increased with an increasing number of positive specific IgE tests to inhalant allergens. For this reason, young adults had a higher mean total IgE level than older subjects. When taking differences in the distribution of sensitization between age groups into account, no relationship of total IgE with age was left.

Although the total prevalence of sensitization to common inhalant allergens was similar for males and females, sex differences were found in the prevalence of sensitization to individual allergens: males were more frequently sensitized to house dust mite and females more frequently to birch. Males had higher mean total IgE levels than females and current cigarette smokers had a higher mean total IgE level than individuals who denied smoking.

**Chapter 4** negates the thought that health care costs can be reduced by measuring total IgE as a first step in the diagnostic work up of a potentially allergic adult. It was shown that there existed no specific cutoff value of total IgE below which

sensitization to common inhalant allergens would be unlikely enough to give up further testing in individuals with asthma or allergy symptoms. High total IgE levels, on the other hand, indicated a high probability of sensitization. Thus, a high total IgE might be useful to decide whether further investigation is warranted in patients with negative specific allergy tests to a panel of common inhalant allergens. The discriminating ability of total IgE was better in the age group 20-44 years than in the older age group 45-70 years, probably due to the higher degree of sensitization in young adults as shown in chapter 4. The ROC-curves shown in chapter 4 indicate that a lower cutoff value of total IgE is mandatory for females than for males should be used to obtain equal sensitivity and specificity of total IgE to assess sensitization.

**Chapter 5** shows that almost half of adults with detectable specific IgE to common inhalant allergens experience no symptoms of asthma or rhinitis. The overall prevalence of asymptomatic sensitization to common inhalant allergens was estimated to be 14%.

The probability of having symptoms with sensitization increased both with the level of specific IgE and with the number of positive specific IgE tests. Especially specific IgE levels higher than 3.5 kU/l ( $\geq$ class 3) were rare among those who did not report symptoms (4%), while this was frequently found in symptomatic individuals (31%).

In individuals who were sensitized to the indoor allergens house dust mite or cat, the risk of having symptoms of asthma or rhinitis was higher when they expressed bronchial hyperresponsiveness or had a high blood eosinophil count at the same time. The results suggest that low levels of specific IgE to indoor allergens are only associated with symptoms of asthma or rhinitis when pre-existing inflammation of the airways is present.

Sensitization to outdoor allergens was, as opposed to indoor allergens, also associated with symptoms at the lowest class of specific IgE and this was not influenced by the presence of bronchial hyperresponsiveness or a high blood eosinophil count.

The observed differences between sensitization to indoor and outdoor allergens in the association with allergic diseases were further elaborated in **Chapter 6**. In this chapter the independent association between sensitization to indoor and outdoor allergens and bronchial hyperresponsiveness (BHR) was studied among adults. In young adults (20-44 years), specific IgE to indoor allergens had to be at least class 3 to be associated with BHR, while in the older age group (45-70 years) lower levels, i.e. class 2, were already associated with BHR. Individuals, exclusively sensitized to grass or birch pollen did not show increased BHR at any level of sensitization.

Finally, a significant dose-response relationship between serum total IgE and BHR was only found in the older age group, probably due to the lower degree of sensitization to common inhalant allergens in older people.

The results from **Chapter 7** show that exposure to combustion products of gas cooking may increase bronchial responsiveness in a susceptible group of individuals. This group is characterized by a high total IgE level, probably indicating a high degree of sensitization. In this susceptible group of people there was also a protective effect of the use of an extractor fan, which supports the idea that air pollution caused the observed adverse effects on bronchial responsiveness. Besides, the results suggest that these susceptible individuals selectively avoid cigarette smoking. An adverse effect of cigarette smoking on bronchial responsiveness was only found in individuals not belonging to this group.

**Chapter 8** shows results that suggest the in utero environment to be of importance in the predisposition to allergy development, since a negative association was found between the presence of pets at home during pregnancy and the level of total IgE of the infant at birth. Allergy of the mother had a stronger association with a high total IgE than allergy of the father. The elevated total IgE level in boys compared to girls was dependent on the presence of allergy of the mother. Thus, it was only in boys that allergy of the mother was associated with an elevated total IgE level.

As opposed to the generally accepted hypothesis that contact with other children protects against atopic disease (perhaps by facilitating the spread of infections), **Chapter 9** shows attendance at day care to increase the risk of atopic dermatitis in the first year of life. The longitudinal design of the PIAMA-study made it possible to study the time-course of this relationship. The effect of day care attendance seemed to be most pronounced in children in whom symptoms of atopic dermatitis were already present at 3 months of age, thus before day care attendance usually starts. Therefore, it is unlikely that day care attendance plays a causal role in the development of atopic dermatitis, yet it may constitute a risk factor for the preservation of atopic dermatitis and thus for visible signs of atopic dermatitis at physical examination. A high birth weight was found to be a risk factor for the development of atopic dermatitis, while exclusive breast-feeding in the first three months of life was protective.