

Epidemiology of pollution-induced airway disease in Scandinavia and Eastern Europe

Björkstén B. Epidemiology of pollution-induced airway disease in Scandinavia and Eastern Europe.
Allergy 1997; 52 (suppl 38): 23–25. © Munksgaard 1997.

Several potential environmental factors, particularly air pollutants, have been implicated as causal factors for the increased prevalence of allergic disease in western industrialized countries. However, even when combined, these factors can only partly explain the increase. Differences in prevalence of allergy are apparent between urban and rural areas of industrialized countries, with positive skin prick tests being more common in children living in urban regions. However, the prevalence of atopy is lower in children in central and Eastern Europe, where air pollution poses a major problem, than in Western Europe. Indeed, preliminary data from the International Study of Asthma and Allergy in Children (ISAAC) confirm that the prevalence of childhood atopy is lower in Eastern Europe than in Scandinavia. Although air pollution is undoubtedly associated with the development of allergic disease, other factors connected with western lifestyle, such as changes in diet and living conditions, may play an important role and provide a possible explanation for the higher prevalence of allergic disease in western industrialized countries.

B. Björkstén

Department of Paediatrics, University Hospital,
Linköping, Sweden

Key words: allergy; atopy; Eastern Europe; pollution; Scandinavia; sensitization.

Professor Bengt Björkstén
Department of Paediatrics
University Hospital
S-581 85 Linköping
Sweden

Introduction

The aetiology of allergy is multifactorial and depends on the interaction, in genetically susceptible individuals, between the time and degree of allergen exposure and the presence of non-specific 'adjuvant' factors, including air pollution. Environmental factors that influence the development of allergic disease are either specific or non-specific.

There is now an almost universal consensus that the prevalence of allergic diseases has increased considerably in western industrialized countries, particularly since the second world war (1, 2). The reasons for this increase are most likely associated with the environment. Indeed, several potential risk factors in the environment have been identified. However, even if all the factors that are known to affect the incidence of allergic manifestations were combined, this would only partially explain the increase.

Experimental, epidemiological, and clinical observations provide strong support for the concept that the conditions under which the primary encounter with an allergen occurs influence the immune response, i.e. whether tolerance or sensit-

ization is triggered (3, 4). Thus, the conditions under which an allergen is encountered in infancy may have consequences for many years, perhaps even for life. If indeed this is true, then the prevalence of allergic disease in adults will continue to increase for many years, even after introduction of effective allergy-preventive measures in childhood.

Allergy and environmental factors

There are considerable differences in the prevalence of allergy within industrialized countries, i.e. between urban and rural areas. For example, the relative risk for a positive skin prick test is 70% higher among 11-year old children living in a moderately polluted town in Northern Sweden than in children living in the neighbouring countryside (5, 6).

Air pollution is a major problem in many formerly socialist countries in central and Eastern Europe, yet the prevalence of atopy among children in these areas is much lower than in Western Europe. For example, atopic sensitization is less common in Konin in central Poland (6) and in Estonia (7–9) when compared with Northern Sweden. The prevalence of at least one positive

Table 1. Prevalence of positive skin prick tests and airway symptoms among 11–12 year-old school children in five regions around the Baltic Sea, and levels of certain common air pollutants

	Sweden		Poland (Konin)	Estonia	
	Rural	Urban		Tallinn	Tartu
≥1 positive skin prick test (%)	24.2	35.3	13.7	14.3	8.1
Odds ratio	1	1.71	0.49	0.46*	0.28*
Cough >2 weeks (%)	5.7	12.0	15.1	18.8	13.8
Respiratory infection >6/year (%)	6.3	8.0	14.0	10.4	10.5
Wheeze (%)	9.3	11.6	10.4	9.4	5.8
Asthma diagnosed (%)	6.7	9.5	2.9	3.2	2.5
Mean sulphur dioxide level (µg/m ³)	1.9	2.3	17.1	–	–
Range	0.8–3.9	1.0–14.7	4.3–70.9		
Mean nitrogen dioxide level (µg/m ³)	8.4	19.0	17.5	–	–
Range	1.0–34.8	1.3–66.9	3.9–25.9		
Mean particles (µg/m ³)	4.9	4.4	32.3	–	–
Range	0–11.2	0–21.2	4.9–99.0		

* Odds ratio for a positive skin prick test among children in Tallinn (industrialized city) was 1.81 compared with Tartu (university town).

–=not determined.

skin prick test was significantly higher in Tallinn, an industrialized coastal city, compared with Tartu, an inland university town (Table 1), mirroring the observed differences in skin prick test positivity in an urban and rural area of Sweden. Thus, although air pollution appears to play a role in the development of atopy, other factors associated with western lifestyle play a more important role, though the nature of these factors is presently unknown.

Studies comparing the prevalence of atopy in different environments are complicated by the lack of uniform diagnostic criteria and standardized procedures. Recently, however, international questionnaire surveys have been implemented that should be able to provide comparative prevalence figures in adults (1) and in children (10). Preliminary data from the International Study of Asthma and Allergy in Children (ISAAC) confirm that the prevalence of childhood atopy is much lower in Eastern Europe than in Scandinavia.

The hypothesis that early childhood is a period of particular susceptibility to environmental influences and the onset of 'atopic march' is supported by studies conducted by Wichmann (11). These show that the large differences between East and West Germany with respect to the prevalence of sensitization to inhalant allergens are limited to the age groups born after 1961. Recently, similar data were obtained from a comparative study of two university towns in Estonia and Sweden (7).

Lifestyle factors

In addition to the introduction of many new chemicals into the environment, there have been many changes in 'lifestyle' in industrialized

countries over recent decades (Table 2). The type of foods consumed has changed dramatically with the introduction of new industrial products containing numerous additives. Even fresh food items differ in many respects from those available only a few decades ago. Genetic manipulation and various chemical compounds are now employed to prolong the potential storage time of food, and as a result, some foods, such as apples, may now have a shelf-life of several months. However, virtually nothing is known about the possible influence of changes in diet on childhood allergy.

Conclusion

Living conditions in the formerly socialist countries of Europe are, in many respects, similar to those that prevailed in Western Europe 30–40 years ago, including the type of air pollution, the panorama of childhood infections, types of immunizations, building standards, and food. The nature

Table 2. Examples of changes in 'lifestyle' and environment after the second world war in industrialized countries with a market economy

Urbanization	Major change in habits and exposure to air pollution
Diet	Foods that are new to the area, a wider range of foods, food additives, industrial processed foods, altered intestinal microbial flora
Buildings	New building materials, more efficient insulation, altered methods for construction, construction around the year even in temperate climates
Homes	Larger dwellings, many new compounds at home (chemicals), increased indoor humidity in temperate and cold climates
Lifestyle	Most time spent indoors, extensive travelling and exposure to new environments

of factors associated with the environment and/or changing living conditions are unknown. However, in all studies, there was an inverse relationship between sensitization and manifestations of allergy on one hand, and crowded dwellings and the number of respiratory infections among children on the other hand. In currently ongoing studies, differences in the intestinal flora, dietary habits, and infections in early childhood, as well as other factors related to lifestyle, are being studied in an attempt to explain the different outcomes after exposure to ubiquitous inhalant allergens in western industrialized countries and other parts of the world.

References

1. Burney P. Variations in the prevalence of respiratory symptoms in the European Community Respiratory Health Survey (ECRHS). *Allergy* 1996 (in press).
2. Burr M, Butland B, King S, Vaughan-Williams E. Changes in asthma prevalence: two surveys fifteen years apart. *Arch Dis Child* 1989;64:1452–6.
3. Björkstén B. Risk factors in early childhood for the development of atopic diseases. *Allergy* 1994;49:400–7.
4. Holt P. Environmental factors and primary T-cell sensitisation to inhalant allergens in infancy: reappraisal of the role of infections and air pollution. *Pediatr Allergy Immunol* 1995;6:1–10.
5. Bråbäck I, Kälvesten I. Urban living as a risk factor for atopic sensitisation in Swedish schoolchildren. *Pediatr Allergy Immunol* 1991;2:14–9.
6. Bråbäck L, Breborowicz A, Dreborg S, Knutsson A, Picklik H, Björkstén B. Atopic sensitisation and respiratory symptoms among Polish and Swedish schoolchildren. *Clin Exp Allergy* 1994;24:826–35.
7. Jögi R, Jansson C, Björnsson E, Boman G, Björkstén B. The prevalence of asthmatic respiratory symptoms among adults in an Estonian and Swedish university town. *Allergy* 1996;51:331–6.
8. Riikjäär M, Julge K, Vasar M, Bråbäck L, Knutsson A, Björkstén B. The prevalence of atopic sensitisation and respiratory symptoms among Estonian school children. *Clin Exp Allergy* 1995;25:1198–204.
9. Bråbäck L, Breborowicz A, Julge K et al. Risk factors for respiratory symptoms and atopic sensitisation in the Baltic area. *Arch Dis Child* 1995;72:487–93.
10. Pearce N, Weiland S, Keil U et al. Self-reported prevalence of asthma symptoms in children in Australia, England, Germany and New Zealand: an international comparison using the ISAAC protocol. *Eur Respir J* 1993;6:1455–61.
11. Wichmann H. Environment, life-style and allergy: the German answer. *Allergol J* 1995;4:315–6.