

Allergies in Asia: differences in prevalence and management compared with Western populations

Expert Rev. Clin. Immunol. 6(2), 279–289 (2010)

Irvin Francis A Gerez,
Bee Wah Lee,
Hugo P van Bever
and Lynette P Shek[†]

[†]Author for correspondence
Department of Paediatrics,
National University of
Singapore, 5 Lower Kent Ridge
Road, Singapore 119074
Tel.: +65 67 724 420
Fax: +65 67 727 486
paeshekl@nus.edu.sg

There is wide variability in the epidemiology and management of childhood asthma and related atopic diseases globally. Urbanized, affluent Western countries tend to have a higher prevalence of these diseases compared with Asian nations. However, recent studies have shown that the prevalence in Asia is increasing, although the rate of increase has slowed in the more developed Asian cities. Some possible causes for these differences are socioeconomic status, degree of urbanization, rates of infection, healthcare practices and genetic factors. Importantly, there are significant differences in the way asthma and allergic diseases are managed within Asia. This is of great concern because of the health implications, as these diseases are some of the most common chronic conditions that affect both adults and children. This review compares the differences in prevalence and management between Asia and the West, and discusses some of the possible reasons behind these variations.

KEYWORDS: Asia–Pacific • asthma • atopic disorder • epidemiology • food allergy

The epidemiology of childhood allergies varies in different parts of the world. Many studies have shown that allergic diseases are more common in urbanized Western societies compared with more rural Asian countries. Even within Asia, the prevalence of such diseases is highly variable across the continent. Overall, it has been reported that the global incidence of atopic disorders increased by 0.5% annually between the mid-1990s and mid-2000s. This increase occurred more frequently among children 6–7 years of age than among children 13–14 years of age [1]. Recent studies have shown that this increase occurred not only in developed countries but also in many Asian countries [2]. One postulation is that this is the result of increasing affluence, greater urbanization, change to a Western lifestyle and strong population growth [1,3–5]. This trend in the prevalence of allergic diseases is a matter of worldwide concern owing to its health implications. For many allergy sufferers, their quality of life and school performance are affected. There is also the economic impact associated with treatment costs. The comparison of the prevalence and management strategies between Asia and the West,

and within the Asia–Pacific region itself, may be beneficial in developing our understanding of the roles played by variations in lifestyle, genetic background, cultural differences and environmental exposures.

Epidemiology of asthma & allergies in Asia

Asthma prevalence

The global prevalence of asthma in both adults and children has increased over the last few decades and it is currently estimated to affect 300 million people worldwide [6]. It has become an increasing problem and is the major cause of hospitalization among younger children [101]. Studies have shown that asthma and other allergic diseases are more prevalent in industrialized, affluent Western countries [6,7]. Looking at the 13–14-year-old age group, the highest asthma prevalence was found in the English-speaking, developed countries such as Ireland (26.7%), New Zealand (26.7%), the UK (27.4%) and the USA (22.3%). In Asian countries, such as China (6.0%), Hong Kong (8.6%), the Philippines (8.4%) and Indonesia (5.2%), the prevalence of asthma was much lower (TABLE 1) [1]. However, this

Table 1. Comparison of the prevalence of asthma, allergic rhinoconjunctivitis and atopic dermatitis in the 6–7- and 13–14-year-old age groups between the Asia–Pacific region and Western countries.

Country	Year of study	Age group (years)	Asthma (%)	Change per year (%)	AR (%)	Change per year (%)	AD (%)	Change per year (%)
China	1995	13–14	4.3		8.1		1.2	
	2003	13–14	6.0	0.24	10.4	0.33	1.4	0.05
Hong Kong	1995	6–7	9.1		13.7		3.9	
		13–14	12.4		24.0		2.7	
	2003	6–7	9.4	0.03	17.7	0.67	4.6	0.12
		13–14	8.6	-0.55	22.6	-0.21	3.3	0.08
Indonesia	1995	6–7	4.1		3.8			
		13–14	2.1		5.3		1.2	
	2003	6–7	2.8	-0.21	3.6	-0.03		
		13–14	5.2	0.52	4.8	-0.08	2.2	0.16
Japan	1995	6–7	17.4		7.8			
		13–14	13.4		14.9			
	2003	6–7	18.2	0.10	10.6	0.35		
		13–14	13.0	-0.05	17.6	0.34		
Malaysia	1995	6–7	6.5		4.1		9.5	
		13–14	10.1		13.9		8.9	
	2003	6–7	5.8	-0.12	4.8	0.11	12.6	0.49
		13–14	8.9	-0.13	16.2	0.53	9.9	0.19
Philippines	1995	13–14	12.3		13.9		5.2	
	2003	13–14	8.4	-0.55	16.2	-0.61	7.8	0.37
Singapore	1995	6–7	15.7		8.5		2.8	
		13–14	9.8		15.1		7.4	
	2003	6–7	10.2	-0.80	8.7	0.02	8.9	0.87
		13–14	11.4	0.24	16.5	0.20	9.2	0.25
South Korea	1995	6–7	13.3		9.8		8.8	
		13–14	7.7		10.2		3.8	
	2003	6–7	5.8	-1.45	8.7	-0.18	11.3	0.52
		13–14	8.7	0.20	11.6	0.28	5.7	0.39
Taiwan	1995	6–7	9.6		14.6		3.5	
		13–14	5.4		11.7		1.4	
	2003	6–7	9.9	0.04	24.2	1.37	6.7	0.46
		13–14	7.0	0.26	17.8	1.02	4.1	0.45
Thailand	1995	6–7	8.2		7.3		11.9	
		13–14	13.1		15.5		8.2	
	2003	6–7	11.9	0.47	10.4	0.30	16.7	0.79
		13–14	11.6	-0.21	21.0	0.84	9.6	0.39

Year 1994–1995 (Phase 1) and year 2002–2003 (Phase 3).

AD: Atopic dermatitis; AR: Allergic rhinoconjunctivitis.

Table 1. Comparison of the prevalence of asthma, allergic rhinoconjunctivitis and atopic dermatitis in the 6–7- and 13–14-year-old age groups between the Asia–Pacific region and Western countries (cont.).

Country	Year of study	Age group (years)	Asthma (%)	Change per year (%)	AR (%)	Change per year (%)	AD (%)	Change per year (%)
India	1995	6–7	6.2		3.2		3.0	
		13–14	6.7		6.3		4.3	
	2003	6–7	6.8	0.06	3.9	0.05	2.4	0.00
		13–14	6.4	0.02	10.0	0.43	3.7	-0.03
Australia	1995	6–7	27.2		9.8		11.1	
	2003	6–7	20.0	-0.80	12.9	0.34	17.1	0.67
Canada	1995	6–7	14.1		8.2		8.7	
	2003	6–7	18.2	0.47	10.8	0.29	12.0	0.36
Republic of Ireland	1995	13–14	29.1		19.3		13.6	
	2003	13–14	26.7	-0.30	15.5	-0.48	8.6	-0.62
New Zealand	1995	6–7	23.6		9.5		14.3	
		13–14	29.7		19.1		12.9	
	2003	6–7	22.2	-0.11	11.4	0.19	15.0	0.08
		13–14	26.7	-0.39	18.0	-0.13	8.8	-0.44
UK	1995	6–7	18.4		9.8		13.0	
		13–14	31.0		18.9		14.7	
	2003	6–7	20.9	0.50	10.1	0.05	16.0	0.60
		13–14	27.4	-0.71	15.3	-0.57	10.6	-0.39
USA	1995	13–14	22.9		13.4		8.5	
	2003	13–14	22.3	-0.07	19.1	0.71	8.3	-0.03

Year 1994–1995 (Phase 1) and year 2002–2003 (Phase 3).

AD: Atopic dermatitis; AR: Allergic rhinoconjunctivitis.

may change with time as asthma prevalence has stabilized in the West but is still increasing in Asia. In a recent survey by the CDC, it was reported that from 1997 to 2009, the prevalence of asthma appeared to have reached a plateau [102]. This was also seen in the latest data from the International Study of Asthma and Allergies in Childhood (ISAAC) survey, where a stabilization in asthma prevalence as well as a possible downward trend was observed in some Western societies with a high prevalence (Australia, Canada, the Channel Islands, the Isle of Man, New Zealand, the Republic of Ireland, the UK and the USA) [4]. The prevalence of current asthma in the aforementioned countries decreased by 0.09 and 0.51% per year over a period averaging 7 years in the 6–7 year olds and 13–14 year olds, respectively [4]. It therefore appears that the rate of asthma increase is stabilizing, and asthma prevalence may actually be decreasing in some Western societies. Comparing trends in Asia is more complicated as there are marked differences in prevalence of asthma and allergies in Asian countries. This can be ascribed to vast cultural differences, environmental exposures, lifestyles and economic diversity. In countries with greater affluence and urbanization, such as Japan, Hong Kong and Singapore, there has been an increase in current asthma prevalence rates,

although the rate of increase has slowed [8–13]. Some less affluent countries, such as Thailand and Indonesia, were also noted to have increases in the prevalence of current asthma (TABLES 2 & 3) [1]. This is in contrast to South Korea and the Philippines, where there were decreases in asthma prevalence of 1.45% in 6–7-year olds in South Korea (TABLE 2) and 0.55% in 13–14-year olds in the Philippines (TABLE 3) [1]. These differences in the Asia–Pacific region lend credence to the hygiene hypothesis (discussed later), as it appears that the affluent and urbanized countries have higher rates of asthma.

Allergic rhinoconjunctivitis & atopic dermatitis prevalence

The prevalence of both allergic rhinoconjunctivitis and atopic dermatitis (AD) in Western countries is higher than that of Asian countries (TABLE 1). In fact, the prevalence of both diseases is still increasing globally as shown in the recent ISAAC survey. It was reported that almost 80 and 70% of all the centers included in the ISAAC study showed an increase in the prevalence of allergic rhinoconjunctivitis by 1 standard error or more both in the 6–7- and 13–14-year-old age groups, respectively. Similarly, there was an 81 and 75% rise in the prevalence of AD in the aforementioned two age groups, respectively [1]. In general, the Asia–Pacific region

Table 2. Prevalence of asthma, allergic rhinoconjunctivitis and atopic dermatitis in the 6–7-year-old age group in the Asia–Pacific region.

Country	Asthma			Allergic rhinoconjunctivitis			Atopic dermatitis		
	Phase 1	Phase 3	Change per year (%)	Phase 1	Phase 3	Change per year (%)	Phase 1	Phase 3	Change per year (%)
Hong Kong	9.1	9.4	0.03	13.7	17.7	0.67	3.9	4.6	0.12
Indonesia	4.1	2.8	-0.21	3.8	3.6	-0.03			
Japan	17.4	18.2	0.10	7.8	10.6	0.35			
Singapore	15.7	10.2	-0.80	8.5	8.7	0.02	2.8	8.9	0.87
South Korea	13.3	5.8	-1.45	9.8	8.7	-0.18	8.8	11.3	0.52
Taiwan	9.6	9.8	0.04	14.6	24.2	1.37	3.5	6.7	0.46
Thailand	8.2	11.9	0.47	7.3	10.4	0.30	11.9	16.7	0.79

Year 1994–1995 (Phase 1) and year 2002–2003 (Phase 3).

showed increases in the prevalence of all three atopic diseases (i.e., asthma, allergic rhinoconjunctivitis and AD) in both age groups [1]. The increase was more marked in the younger age group for both AD and allergic rhinoconjunctivitis.

Food allergy prevalence

Food allergy is another allergic disorder that is fairly common in the West and has been reported to occur with increasing frequency in many parts of Asia. It is estimated to affect approximately 4–5% of Singaporean school children [14] and as many as 12% of children in South Korea and Japan [15,16]. In Hong Kong, the prevalence of parent-reported allergic food reaction (AFR) was 8.1% and doctor-diagnosed AFR was 4.6%, which is comparable to that reported in American children, where it was estimated to affect approximately 5% of children under 3 years of age [17,18]. Food allergy is an increasingly important etiology of severe allergic reactions in this region. However, when compared with the incidence of anaphylactic reactions secondary to food in the USA (65%) [19], as well as documented hospitalizations in the UK [20] and Australia [21], the incidence was lower in Asian countries such as Singapore (44.8%) [22], Hong Kong (49.6%) [23] and Thailand (24.0%) [24]. Furthermore, fatal anaphylaxis is also more common in Western countries such as the UK (22.0%) [25], New Zealand (11.0%) [26] and Australia (6.0%) [27], whereas cases from Asia are rarely reported.

Interestingly, Asia has unique food allergens that are not found in the West. This is because Asians eat certain foods not commonly consumed in the West, resulting in unique food allergies [28]. Several studies from Asia showed that peanuts and tree nuts were not common causes of anaphylaxis as compared with the Western world, and that the patterns of food allergies were also different [29–31]. A good example is the edible bird's nest from swiftlets, which has been reported to be the most common cause of anaphylaxis in Singaporean children [32] and is known to trigger asthma in Hong Kong [33]. Furthermore, buckwheat in Japan, South Korea and China, chickpeas in India, as well as chestnuts in South Korea have been identified as common causes of immediate hypersensitivity reactions [28,34,35]. This has been extensively reviewed by Shek and Lee [30].

What are the possible causes for the difference in epidemiology of asthma & allergy between Asia & the West?

It is intriguing to consider the reasons for the differences in rates of asthma and allergy between Asia and the West. These differences are very likely to be real and not due to a lack of awareness among the public, differences in case definition or differences in methodology and research tools used. In fact, many studies in Asia have used standardized protocols and definitions (e.g., the ISAAC study) and have clearly shown a disparity in rates of allergic disease between Asian and Western populations. What are the possible reasons for these differences?

One obvious difference between most of Asia and the West is the difference in socioeconomic status. Many studies have shown an association between socioeconomic status and prevalence of asthma and allergic disease, with countries that have higher Gross Domestic Products (GDPs) experiencing higher rates of these conditions. For example, countries with the lowest rates of current wheeze in the ISAAC study are also among those with the lowest GDP [36]. How does socioeconomic status translate into differences in allergy? One postulation is the 'hygiene hypothesis', which most readers would be familiar with. This states that as hygiene improved and rates of infection declined through the last century (particularly in developed countries), there has been decreased microbial exposure, leading to a predominantly skewed Th2 response and the resultant tendency to an atopic constitution [37]. This effect of hygiene and subsequent decreased 'microbial pressure' on the immune system has been shown in many studies to be associated with decreased wheezing, rhinitis symptoms and eczema. For example, Sherrieff *et al.* very elegantly showed that high levels of hygiene were associated with increased wheezing and asthma in early life [38]. These effects may be mediated via environmental endotoxin exposure, and various studies have shown that children who grow up in rural farming environments have greater endotoxin exposure and are protected against allergies [39]. For example, studies from farms in Europe show an inverse relationship between environmental endotoxin levels and the prevalence of hayfever, atopic wheeze

Table 3. Prevalence of asthma, allergic rhinoconjunctivitis and atopic dermatitis in the 13–14-year-old age group in the Asia–Pacific region.

Country	Asthma			Allergic rhinoconjunctivitis			Atopic dermatitis		
	Phase 1	Phase 3	Change per year (%)	Phase 1	Phase 3	Change per year (%)	Phase 1	Phase 3	Change per year (%)
Hong Kong	12.4	8.6	-0.55	24.0	22.6	-0.21	2.7	3.3	0.08
Indonesia	2.1	5.2	0.52	5.3	4.8	-0.08	1.2	2.2	0.16
Japan	13.4	13.0	-0.05	14.9	17.6	0.34			
Philippines	12.3	8.4	-0.55	15.3	11.0	-0.61	5.2	7.8	0.37
Singapore	9.8	11.4	0.24	15.1	16.5	0.20	7.4	9.2	0.25
South Korea	7.7	8.7	0.20	10.2	11.6	0.28	3.8	5.7	0.39
Taiwan	5.4	7.0	0.26	11.7	17.8	1.02	1.4	4.1	0.45
Thailand	13.1	11.6	-0.21	15.5	21.0	0.84	8.2	9.6	0.39

Year 1994–1995 (Phase 1) and year 2002–2003 (Phase 3).

and atopic sensitization [40]. Our group has demonstrated higher home endotoxin levels in rural South Thailand compared with urban Singapore, where higher prevalences of asthma, allergic rhinitis and eczema are seen [41].

Apart from external microbial exposure, differences in gut microflora may also play a role. In their seminal paper, Björkstén and coworkers demonstrated that allergic children in Estonia and Sweden harbored less lactobacilli and more coliforms compared with their nonallergic counterparts [42]. This difference is also seen in Asia. In two communities (urban Singapore and rural South Thailand), where there are differences in allergic disease prevalence [2,43], our group has also demonstrated differences in gut microflora composition [44]. Specifically, rural Thai children, among whom there were fewer allergies, had higher counts of lactic acid bacteria, coliforms and staphylococci compared with Singaporean children. These observations have led to many groups implementing intervention studies through the introduction of probiotics to babies from birth. It was hoped that this strategy would be a means of primary prevention of allergy; the holy grail of allergists. There was some initial promise but later studies have not shown the same positive results as earlier studies [45].

Another reason for the difference between Asian and Western societies may be the healthcare practices in these regions. Van Bever *et al.* have provocatively suggested that doctors may be responsible for the increase in allergic disease in the last decade [46]. There is an obvious gap in the availability of medicines between First and Third world countries, with many countries in Asia lacking access to medicines such as antibiotics [47]. Studies have shown a positive correlation between the use of antibiotics and the prevalence of allergic disease. There is credence given to this hypothesis because the association grows stronger with broad-spectrum antibiotics, the number of antibiotic courses received and with early onset of use [48–51]. Antibiotics affect the balance of enteric organisms and, by either increasing the prevalence of pathogenic organisms or by decreasing ‘microbial load’ in the gut, may enhance atopic (Th2) responses. However, studies of antibiotic use and atopic disease are conflicting, with some reports showing no association [52].

Certain other factors have been shown to impact allergic diseases in the West. For example, environmental tobacco smoke (ETS), pollution and a high BMI have all been shown to contribute to asthma prevalence and severity. Japan has a high rate of smoking and in one study, 63.8% of asthmatic children were found to be living in households with one or more smokers [53]. In that same study, the children who were exposed to high levels of ETS had more severe asthma symptoms and needed more asthma medication compared with children experiencing less exposure, confirming the trend in many other studies of ETS worsening asthma. Similar findings were obtained among Taiwanese children, with 54.3% of them exposed to ETS at home, and these children having earlier onset of asthma [54]. Interestingly, a study of all emergency department visits by ambulance over a 1-year period (January to December 2005) in Tokyo did not show air pollution to be a significant risk factor for asthma exacerbation. Instead, cold ambient temperature was a trigger for asthma visits to the emergency department, with the winter months having the highest mean number of ambulance transports for this [55].

Finally, ethnic/genetic factors may be the most important influences on the development of allergic disease in Asia. Of course, the environment still plays a role, as shown by Wong and associates who reported that Chinese subjects born and raised in Hong Kong tended to have more asthma and atopy compared with Chinese individuals born in China who subsequently migrated to Hong Kong [56]. Similarly, families from Hong Kong who migrate to Australia have higher rates of atopy than their Hong Kong counterparts and similar to the rates found in Australia [57]. However, genetic factors have been found to have the strongest association with asthma, hayfever and AD; the relationship is much stronger than that found with environmental influences [58,59]. There have been many candidate gene studies performed in Asian populations to elucidate these genetic influences. The candidate gene studies have focused on genes related to the immune system, such as cytokines, chemokines, adhesion factors and genes of the innate immune system. Regarding genome-wide scans, these have mostly

been performed on Caucasian populations; instead, studies in Asia have focused on specific chromosomal regions. For example, our group has identified loci on chromosome 5q31–33 with significant linkage to doctor-diagnosed asthma and atopic phenotypes (high total IgE or allergic sensitization to aeroallergens) [60]. Genetic studies performed in the region, even among similar ethnic groups, are not always replicable, again highlighting the importance of the interplay between genes and the environment. A full review of this extensive topic is not possible here – readers are directed to a recent comprehensive review on this subject [61].

Management of asthma, allergic rhinitis & AD in Asia

Managing childhood asthma involves a holistic approach – the doctor has to appreciate current treatment practices, be willing to educate and support the child and their family over the long term, and empower the child to manage their own condition so that they can function without limitations. The role of pharmacotherapy is central to asthma management, and drugs such as corticosteroids, β -agonists and leukotriene antagonists have been developed and are widely used.

For the management of acute asthma exacerbations, it is important to note that the administration of nebulized salbutamol or terbutaline every 20 min was the treatment of choice for the majority of doctors in Southeast Asia [62]. Between 27.3 (the Philippines) and 68.3% (Taiwan) of doctors would consider administering systemic corticosteroids in the acute setting. The same study by Wong *et al.* also showed that for maintenance treatment, the percentage of doctors who would use inhaled corticosteroids in school-age children was relatively low, being 24.0% in Indonesia, 35% in the Philippines, 42.6% in India and 81% in China [62]. It has been noted previously that Asian doctors underuse corticosteroids [63], and this may be due to the misconception by Asian parents that the use of steroids results in unwanted side effects. What was of a greater concern was that many doctors in Southeast Asia would use long-acting β -agonists as monotherapy in asthmatic children who need maintenance therapy. The highest rates of this practice were in preschool children in China (58%), Indonesia (43.4%) and India (15.9%). This clearly contravenes guidelines from the Global Initiative for Asthma (GINA), which state that long-acting β -agonists should not be used in children aged 5 years of age or younger. Another interesting point to note is that the leukotriene antagonist montelukast was widely used in Asia, with up to 70% of doctors in China prescribing this medicine in patients with chronic asthma [62]. This medicine is generally safe and well tolerated; however, its high cost prohibits its use in many parts of Asia. Regarding antibiotics, inappropriate use still occurred, with between 32.7 and 80.2% of doctors prescribing them for acute exacerbations. In Western countries, such inappropriate antibiotic use is declining as a result of education of doctors on appropriate antibiotic use [64]. It is clear that much still needs to be done to educate doctors in Asia regarding what is appropriate therapy in the acute and long-term management of asthma.

In Asian countries, there is a clear inverse trend between the use of inhaled corticosteroids and asthma morbidity/mortality. Although countries such as Australia, Japan, Hong Kong and

Singapore have the highest rates of current asthma prevalence in the region, decreases in asthma mortality and hospitalization rates have been reported [8–11]. Furthermore, in a recent study by Chua and associates, it was reported that asthma hospitalizations in both Australia and Singapore have declined [65]. This is because local health authorities have made asthma management a priority and have given due importance to the management of asthma by promoting the regular use of controllers (inhaled corticosteroids) and reducing the dependence on reliever medications [66]. This has resulted in lower rates of mortality and hospitalizations. In a study by Suissa *et al.*, there was a reported 80% reduction in asthma hospitalization rates and a significant decrease in mortality rates with good compliance to inhaled corticosteroids [67]. On the other hand, Thailand has seen increases in admission due to asthma exacerbations and Taiwan has seen an increasing trend in asthma mortality over the last decade. This is despite both countries having relatively lower asthma prevalence in the region [68,69]. Lai and associates found that 15.3% of asthmatics were hospitalized for acute exacerbations over a 12-month period, which was significantly higher than that in Western countries such as Europe and the USA [70]. This was due to the fact that only 13.6% of asthmatics in those countries use inhaled corticosteroids, in contrast to 23% of asthmatics in Europe [70].

For allergic rhinitis, oral antihistamines are effective in reducing symptoms of rhinorrhea, nasal pruritus and sneezing, while congestion is most effectively controlled by intranasal glucocorticosteroids [71,72]. In a study by Valovirta *et al.*, the use of antihistamines and nasal corticosteroids for allergic rhinoconjunctivitis was significantly higher in Europe (France, Germany, Italy and the UK) compared with the Asia-Pacific region (China, Singapore, South Korea and Taiwan) [73]. Instead, traditional herbal remedies were regularly used as treatment in these Asian countries.

Regarding AD, moisturizers have always been the first choice in its management in most parts of the world. Moisturizing the skin has been shown to improve the skin's barrier function and decrease the severity of symptoms in AD. In a recent study looking at the treatment approach to AD in Southeast Asia, moisturizers were recommended by the majority of dermatologists in Malaysia, the Philippines, Singapore and Thailand [74]. The use of topical corticosteroids, antibiotics, immunosuppressants and topical calcineurin inhibitors have also been shown to reduce AD severity. In Asian countries, it has been shown that the majority of physicians used topical corticosteroids as well as systemic antibiotics in mild-to-moderately severe AD. However, respondents from the Philippines and Vietnam only used steroids and antibiotics in severe AD cases [74]. A comparative study showed that physicians from the USA and the UK were significantly more aggressive in prescribing systemic medications such as steroids, antibiotics and immunosuppressants compared with those in Japan [75]. Oral antihistamines have only a limited effect on itching and it is mainly the older sedating antihistamines that have been shown to be effective. The majority of the respondents (60–100%) in the Asian study prescribed both sedating and nonsedating antihistamines, but some physicians from Indonesia (21%), the Philippines (21%) and Vietnam (31%) only prescribed

nonsedating antihistamines [74]. The use of alternative remedies for AD is significantly more common in Japan than in the USA and the UK [75].

Management of allergies in Asia

Anaphylactic reactions are increasing worldwide and the most common implicated cause is food allergy [76]. Anaphylaxis is a medical emergency that requires immediate treatment owing to its potentially fatal outcome. The use of epinephrine is life saving [77]; hence, it is recommended that an epinephrine auto-injector be carried at all times, especially in children with previous severe anaphylactic reactions. In many Asian countries, epinephrine auto-injectors are not prescribed for use in first-aid treatment. This is due to the high cost or lack of availability of such devices [78]. In Singapore where epinephrine auto-injectors are readily available, prescription rates are low, at one per 10,000 population. This is much lower than the rates in Canada, which are 9.5 per 10,000 population [79]. There were also ethnic differences in the prescription of these devices, with non-Asians having higher prescription rates, once again emphasizing the differences in epidemiology of allergies between Asia and the West.

Apart from the availability (or lack) of epinephrine auto-injectors in Asia, families of food-allergic children have to contend with other issues. First, there is the issue of food labeling. Whilst the Food Allergen Labeling and Consumer Protection Act (FALCPA) of the USA requires the eight most common allergens accounting for 90% of allergic reactions to be listed as a warning for adults and older children, similar legislature is not commonplace in most Asian countries. For example, even though current food labeling laws in Singapore mandate that a list of ingredients used in packaged food be stated on the label, they do not require common allergens or trace allergens to be listed separately and comprehensively from other ingredients as a noticeable food warning [103]. Unlike the FALCPA, there is also no legislature in place in most Asian countries to enforce ingredient listing in simple discernible language [80]. Second, unlike countries such as the USA, which have legislation such as the Food Allergy and Anaphylaxis Management Act [104] mandating protocols for coping with allergic reactions, Asian countries have not highlighted the importance of such measures in schools. It is not surprising that immigrant parents typically opt to enroll their children in international schools, which are generally more aware of the issue of food allergy. Finally, there is also the danger of eating out in Asian restaurants, as Asian cooking involves the use of a multitude of foods, nuts and spices to season the food. This may result in a food-allergic individual inadvertently consuming hidden trace amounts of the offending food when eating out. Migrant parents have suggested that Asian eateries are not food-allergy trained and do not have contingencies to provide safe meals, which contrasts with the standards they may have been accustomed to in the West [81].

There are unique differences between countries for managing allergy. For example, in India, sensitivity testing to penicillins and cephalosporins (skin tests, intradermal tests and test doses) are frequently carried out for patients who are prescribed these drugs in

the absence of drug allergy [82]. This practice is not recommended by most allergy societies. Another difference is the use of alternative/complementary therapies in treating allergy. Traditional Chinese Medicines have been around for more than 1000 years and are used in many parts of Asia for the treatment of most allergic disorders, including asthma [83], eczema [84,85], allergic rhinitis [86] and food allergy [87]. In time, this use of complementary and alternative medicines may not be as different between Asia and the West, as more and more Western populations are embracing such therapies [88].

Conclusion

There is presently a significant difference in the prevalence of asthma, allergic rhinoconjunctivitis, AD and other allergies between Asia and the West. The gulf in management practices is just as wide, with doctors in Asia using less inhaled corticosteroids, using more long-acting β -agonists as monotherapy and not having access to epinephrine auto-injectors. In fact, there appears to be the paradox of less allergy in Asia but poorer management strategies for those who suffer from it. This demonstrates that doctors in Asia still need to be educated on the 'best practices for asthma and atopic disorders'. As borders blur with easier travel, migration and access to mass media, these differences are likely to disappear. Until then, they give us clues and help us understand the factors that play a role in the causation and maintenance of allergy in different populations.

Expert commentary

Although new drug products and clinical strategies are clearly needed to improve care for patients with asthma and allergy, what Asia needs is increased education and improvement in socioeconomic conditions. Doctors should be educated on appropriate management strategies and should be up-to-date on the latest evidence-based treatment protocols. Allergy societies in each country need to identify their training needs and use every opportunity to improve their knowledge, attitudes and practices. For example, it is imperative that a written asthma and atopic disease management plan should be developed for all patients. Patients also need to be educated on how to recognize worsening asthma/allergic disorders, how to use medications appropriately, when to seek medical care and how to monitor treatment response. Patients and their families should be encouraged to be proactive in increasing awareness among the public and community regarding asthma- and allergy-related issues. Just as important is the need to improve economic conditions in some Asian countries, as this will have a considerable impact on healthcare. As medicines become affordable for everybody, this will lower the hospitalization and mortality rates associated with such illnesses. This in turn will help in lowering the cost incurred in the management of these patients and improve quality of life.

Five-year view

It is our view that the prevalence of childhood asthma and other atopic disorders in Asia will continue to increase, but at a slower rate. This is in line with the increased urbanization, population growth and adoption of a westernized lifestyle seen in many parts of Asia. We do not think that it will reach the highs seen in some

Western countries as the incidence appears to have plateaued at a lower prevalence in countries such as Singapore and Hong Kong. Of course, the prevalence is still subject to the influence of environmental factors, inappropriate use of antibiotics, genetic background and cultural differences. We also see the economic situation improving in most Asian countries. This should lead to a higher quality of healthcare, which should in turn lead to Asian individuals receiving appropriate care for asthma and atopic disorders.

Financial & competing interests disclosure

Lynette P Shek is supported by the National Healthcare Group, Singapore, Researcher–Investigator–Scientist Enabler (RISE) grant. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

No writing assistance was utilized in the production of this manuscript.

Key issues

- The prevalence of asthma and other atopic disorders, such as allergic rhinoconjunctivitis and atopic dermatitis, are lower in most Asian countries compared with the West.
- The rate of increase in the more urbanized Asian countries appears to be slowing, mimicking the plateau in incidence rates seen in Western nations.
- Possible reasons for the difference of prevalence are infection rates, cultural differences, environmental exposures, lifestyles and economic diversity.
- There are unique differences in some countries in terms of food allergies owing to the consumption of foods unique to the country.
- The management of asthma in Asia lags behind that in the West owing to parental misconception, financial limitations and a lack of up-to-date information for doctors.

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- Bee Wah Lee, MBBS, FRCP (UK), FAAAAI
Yong Loo Lin School of Medicine, Department of Paediatrics, National University of Singapore, 5 Lower Kent Ridge Road, Singapore 119074
Tel.: +65 6772 4420
Fax: +65 6772 7486
paeleebw@nus.edu.sg
 - Hugo P van Bever, MD, PhD
Yong Loo Lin School of Medicine, Department of Paediatrics, National University of Singapore, 5 Lower Kent Ridge Road, Singapore 119074
Tel.: +65 6772 4420
Fax: +65 6772 7486
paevbhps@nus.edu.sg and
Department of Paediatrics, Children's Medical Institute, National University Health System, Singapore 119074
 - Lynette P Shek, MBBS, MRCP, FAAAAI
Yong Loo Lin School of Medicine, Department of Paediatrics, National University of Singapore, 5 Lower Kent Ridge Road, Singapore 119074
Tel.: +65 6772 4420
Fax: +65 6772 7486
paeshekl@nus.edu.sg and
Department of Paediatrics, Children's Medical Institute, National University Health System, Singapore 119074

Affiliations

- Irvin Francis A Gerez, MD
National University Health System, 5 Lower Kent Ridge Road, Level 4 Main Building, Department of Pediatrics, Singapore 119074
Tel.: +65 6772 4420
Fax: +65 6772 7486
paev26@nus.edu.sg

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