Prevalence of Asthma, Rhinitis and Eczema in Children from the Bangkok Area Using the ISAAC (International Study for Asthma and Allergy in Children) Questionnaires

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Abstract

Within the past three decades, there has been a rising trend for prevalences of asthma and allergic diseases worldwide, particularly from developed and industrializing countries. In Thailand, limited studies on epidemiology of atopic diseases have indicated relatively low prevalences of these conditions among the Thais. Recently, a standardized phase I questionnaire of the International Study of Asthma and Allergies in Childhood (ISAAC) has been developed to study and to compare geographical and temporal trend for prevalences of asthma, allergic rhinitis and eczema in children. The objectives of phase I ISAAC study in Thailand are to study prevalence of the three most common allergic diseases i.e. asthma, allergic rhinitis and eczema among Thai children of the two age groups (i.e., 6-7 and 13-14 years) living in the Bangkok metropolitan area and to collect basic epidemiologic data of these diseases among these children. The Thai translated version of phase I ISAAC questionnaires was administered to Thai children of the two age groups as above. Questionnaires were answered by parents of younger children, whereas, they were self-administered by 13-14 years old children. In addition, the validated international video questionnaires were used with older children. Fourteen primary schools and 13 secondary schools were randomly selected to cover the entire Bangkok metropolitan area. A total of 7341 questionnaires were eligible for the analysis (3628 from the younger age group and 3713 from the older age group). Data were entered and analysed by the Epi-Info program. The cumulative and 12 month period prevalences of the three conditions for all children were as follows; wheezing, 18.3 per cent, 12.7 per cent; rhinitis, 44.2 per cent, 38.7 per cent; and eczema, 15.4 per cent, 14.0 per cent, respectively. The period prevalence of wheezing for older children (13.6%) was higher than for younger children (11.7%). Prevalences of severe wheeze and exercise wheeze were more common among older children (4.0% and 15.7%). Both age groups reported high percentages for night cough (23.6% and 28.6%). A significantly large number of children from both groups reported symptoms of rhinitis with the majority indicating that symptoms were severe enough to limit their daily acitivities. Nevertheless, when confined only to those with eye symptoms, the prevalence decreased to 13.1 per cent.

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Eczema, in contrast to the other two conditions, occurred more frequently among younger children than among older children (period prevalence of 16% *vs* 9.1%). The rash was of a relatively mild nature since 77 per cent of children reporting symptoms indicated that the rash had cleared within the past 12 months. Allergic conditions are very common among children residing in Bangkok. Compared to the last survey in 1990, the period prevalence of wheezing has increased 4 fold, allergic rhinitis has increased nearly 3 fold whereas, eczema has remained stable. A large number of children in Bangkok are suffering from rhinitis symptoms. Results of this phase I ISAAC study indicate that allergic diseases are perhaps the most common childhood diseases in Thailand and could lead to a substantial economical loss for the country. There is an urgent need for an in-depth study to define epidemiological factors responsible for this increase.

During the past three decades, reports from around the world, especially from developed countries, have indicated increases in morbidity from asthma and other allergic diseases[1-4]. An increasing trend has also been demonstrated in a study from Taiwan[5] and from Singapore[6]. Generally, prevalences of allergic diseases from Asian countries[7-9] were reported to be lower than those observed in western countries[10]. For instance, the prevalence of childhood asthma in Thailand was observed at 4.2 per cent in 1992[9]. Such differences could be a real phenomenon or could be due to differences in methods used in the surveys. In recent years, there has been a consensus among most Thai physicians that cases of childhood wheezing and asthma have increased steadily, particularly among young children. In order to make a geographical and temporal comparison of prevalences for allergic diseases possible, a standardized international study of allergy and asthma in children (ISAAC) questionnaires[11,12] was designed based on questions drawn from the International Union Against Tuberculosis and Lung Diseases (IUATLD) Questionnaire[13] and surveys conducted in London[14], Melbourne[1], and Auckland[15].

The general aims of ISAAC are: 1. To describe prevalence and severity of asthma, rhinitis and eczema in children from the two age groups (i.e, 6-7, 13-14 years) living in different areas for the purpose of comparisons within and between countries. 2. To obtain baseline measurements for the assessment of future trends in the prevalence and severity of these diseases. 3. To provide a framework for further etiological research into genetic, lifestyle, environmental and medical care factors affecting these diseases. We, herein, report the results of our ISAAC phase I study in 7341 children from the two age groups living in the Bangkok Metropolitan Area.

MATERIAL AND METHOD

ISAAC questionnaires:

The written questionnaire used in the ISAAC phase I study consists of three one-page modules asking questions to determine prevalences of wheezing, rhinitis and eczema and their certain characteristics (demographic data, severity of symptoms, associated symptoms and seasonality)[11]. This ISAAC questionnaire has been validated against bronchial hyperresponsiveness and was found to have as high a sensitivity and specificity as the IUATLD questionnaire[16]. The questionnaires were translated into Thai by a panel of pediatric allergists from several academic centers in Thailand. For the wheeze module, the term 'wheeze' was directly spelled out in Thai since a limited survey among parents of asthmatic Thai children had indicated that the word was readily understood and was preferred for describing symptoms of their children. The word 'hay fever' in rhinitis module was replaced by a Thai phrase of 'allergic to air', a common layman term denotes 'hay fever' in Thailand. Likewise, 'eczema' was replaced with the Thai term 'allergic skin rash' since there has been no previous official Thai term coined for eczema.

Mainly, children were defined as having asthma when there were affirmative responses to a question 'have you ever wheezed or had wheezing in the chest, within the past 12 months?'. Similarly, an affirmative response to a question 'have you ever had a runny nose, sneezing, blocked nose, apart from when you were having a cold or flu ?' defined the presence of allergic rhinitis, whereas, definition of eczema was defined with a positive response to a question 'have you ever had itchy recurrent rashes within the past 12 months ?'.

Questions were answered by parents of younger children, whereas, they were self-administered under supervision for older children. In addition, the international version of the ISAAC video questionnaire was used for older children. The video questionnaires, consisting of five video sequences showing wheezing developing at rest, on exertion, at night, night cough and severe wheeze. Video questionnaire was developed to obviate any confusion that might occur from the translation of the term 'wheezing' into the local languages[17]. In validation studies, this video questionnaire was found to be sensitive and specific for predicting bronchial hyperresponsiveness and was more substantially repeatable than the IUATLD questionnaire[16,17]. Moreover, a high degree of concordance in the prevalence of wheezing determined by ISAAC written and video questionnaires have been demonstrated[18]. In this study, children completed the written questionnaires first and then proceeded on to answer video questionnaires.

Data collection and analysis:

Fourteen primary schools and 13 secondary schools in Bangkok were randomly mapped, stratified and chosen to represent the population of the entire Bangkok Metropolitan area. In addition, equal numbers of governmental and private schools were selected in order to avoid an overrepresentation of any predominant socioeconomic classes. Data were collected from January to May of 1995. Although participation rates for both age groups from these schools were exceptionally high (over 90%), a large number of questionnaires were incompletely answered and were therefore excluded from the analysis. This left a grand total number of 7341 children (3628 for 6-7 years and 3713 for 13-14 years) for the inclusion in the analysis.

Data were entered into spreadsheets of the Epi-info version 5 statistical package[19] and descriptive modules of the program was used to derive statistics described below.

RESULTS

Positive responses to wheezing modules for younger and older age groups as well as for all children surveyed are tabulated in Table 1. In addition, ratios of prevalences among males and females are also shown. Such ratios are more meaningful than male:female case ratios since the total samples did not include equal numbers from each sex. Prevalences of ever-wheeze in the older age group were slightly higher than in the younger age group (19.2% *vs* 17.4%). This was also true for percentage of wheezing in the past 12 months (13.6% *vs* 11.7%) and for attacks within the past 12 months (12.5% *vs* 10.2%). Percentages for severe wheeze and exercise wheeze were much higher among older children (4.0% *vs* 1.8% and 15.7% *vs* 5.3% respectively). Nevertheless, percentages of night awakening and night coughs were similar

Table 1. Per cent of positive responses to questions in wheezing module.

Symptoms	6-7 years (n = 3628)	13-14 years (n = 3713)	All (n = 7341)	Male: Female Per cent Ratio
Wheezing ever	17.4	19.2	18.3	1.13
Asthma ever	9.5	14.2	11.9	1.42
Symptoms in past 12 months				
-wheezing	11.7	13.6	12.7	1.01
-attacks	10.2	12.5	11.4	1.01
-night waking	5.1	4.2	4.6	0.89
-severe wheeze	1.8	4.0	2.9	0.71
-exercise wheeze	5.3	15.7	10.7	1.02
-night cough	23.6	28.6	26.2	0.81

between the two groups. Percentages of night cough were noticeably high in both groups (23.6% and 28.6%). The prevalence for diagnosed asthma (asthma-ever, 9.5% and 14.2%) were much lower than wheezing-ever for both groups (17.4% and 19.2%). As for male:female ratio, there was no predominance for males over females other than responses for question of 'asthma ever' (1.42).

The results of positive responses to video questionnaires in Table 2 confirm the results obtained from written questionnaires, i.e. 14 per cent of children gave affirmative responses to wheezing at rest. Percentages for night wheeze (4.5%) and night cough (24.5%) were almost the same figures as those derived from written questionnaires (4.2% and 28.6%). The video responses to exercise question (22%) was much higher than from the written ones (15.7%). The reason for this discrepancy could be due to a confusion generating from the video sequence showing the two boys developing shortness of breath after running, one of which with wheezing and the other without. The most surprising video response was for severe wheeze in which a large number of children (up to 8.7%) indicated that they had had severe wheeze in the past. Nevertheless, when limited to the past 12 months, this percentage dropped to 4.6 per cent, a much closer figure to that obtained from the written questionnaire (4.0%).

In Table 3, prevalences of rhinitis and other associated symptoms are shown. An exceptionally high number of children from both age groups (37.5% and 50.6%) reported nasal symptoms. Approximately one-third (38.7%) experienced nose symptoms within the past 12 months; whereas, 13.1 per cent reported concomitant eye symptoms. These children indicated that their symptoms were bothersome at some point. Although the term 'hay fever' does not exist in the Thai language, 30.3 per cent indicated that they suffered from 'allergy to the air', a common term denoting hay fever in Thai. Figure 1 illustrates percentages of symptoms suffered among affected children in various months. Pattern of rhinitis symptoms of children in Bangkok were of perennial type with a slight predominance in winter months and in the rainy season.

Positive responses to questions in the eczema module are shown in Table 4. Surprisingly, prevalence of rash possibly representing eczema among Thai children was much higher than what had been previously conjectured that eczema was uncommon in Thailand. For instance, the percentage of younger children reported 'rashes within the past 12 months' was 16 per cent and up to 13 per cent indicated that rashes localized in areas typical for diagnosis of atopic dermatitis. Slightly lower numbers were reported in older children (9.1% and 6.9%, respectively). The majority of children with a rash indicated that the rash had mostly cleared within the past twelve months (11.4% and 7.3%) and was not bothersome to them

Table 2. Per cent of positive responses to video questionnaires for wheezing.

Sequence of video questionnaire	13-14 years (n = 3713)
Description of video sequences:	
1. wheezing at rest	14.1
2. exercise wheeze	22.0
3. night wheeze	4.5
4. night cough	24.5
5. severe wheeze	8.7

Table 3. Per cent of positive responses to questions in rhinitis module.

Symptoms	6-7 years (n = 3628)	13-14 years (n = 3713)	All (n = 7341)	Male: Female Per cent Ratio
Nose ever	37.5	50.6	44.2	1.11
Hay fever, ever	29.6	30.9	30.3	1.18
Symptoms in past 12 months				
-nose	33.7	43.4	38.7	1.12
-eyes	10.4	15.6	13.1	1.04
-activities limited	29.0	39.2	34.3	1.12

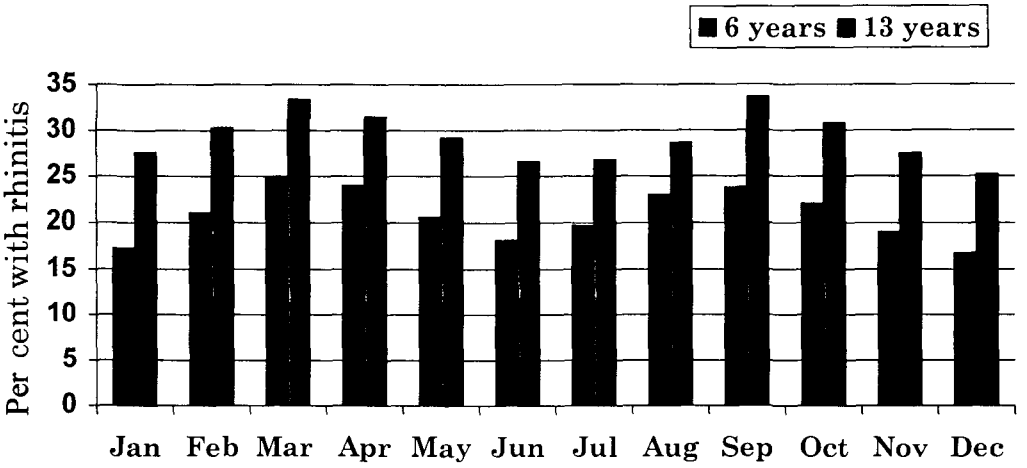

Fig. 1. Percentages of children reporting rhinitis symptoms in each month identified by responses in the rhinitis module. Solid bars indicating 6-7 year old children, hatch bars indicating 13-14 year old children.

Table 4. Per cent of positive responses to questions in eczema module.

Symptoms	6-7 years (n = 3628)	13-14 years (n = 3713)	All (n = 7341)	Male: Female Per cent Ratio
Rash ever	17.5	10.5	15.4	0.83
Eczema, ever	23.0	25.6	24.2	1.00
Flexural area	13.5	6.9	11.4	0.81
Symptoms in past 12 months				
- rash	16.0	9.1	14.0	0.81
- rash clear	11.4	7.3	10.9	0.75
- night waking	6.6	3.2	5.5	0.80

suggesting that degree of eczema was mild among Thai children. Male to female ratio suggested that slightly more females than males were affected with these rashes.

DISCUSSION

There have been relatively few epidemiologic studies on allergic diseases reported in Thailand[20-22]. The current study represents the most up to date and the largest study of its kind ever reported in Thailand. Prevalences of allergic diseases reported from Asian countries including from Thailand[9], China[7] and Singapore[23] have indicated lower prevalences of allergic diseases, particularly of asthma and allergic rhinitis, compared to those reported from western countries with European descendents such as from Australia[1], the United Kingdom[2], New Zealand and from West Germany[18]. The comparison of these data are difficult because of differences in methodologies used in different surveys. The establishment of ISAAC questionnaires[11,15] allows an excellent opportunity for different countries to establish their own basic epidemiological data for allergic diseases that can be compared internationally. The results of this ISAAC study in Thailand indicate that prevalences of asthma, allergic rhinitis and eczema in this country are extremely common among Thai children.

The overall cumulative and 12 month period prevalence of wheezing among Thai children (17.4% and 11.7%) are much higher than

asthma prevalence of 4.29 per cent observed in the 1990 survey of Thai children age 9-10 years from the Bangkok area. These current percentages are, nevertheless, comparable to those reported from Singapore -12 per cent[6], Hong Kong -12.4 per cent[24], Japan-13.4 per cent [25] and Korea-14 per cent[26]. Although the rising trend of wheezing in Bangkok could be a real phenomenon, such increase could result from a difference between sensitivities of questionnaires used in the two surveys. The validity of the ISAAC written questionnaires as well as the video questionnaire have been examined and have been found to be reasonably sensitive and specific using bronchial hyperresponsiveness as a gold standard[17]. Although the Thai version of ISAAC questionnaires needs to be validated, results from the international video questionnaires from this study agreed well with results from the written questionnaires indicating a high reliability of the data. Since sequence #1 from the video questionnaire i.e. wheezing at rest has been previously found to have high sensitivity and specificity when compared with bronchial hyperresponsiveness[16], positive response of 14.1 per cent to this question should be the most reliable figure indicating the current prevalence of asthma in Thai children. Compared to data from western countries, figures of current wheezing (12.7%) from Thailand are much lower than from Sydney, Australia (21%), New Zealand (20%) but are comparable to West Sussex, England (11%), Bochum, Germany (9%)[18] and from a national survey in Great Britain (15%)[27]. These figures are higher than prevalences observed in the U.S.A. (4.3-8.6%)[4,28]. Similar prevalence figures from Singapore[6], Hong Kong[24], Fukuoka-Japan[25] and Korea[26], are interesting and indicate that factors other than genetics and ethnicity govern the rate of occurrence of asthma within this region. In the Singapore study, however, asthma is more prevalent and more severe among the Malays and the Indians than among the Chinese[6]. Data which supports environmental effects on the prevalence of asthma came from a study by Leung et al who demonstrated that Chinese children residing in San Bu of the Guangdong province, in mainland China suffered a much lower prevalence of wheezing (1.1%) than Chinese children of the same ethnic origin residing in Hong Kong island (3.7%) or in Kota Kinabalu, Malaysia (4.9%)[7]. In our study, children with severe wheeze represents only a minor fraction of children who reported wheezing (2.9% of the total survey with a ratio of severe wheeze/total wheeze at 15%). Surprisingly, these ratios are uniform among various surveys, such as those from Melbourne (18%), Switzerland (13%), Chile (15%) and from the United Kingdom (14%) [10,27], indicating that there is a similarity in the distribution of degree of bronchial hyperresponsiveness among wheezing children regardless of their genetic or environmental background. Ratio of children who wheezed with exercise to all wheezing children in this study (62%) is similar to the ratio from Singapore (50%) and is much lower than from Australia and Switzerland (over 100% of children wheezed with exercise) indicating that exercise-induced wheezing is not a prominent feature of childhood asthma in Southeast Asia. In contrast, night cough is a common complaint (up to 26% of children in this survey gave affirmative responses to this question). This is similar to data from La Serena, Chile which has a similar economic and industrial profile as Southeast Asia[10].

Perhaps the most astounding prevalences obtained from this study are figures of rhinitis complaints by children of both age groups (Table 3), particularly among older children in whom half reported symptoms of rhinitis at some point. Moreover, upon further inquiring, up to 77 per cent indicated that their symptoms were severe enough to limit their daily activities. ISAAC surveys using identical protocols from countries in Southeast Asia (Singapore[6]) and East Asia (Hong Kong[24], Korea[26] and Japan[25]) have shown similar prevalences for rhinitis indicating that factors responsible for the increasing epidemic of childhood rhinitis is not only limited to Thailand but is affecting almost the entire newly industrialized nations of Asia. In fact an epidemiologic study from children residing in Tucson[29] has shown a similar rhinitis prevalence (40%) as in this study. Although conceivably not all of rhinitis from this survey represents cases of allergic rhinitis, a similar survey using almost identical questionnaires in Southwest London found that over 60 per cent of such positive responses were atopic (allergic) by skin testing[30]. Thus, a large majority of children with rhinitis symptoms identified in this study could possibly be classified as cases of allergic rhinitis. A symptom of itchy eyes which has been found to have good sensitivity (0.8), good positive predictive value (0.78) but relatively low speci-

ficity (0.4) for detecting atopic (allergic) condition[31], was observed in at least 13 per cent of children in this study. Since not all allergic rhinitis, even of the seasonal type, exhibited eye symptoms, the real prevalence of allergic rhinitis in Thai children perhaps lies between 13-44 per cent, a much higher prevalence figure than has been previously reported of 17.98 per cent[9]. A more definitive method to establish prevalence of allergic rhinitis possibly would be an interview survey and a confirmation with physical examinations and laboratory investigations (such as nasal cytology and allergy skin testings). Such surveys would be too laborious and too expensive to accomplish. Nevertheless, in a limited scale interviewing and skin testing of subjects who reported positive responses to similar questionnaires as in this ISAAC rhinitis module, Sibbald and Rink demonstrated that such a questionnaire was adequately sensitive and specific since the agreement rate between self-reported questionnaires and interview data were as high as 96 per cent[30]. However, such a high rate of concordance could depend on the educational level and socioeconomic background of the populations surveyed. Thus, a validation of ISAAC rhinitis questionnaire in an Asian population especially among the Thais is required. Typically, allergic rhinitis is commonly conceived to be of seasonal type rhinitis *viz.* 'hay fever', especially in a temperate climate, due to prevailing seasonal pollens and mold spores[29]. Nevertheless, a classical epidemiologic study of allergic rhinitis from England has shown that perennial rhinitis was almost twice as common as seasonal rhinitis[30]. The perennial nature of rhinitis symptoms observed among Thai children in this study is not surprising since the majority of children with rhinitis and asthma in Thailand are commonly sensitive to house dust mites which are prevalent all year round in Thailand[32-34].

Results from this report indicate that atopic dermatitis is not an uncommon disease in Thailand. Prevalence of eczema has received little attention from most researchers in the field of allergy compared to asthma and allergic rhinitis. A summary of data reported in Europe between 1990-1991 indicated that cumulative incidences of atopic dermatitis before age 7 has increased during the past decade, with current prevalence rates of atopic dermatitis approximating 10 to 12 per cent with a slight female predominance[35]. These data were confirmed by recent reports from Germany which reported life time prevalence rates of 8.3 per cent to 13.9 per cent[36,37]. Higher numbers were reported from Norway (23.6%) and the United Kingdom (19-21%)[37]. In Asia, especially in Thailand, little is known about epidemiology of atopic dermatitis. Boonyarittipong reported in 1990 that the prevalence of eczema was 14.78 per cent[9], a relatively high prevalence rate compared to feelings from most local allergists. However, this is confirmed by the 15.4 per cent cumulative prevalence found in our study. Since validity of this questionnaire on eczema has not been performed, we focused on the response to the question which limits the distribution of rash on flexural areas only. The response to this question was still fairly high at 11.4 per cent. Younger children reported a higher prevalence of eczema than older ones (16% *vs* 9.1% for rash at flexural sites). Although most children reported a recurrence of the rash within the past 12 months, these rashes also cleared during the same period indicating a relatively mild nature of atopic dermatitis in Thailand. The cumulative prevalence rate of atopic dermatitis from Singapore of 12 per cent[6] is quite similar to the result from this report. Much higher prevalences were reported from Korea (20%)[26] and Japan (19%)[25] indicating that there may be a racial predilection for this disease.

The underlying factor for the recent worldwide increase in prevalences of asthma and other allergic diseases is not clear. Although it is well accepted that atopy is the most influential factor governing the occurrence of asthma and allergy[38], a study by Peat et al from New South Wales, Australia, in which almost a 4 fold increase in prevalence of asthma and two fold increase in bronchial hyperresponsiveness over a 10 year period was observed, the investigators failed to demonstrate an increase in the rate of atopy as measured by rate of positive skin prick testing during the same study period[3]. Amount of allergens such as number of house dust mites, however, had increased indicating that environmental factor(s) may play a more important role than changes in genetic background for the increase of prevalence of asthma. The impact of early development of rhinitis on prevalences of atopic diseases has been a more controversial issue. Studies by Strachan et al who examined the effect of numbers of siblings in the family indicated that development of atopic

diseases later in life is inversely correlated with the size of the family[39]. This was confirmed by a similar study from Germany[40]. Extrapolation from these studies has been that with a larger family size, infections during younger age are more frequent and it is perhaps because of these early infections in life that the T helper cells development was skewed towards Th1 rather than Th2 development thus reducing propensity for allergy development[41,42]. Nevertheless, a study from the US gave a contradictory result, since children who experienced rhinitis early in life were shown to be diagnosed as asthmatics more oftenly, with more wheezing symptoms and required more medication than those who did not have rhinitis in the early age[29]. The underlying factors for such an epidemic increase in prevalence of rhinitis in Southeast Asia is unknown. Although, rapid industrialization in this part of the world is associated with increasing air pollution, evidence from Europe, especially from Germany[43] and from Sweden, Poland and Estonia[44] do not support the contention that air pollutants are associated with increasing prevalences of atopic diseases. Nevertheless, air pollutants, particularly particulate matters, have been shown to be associated with increasing asthmatic attacks[45] and thus could lead to higher affirmative responses to questions regarding recent wheeze in most surveys. Moreover, particulates pollutants such as from diesel exhaust particulates have been found to be an adjuvant for IgE production both in animal[46] and in human[47] studies. Effects of air pollution, therefore, should not be entirely excluded as a cause of increase in allergic diseases in Southeast Asia.

In conclusion, prevalences of asthma, allergic rhinitis among children living in Bangkok are much higher than what was found in the previous survey, whereas, the prevalence of eczema remains stable. These prevalences are similar to ISAAC results conducted in countries from Southeast and East Asia indicating that there are strong effects from common environmental factors exerted upon the population within this region of the world. There is an urgent need for concerted efforts in conducting further epidemiologic studies to identify the risk factors to improve healthcare for these patients.

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การศึกษาความชุกของโรคหอบหืดและโรคภูมิแพ้อื่นๆ ในเด็กไทยที่อาศัยอยู่ในกรุงเทพมหานคร โดยใช้แบบสอบถาม ISAAC (International Study of Asthma and Allergy in children)

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คณะผู้วิจัยได้ทำการศึกษาความชุกของโรคหอบหืด โรคภูมิแพ้ทางจมูกและโรคภูมิแพ้ทางผิวหนังในกลุ่มเด็กนักเรียนไทยอายุ 6-7 ปี และ 13-14 ปี ที่กำลังศึกษาอยู่ในโรงเรียนในเขตกรุงเทพมหานคร โดยการใช้แบบสอบถามซึ่งแปลจากแบบสอบถาม ISAAC ระยะที่ 1 ในการศึกษาดังกล่าวผู้ปกครองของเด็กเล็กเป็นผู้ตอบแบบสอบถามให้เด็กและเด็กอายุ 13-14 ปีเป็นผู้ตอบแบบสอบถามด้วยตนเอง โดยที่ในกลุ่มเด็กโตนั้นผู้ศึกษาได้ใช้แบบสอบถามทั้งชนิดแบบเขียนและแบบวีดีโอประกอบไปด้วยกัน โรงเรียนที่ทำการสำรวจประกอบด้วย 14 โรงเรียนสำหรับเด็กเล็ก และ 13 โรงเรียนสำหรับเด็กโต จำนวนแบบสอบถามที่ใช้วิเคราะห์ได้มีจำนวนทั้งสิ้น 7341 แบบสอบถาม เป็นแบบสอบถามจากเด็กเล็กจำนวน 3628 คนและจากเด็กโตจำนวน 3713 คน

ผลการศึกษาพบค่าความชุกแบบ cumulative และ period prevalence ของโรคหอบหืดเป็นร้อยละ 18.3 และร้อยละ 12.7, ของโรคภูมิแพ้ทางจมูกเป็นร้อยละ 44.2 และร้อยละ 38.7 และของโรคผื่นภูมิแพ้ทางผิวหนังเป็นร้อยละ 15.4 และร้อยละ 14 ค่า period prevalence ของโรคหอบหืดในเด็กโต (ร้อยละ 13.6) มีค่าสูงกว่าในเด็กเล็ก (ร้อยละ 11.7) อัตราความชุกของอาการหืดรุนแรงและอาการหืดในระหว่างการออกกำลังกายในเด็กโตมีค่าสูงกว่าในเด็กเล็ก (ร้อยละ 4.0 และร้อยละ 15.7 ในเด็กโต และร้อยละ 1.8 และ 5.3 ในเด็กเล็ก) อาการไอกลางคืนพบได้บ่อยในเด็กทั้ง 2 กลุ่มอายุ พบอาการทางจมูกเป็นจำนวนมากในเด็กทั้ง 2 กลุ่มอายุ และอาการดังกล่าวมีความรุนแรงพอสมควร อย่างไรก็ดีเมื่อจำกัดกลุ่มที่มีอาการของโรคภูมิแพ้ทางจมูกอยู่กับเด็กที่มีอาการทางตาด้วยแล้วพบว่าอัตราความชุกดังกล่าวลดลงเป็นร้อยละ 13.1 อัตราความชุกของโรคผื่นภูมิแพ้ทางผิวหนังพบได้บ่อยในเด็กเล็ก (ร้อยละ 16) มากกว่าในเด็กโต (ร้อยละ 9.1) และผื่นดังกล่าวมีอาการไม่รุนแรงนัก

สรุปได้ว่า โรคภูมิแพ้พบได้บ่อยมากในเด็กที่อาศัยอยู่ในเขตกรุงเทพมหานคร เมื่อเปรียบเทียบกับการศึกษาเมื่อ 7 ปีที่แล้ว พบว่าอัตราความชุกของโรคหอบหืดเพิ่มขึ้นเป็น 4 เท่าตัว โรคภูมิแพ้ทางจมูกเพิ่มขึ้นเกือบ 3 เท่าตัว และโรคผื่นภูมิแพ้ทางผิวหนังมีอัตราที่คงที่ ผลการศึกษาดังกล่าวบ่งชี้ให้เห็นว่าโรคภูมิแพ้เป็นโรคที่พบได้บ่อยที่สุดโรคหนึ่งในเด็กไทย

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