

Asthma and other allergic diseases in 13–14-year-old schoolchildren in Urmia: an ISAAC study

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الربو وسائر الأمراض الأَرَجِيَّة لدى التلاميذ في عمر 13 - 14 عاماً في مدينة أورمية

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الخلاصة: قام الباحثون بتحديد معدل انتشار الربو، والتهاب الأنف، والإكزيمة التأتبية، وعوامل اختطارها، لدى 3000 تلميذ، أعمارهم 13 - 14 عاماً في مدينة أورمية الإيرانية، مُستخدِمين الاستبيان الكتابي والفيديوي الخاص بالدراسة الدولية للربو والأَرَجِيَّات في مرحلة الطفولة (ISAAC). وقد دلَّ الاستبيان الكتابي على أن معدل انتشار الأعراض الحالية (خلال الإثني عشر شهراً السابقة) كان على النحو التالي: الأزيز بنسبة 14.5٪، والتهاب الأنف بنسبة 23.6٪، والإكزيمة بنسبة 10.1٪. ولم تزد نسبة الربو المبلغ ذاتياً على 2.1٪. أما الاستبيان الفيديوي فقد بيَّن أن معدل انتشار الأزيز كان أخفَّض؛ فقد بلغت نسبته في حالة الراحة 7.4٪، و4.6٪ خلال الاثني عشر شهراً السابقة. وكان انتشار جميع البنود المفحوصة أعلى بدرجة يُعتدُّ بها إحصائياً لدى الذكور، باستثناء الإكزيمة.

ABSTRACT We determined the prevalence and risk factors of asthma, allergic rhinitis and atopic eczema in 3000 13–14-year-old schoolchildren in Urmia, Islamic Republic of Iran. We used the International Study of Asthma and Allergies in Childhood (ISAAC) written and video questionnaires. With the written questionnaire, the prevalence of current symptoms (within the past 12 months) was: wheeze 14.5%, allergic rhinitis 23.6% and eczema 10.1%. Self-reported asthma ever was only 2.1%. With the video questionnaire, the prevalence of wheeze was lower; 7.4% for wheeze at rest ever and 4.6% during the past 12 months. Boys had a significantly higher prevalence for most items examined except for eczema.

Étude ISAAC : asthme et allergies chez des écoliers de 13-14 ans résidant à Urmia

RÉSUMÉ Nous avons déterminé la prévalence et les facteurs de risque de l'asthme, de la rhinite allergique et de l'eczéma atopique (ou constitutionnel) chez un échantillon de 3000 écoliers âgés de 13 à 14 ans résidant à Urmia (République islamique d'Iran). Pour ce faire, nous avons eu recours aux questionnaires écrits et vidéo de l'étude ISAAC (pour *International Study of Asthma and Allergies in Childhood*, Étude internationale de l'asthme et des allergies chez l'enfant). Le questionnaire écrit a fait apparaître la prévalence suivante des symptômes actifs (c.-à.-d. s'étant manifestés au cours des 12 derniers mois) : respiration sifflante : 14,5 %, rhinite allergique : 23,6 % et eczéma 10,1 %. Les cas d'asthme autorapportés ne dépassaient pas 2,1 %. Le questionnaire vidéo a permis d'établir une prévalence inférieure pour la respiration sifflante, à savoir un maximum de 7,4 % au repos et 4,6 % au cours des 12 derniers mois. Pour la plupart des items, exception faite de l'eczéma, la prévalence s'est avérée significativement supérieure chez les individus de sexe masculin.

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Introduction

About 300 million people around the globe suffer from asthma, and 255 000 people died of asthma in 2005 [1]. The surveillance of asthma as part of a global World Health Organization (WHO) programme is essential [2].

The prevalence of asthma and other allergic diseases varies among nations and countries. This is partly due to a true differences in the prevalence of the disease and partly due to differences in definition or the study methodology. The etiology of asthma and allergic diseases remains poorly understood, despite considerable research. The International Study of Asthma and Allergies in Childhood (ISAAC) was founded to maximize the value of epidemiological research into asthma and allergic disease by establishing a standardized methodology and facilitating international collaboration. The ISAAC project has 3 phases. Phase I uses core questionnaires to evaluate the prevalence and severity of asthma and allergic disease in different populations. Phase II investigates possible etiological factors. Phase III investigates whether asthma prevalence is increasing [3].

WHO collaborates in ISAAC and, more particularly, in the implementation of the study in developing countries with areas of severe air pollution. A preliminary objective is to obtain information on the association between childhood asthma and air pollution. The first results of ISAAC have shown the prevalence of asthma symptoms varies from 1.6% to 36.8% [1,3].

The aim of our study was to investigate the prevalence, severity and related factors of asthma, rhinitis and atopic eczema in 13–14-year-old schoolchildren in Urmia the capital of western Azerbaijan, Islamic Republic of Iran using the ISAAC protocol, and to compare our results with other studies using the same protocol.

Methods

Study population

The population of interest in ISAAC is 2 age groups of schoolchildren: 13–14 years and 6–7 years. The older age group has been chosen to reflect the period when mortality from asthma is commoner, and to enable the use of both a self-completed questionnaire and a video questionnaire [3]. In this cross-sectional study we decided to focus on 13–14-year-old schoolchildren. They were selected from 25 schools among 81 secondary schools by random cluster sampling. In line with the ISAAC committee recommendations, we aimed to recruit 3000 schoolchildren. With a sample size of 3000, the power to detect a statistically significant difference in the 1-year prevalence of wheezing and severe asthma between 2 centres would be 99% and 90% respectively, at the 1% level of significance [3].

The study was approved by the Research Committee of Urmia University of Medical Sciences. Letters with explanation of the purpose of the study were sent to the parents of the study group.

Students completed the questionnaires during class hours under the supervision of their teachers and members of Urmia University of Medical Sciences Students' Research Committee. No students declined to participate. Children who were selected but were absent on the school visiting day completed the questionnaire on another day.

Questionnaires

We used the translated Persian versions of the ISAAC questionnaires. They had already been translated according to ISAAC recommendations and used in the Iranian branch of the ISAAC study in Tehran and Rasht and published by ISAAC Steering Committee report [4,5].

Both the written questionnaire and the international version (AVQ3.0) of the ISAAC video questionnaire on asthma symptoms were used. Epidemiological studies rely largely on reported symptoms such as dyspnoea, wheezing, chest tightness, and cough. Although symptoms are sensitive for the presence of asthma, they are relatively non-specific. Furthermore, they may be influenced by perception, recollection, culture, and the interviewer. To counter the problem, ISAAC uses both written and video questionnaires to determine the prevalence and severity of asthma symptoms. Showing, rather than describing, symptoms and signs of asthma may provide more accurate recognition of asthma without the potential biases of written questionnaires

The ISAAC written questionnaire includes questions on past and current wheezing episodes, wheezing frequency, sleep disturbance, speech limitation during attacks, exercise-induced wheezing and persistent cough unrelated to respiratory infections. Other questions are concerned with the presence and severity of rhinitis and atopic eczema. The video questionnaire explores asthma symptoms and severity.

Definitions of terms

The terms used throughout the paper are shown below and relate to an affirmative response to the questions indicated.

- *Wheeze ever*: Have you ever had wheezing or whistling in the chest at any time in the past?
- *Current wheezing*: In the past 12 months, have you had wheezing or whistling in the chest?
- *Severe wheeze in the past year*: In the past 12 months, has wheezing ever been severe enough to limit your speech to only 1 or 2 words at a time between breaths?

- *Asthma ever*: Have you ever had asthma?
- *Exercise-induced wheeze in the past year*: In the past 12 months, has your chest sounded wheezy during or after exercise?
- *Nocturnal cough in the past year*: In the past 12 months, have you had a dry cough at night, apart from a cough associated with a cold or a chest infection?
- *Allergic rhinitis ever*: Have you ever had a problem with sneezing, or a runny, or a blocked nose when you *did not* have a cold or the flu?
- *Current allergic rhinitis*: In the past 12 months, have you had a problem with sneezing, or a runny, or a blocked nose when you *did not* have a cold or the flu?
- *Current rhinoconjunctivitis*: In the past 12 months, has this nose problem been accompanied by itchy/watery eyes?
- *Hay fever ever*: Have you ever had hay fever?
- *Itchy rash ever*: Have you ever had an itchy rash which came and went for at least 6 months?
- *Current itchy rash*: Have you had this itchy rash at any time in the past 12 months?
- *Itchy flexural rash in the last year*: Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?
- *Eczema ever (skin allergy ever)*: Have you ever had eczema (skin allergy)?

Statistical analysis

The data were entered into the computer according to ISAAC Committee instruc-

tions. The data were analysed using *SPSS*, version 11. We calculated the prevalence for each of the symptoms. We made a comparison between males and females using the chi-squared test and P -value < 0.05 was considered significant. We also assessed the correlation between current wheezing and wheezing ever and some associated factors.

Results

In all, 3053 students were given the questionnaires, 53 of which were unfilled or too incomplete; thus the results of 3000 (1500 boys and 1500 girls) questionnaires were analysed. Missing data for key questions, e.g. presence of symptoms ever of any of the conditions ranged from 0.1% to 0.3%. As recommended by the ISAAC Committee these missing data were included in denominators when calculating prevalence.

Written questionnaire

Table 1 shows the prevalence ever and currently of asthma, rhinitis and atopic eczema overall and by sex in our sample. In general, more children had respiratory and allergic rhinitis symptoms than had medically diagnosed illness. Rhinitis ever (31.6%) was the most commonly reported symptom. Apart from eczema ever, boys were significantly more likely than girls to report all the other conditions included in the questionnaire. There were no significant sex differences for eczema or chronic rash.

Figure 1 shows the overlap of asthma, eczema and allergic rhinitis. While 19.5% of the 13–14-year-olds reported having at least 1 of these conditions in the past 12 months, only 3.5% reported having all 3.

Table 1 Responses to the key questions of the written questionnaire in 13–14-year-old schoolchildren

Question	Boys (%) (n = 1500)	Girls (%) (n = 1500)	Total (%) (n = 3000)	P-value
Wheeze ever	32.9	14.5	23.7	< 0.001
Current wheeze	20.7	8.2	14.5	< 0.001
Severe wheeze in the past year	6.8	2.8	4.8	< 0.001
Asthma ever	2.86	1.26	2.06	0.002
Exercise-induced wheeze in the past year	33.3	16.4	24.5	< 0.001
Nocturnal cough in the past year	25.5	16.9	21.6	< 0.001
Allergic rhinitis ever	38.4	24.8	31.6	< 0.001
Current rhinitis	28.6	18.7	23.6	< 0.001
Current rhinoconjunctivitis	15.5	13.9	14.7	0.01
Hay fever ever	11.4	8.1	9.6	0.007
Itchy rash ever	18.6	10.3	14.4	< 0.001
Current itchy rash	13.4	6.9	10.1	< 0.001
Itchy flexural rash in the past year	7.9	6	7.0	0.002
Eczema ever (skin allergy ever)	24.0	24.6	24.0	0.384

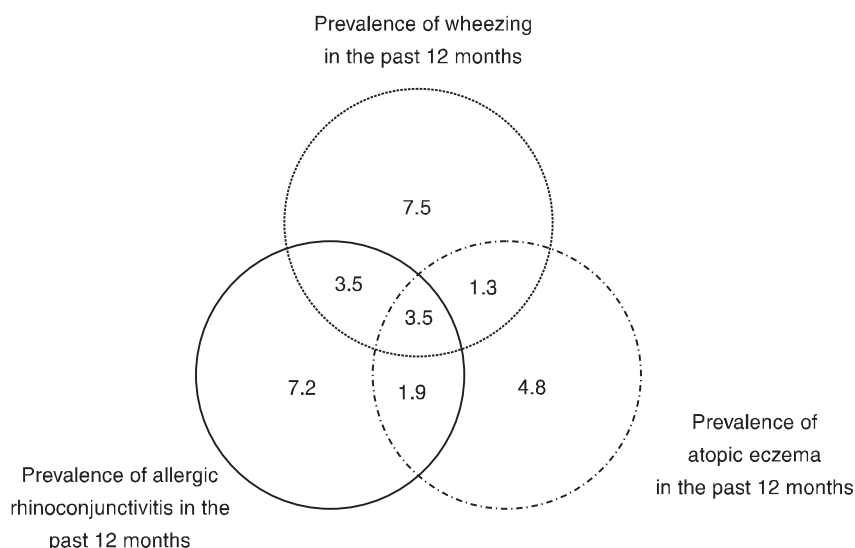


Figure 1 Prevalence (%) of asthma, allergic rhinitis and eczema symptoms in the past 12 months alone or together

Video questionnaire

The responses to the video questionnaire are shown in Table 2. Similar to the written questionnaire, boys had a significantly higher prevalence for most items, particularly exercise-induced wheeze. There were no significant differences between the sexes with regard to wheeze at rest ever, nocturnal wheeze in the past year, nocturnal wheeze ≥ 1 times per month, and nocturnal cough ≥ 1 times per month.

Table 3 shows the association between various risk factors and wheezing ever and current wheezing. There were significant associations between current wheeze and male sex, rhinitis ever, eczema ever, acetaminophen at least once a month, cat in the home and living on a busy road. As regards wheezing ever, there were significant associations with male sex, rhinitis ever, eczema ever, acetaminophen at least once a month,

cat in the home, paternal smoking, maternal education of high school or university level, and living on a busy road.

Discussion

The use of the standard ISAAC protocol permits comparison of our results in Urmia with other cities and countries.

The summary results of phase I of the ISAAC survey in 56 countries has been published [4,5]. There were between 20-fold and 60-fold differences among countries in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis and atopic eczema with between 4-fold and 12-fold variations between the 10th and 90th percentile for the different disorders. The self-reported 12-month prevalence of wheezing in children aged 13–14 years ranged from 2.1% in

Table 2 Responses to the key questions of the video questionnaire in 13–14-year-old schoolchildren

Question	Boys (%) (n = 1500)	Girls (%) (n = 1500)	Total (%) (n = 3000)	P-value
Combined wheeze ^a ever	28.6	11.9	20.2	< 0.001
Combined wheeze ^a in the past year	16.3	8.7	12.5	< 0.001
Wheeze at rest ever	9.7	5.2	7.4	0.362
Wheeze at rest in the past year	5.7	3.5	4.6	< 0.001
Wheeze at rest \geq 1 times per month	5.0	2.1	3.6	< 0.001
Wheeze during exercise ever	27.7	8.3	16.1	< 0.001
Wheeze during exercise in the past year	12.6	6.3	9.3	< 0.001
Wheeze during exercise \geq 1 times per month	14.6	3.7	9.3	< 0.001
Nocturnal wheeze ever	3.0	1.73	2.4	0.002
Nocturnal wheeze in the past year	1.4	1.0	1.2	0.103
Nocturnal wheeze \geq 1 times per month	1.2	0.5	0.9	0.123
Nocturnal cough ever	18.7	8.1	11.9	< 0.001
Nocturnal cough in the past year	10.9	4.6	7.7	0.002
Nocturnal cough \geq 1 times per month	5.6	2.8	4.2	0.098
Severe asthma attack ever	9.1	3.6	5.6	< 0.001
Severe asthma attack in the past year	4.7	1.7	3.2	< 0.027
Severe asthma attack \geq 1 times per month	2.4	0.9	1.7	< 0.012

^aA positive response to any of the wheezing sequences in the video questionnaire.

Indonesia to 32.2% in the United Kingdom (UK). The prevalence was highest (> 20%) in English-speaking countries (UK, New Zealand, Australia and North America and some Latin American countries (Peru and Costa Rica). Taken together, the data suggest that there are more cases of asthma in more affluent countries [4,5]. In the ISAAC study, the Islamic Republic of Iran (Rasht and Tehran) was ranked 28th for a 12-month prevalence of wheezing (12.4% Tehran, 9.7% Rasht) [4,5]. In our study, the prevalence of current wheeze among 13–14-year-old children was 14.5% which is lower than the UK (32.2%), New Zealand

(30.2%) and Australia (29.4%) but higher than China (4.2%), Greece (3.7%) and Indonesia (2.1%) [5].

In a study using ISAAC protocol in Diyarbakir in Turkey, a city near Urmia, the prevalence rates of wheezing, rhinitis and chronic rash in the previous 12 months were 14.7%, 39.9% and 11.8% respectively. Our findings for these conditions were 14.5%, 31.6% and 10.1% respectively [6]. In Urmia, like Diyarbakir, rhinitis was commoner than wheezing and rash but our prevalence was slightly lower than Diyarbakir. For wheezing our results are similar to Diyarbakir and Kuwait (16.1%) [7]. In

Table 3 Correlation between current wheezing and wheezing ever with some risk factors

Risk factor for wheezing	Current wheezing		Wheezing ever	
	P-value	OR (95% CI)	P-value	OR (95% CI)
Male sex	< 0.001	2.99 (2.34–3.65)	< 0.001	2.90 (2.42–3.47)
Rhinitis ever	< 0.001	3.56 (2.89–4.37)	< 0.001	3.32 (2.79–3.95)
Eczema ever	< 0.001	2.96 (2.33–3.76)	< 0.001	2.79 (2.25–3.45)
Acetaminophen at least once a month	< 0.001	2.11 (1.71–2.61)	< 0.001	2.23 (1.87–2.66)
Cat in the home	< 0.001	1.88 (1.47–2.39)	< 0.001	1.63 (1.32–2.01)
Paternal smoking	0.104	–	< 0.001	1.38 (1.16–1.64)
Mother education, high school or university	0.206	–	0.005	0.75 (0.617–0.934)
Living on busy road	< 0.001	1.65 (1.33–2.037)	0.001	1.33 (1.12–1.59)

OR = odds ratio; CI = confidence interval.

another neighbouring country, Iraq, wheezing in the past 12 months was reported by 15.7% of the 12–13-year-olds [8]

There are few reports regarding asthma status in Iranian children. In studies carried out as part of the ISAAC protocol in Tehran in 1994 and 2002, the prevalences of current wheezing were reported as 12.4% [5] and 10.6% [9] respectively. We found a slightly higher rate among schoolchildren in Urmia. In Isfahan the prevalence of wheezing and dyspnoea among primary-school children was 3.9% [10], which is lower than our finding. The difference is most likely related to study method and study sample.

Asthma prevalence in developing countries, characteristically low for a long time, seems to be increasing following the urbanization and industrialization process [11]. Possible explanations for this are: the sudden exposure to pollution from industrial and motor vehicle exhaust emissions as a result of urbanization; a change in diet resulting in a loss of protection against allergic diseases caused by *Lactobacillus*; and a decrease in *Ascaris lumbricoides* infections which is considered by some to have

a role in protection against the development of asthma. The effects of all these factors and of many others may be more important in younger children [12].

Underdiagnosis of asthma

The number of children who were aware that they had been diagnosed with asthma was considerably lower than the number actually reporting wheezing. This might be partly explained by the wheezing resulting from causes other than asthma, but the most likely explanation is an underdiagnosis of the condition or a failure to apply the diagnosis of asthma. This deficiency stems from a lack of recognition of atypical or less common presentations of the condition, such as cough and symptom suggestive of bronchial hyperactivity, and also from a reluctance to label a child as suffering from asthma.

Underdiagnosed asthma is common. In a recent study in North Carolina using the ISAAC protocol, it was found that many children with underdiagnosed asthma miss school and require emergency department visits, although those with a current diagnosis of asthma report more use of resources

[2,13]. In the ISAAC Steering Committee study, the reporting of ever wheezing was much higher than the reporting of asthma ever in some countries [5]. For example, the prevalence of ever wheezing and asthma ever were respectively 6.2% and 2.5% in Ethiopia, 10.9% and 2.7% in the Islamic Republic of Iran, 22.7% and 14.9% in Brazil, 28.1% and 16.5% in Canada, and 13.8% and 5.7% in Germany. In other countries, however, there was much less wheezing ever than asthma ever (4.2% and 6.1% in China, 10.7% and 18.4% in Nigeria, 13.4% and 18.9% in Japan and 9.7% and 20.9% in Singapore respectively).

In the Eastern Mediterranean region, total wheezing ever and ever had asthma were 10.7%. In the Islamic Republic of Iran, Lebanon, Malta, and Pakistan wheezing ever was more prevalent than asthma ever. But in some countries the prevalence of asthma ever was higher than ever wheezing. For example, the prevalence of ever wheezing and asthma ever were respectively 17.0% and 17.5% in Kuwait, 16.0% and 11.1% in Morocco, and 8.9%, and 20.7% in Oman [5]. Although the authors did not give any explanation for this paradoxical finding, in our opinion there are 2 possibilities: misunderstanding of questions by the students in their study or resolution of childhood asthma as children grow older.

In the Table 4 the prevalence of wheezing in the previous 12 months and of ever asthma in some centres that used the ISAAC protocol are shown for comparison. As can be seen, underdiagnosis of asthma in Urmia is higher than other places, which suggests a need to increase the awareness of both physicians and people regarding wheezing and asthma.

Sex differences

In general, boys had a higher prevalence of medical diagnosis and symptoms than

girls with the exception of eczema and eczema-related symptoms. This is similar to many other studies but is different from the findings in most developed countries [14,15]. Asthma is more frequent in young males than young females. However, after puberty, asthma becomes more prevalent in females. By adulthood, the sex ratio (female:male) of the incidence of asthma admission is 3 in the United States of America [14]. In an ISAAC study in the north-east of England, there was a female predominance in 13–14-year-old schoolchildren [14].

In the ISAAC Steering Committee study there was a mixed picture in 13–14-year-olds, with considerable variation between countries [5]. On average, however, females had a slightly higher prevalence than males. It is possible that the emergence of a female predominance of asthma in older adolescents and adults may depend on physical maturation, which is likely to occur at different ages in the range of countries studied. This pattern of sex differences has been reported in other studies in developed countries, including one large study which used ISAAC questionnaires systematically across the age range 5–17 years. In Tehran, asthma was more prevalent in girls [9]. Golshan et al. also reported a higher prevalence of asthma in girls than boys in Zarinshahr [16] and they attributed it to the fact that girls were indoors more and involved in baking, cooking and carpet weaving. The difference with our results may be explained by the fact that Urmia is a large city and cooking with biomass fuels and carpet weaving are not common among girls.

Lower prevalence in the video questionnaire

The questionnaires used in this study were specifically developed for international comparison and both written and video questionnaires have been tested and validated.

Table 4 Prevalence of asthma ever, current wheezing and their ratio in the present study and some ISAAC studies

Study	Asthma ever (%)	Current wheezing (%)	Asthma ever: current wheezing
Present study in Urmia	2.1	14.5	14:100
United Kingdom [25]	11.5	20.0	55:100
Palestine [26]	6.7	10.0	67:100
Tehran in 2001–2002 [9]	2.1	10.6	20:100
Tehran in 1994 [5]	2.6	12.4	21:100
Rasht in 1994 [5]	2.7	9.7	28:100
Ireland [27]	20.9	33.0	64:100
Kuwait [7]	16.1	16.8	95:100
Finland [15]	8.0	15.0	53:100

ed against bronchial hyper-responsiveness in both English-speaking and Chinese-speaking communities [17]. In the present study, the prevalence of asthma obtained using the video questionnaire was lower than that obtained with the written questionnaire, independent of sex. This finding is similar to most other ISAAC studies. Crane et al. reported a higher prevalence in the written questionnaire in 90 centres but the opposite in 9 centres [18]. In contrast to our finding, Behbahani et al. reported a higher prevalence in the video questionnaire in our neighbouring country Kuwait [7]. In our study the prevalence remained higher in the written questionnaire even when a combination of 3 video sequences on wheezing was used.

Risk factors for asthma

There was no positive association between maternal smoking and the prevalence of wheezing in our study; the low frequency of maternal smoking among the participants was probably the reason for this finding.

Rhinitis and eczema ever were strongly associated with current and ever wheezing. Various studies have reported that at-

opic dermatitis and rhinitis are commoner in asthmatics. The risk for asthma attributable to atopy has been estimated at 30% [12].

Children who stated that their home was situated on a road with heavy traffic were more likely to report wheezing than their colleagues who lived in quiet areas. Similar finding have been reported in other studies [19,20]. The lack of catalytic converters and the presence of old and dilapidated cars with high exhaust emissions in our country are likely to play a role in this finding. Experimental evidence obtained in studies on human volunteers, animals and *in vitro* test systems suggests that diesel exhaust particles can enhance immunological responses to allergens and also elicit inflammatory reactions in the airways at relatively low concentrations and short exposure durations [21].

More frequent acetaminophen (paracetamol) use was strongly correlated with wheezing. In an ecological analysis Newson et al. showed that paracetamol sales were high in English-speaking countries and were positively associated with asthma symptoms, eczema and allergic rhinoconjunctivitis in 13–14-year-olds, and with

wheeze, diagnosed asthma, rhinitis and bronchial responsiveness in adults [22].

Nasal problems in the absence of an infection were an even commoner problem than wheezing in our students. Again in this age group the boys suffered more than the girls. The ISAAC Steering Committee study showed a 30-fold variation in the rate of allergic rhinoconjunctivitis symptoms between centres (range 1.4% to 39.7%) [4]. Our results are similar to those of Mirsaid Ghazi et al. [23] who reported the prevalence of allergic rhinitis in Tehran to be 23.28% in 10–14-year-old students and commoner in boys than girls.

An itchy rash that came and went for at least 6 months, which is suggestive of eczema, was the least frequently reported of the 3 allergic conditions investigated in this study. Surprisingly the prevalence of eczema ever was commoner than eczema symptoms. It is possible that in the Islamic Republic of Iran most skin lesions are labeled as eczema; however, the most probable explanation is our inappropriate translation of the word eczema. Since there is no equivalent Persian word for “eczema” we added the Persian word *hassasiat* in parenthesis in the translation of the question “Have you ever had eczema?” *Hassasiat* is a Persian version of an Arabic word and is used in our country interchangeably with the word “allergy”. This mistranslation probably led to an overestimation of eczema

ever. Similarly in an ISAAC study in Bangkok among university students, the use of the term “allergic rash” for eczema led to an overestimation of the prevalence of eczema [24]. The ISAAC Steering Committee study showed a 60-fold variation in the prevalence of atopic eczema symptoms between centres (range 0.3%–20.5%) [4].

Conclusion

Our study showed that the prevalence of asthma and allergic rhinoconjunctivitis is relatively high, but they are still less prevalent than more developed countries. Paternal smoking, acetaminophen use, residence on a busy road, male sex, rhinitis ever, eczema ever and keeping a cat at home were all positively associated with wheezing.

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Facts about asthma

- According to World Health Organization (WHO) estimates, 300 million people suffer from asthma and 255 000 people died of asthma in 2005.
- Asthma is the most common chronic disease among children.
- Asthma is not just a public health problem for high income countries: it occurs in all countries regardless of level of development. Over 80% of asthma deaths occur in low and lower-middle income countries.
- Asthma deaths will increase by almost 20% in the next 10 years if urgent action is not taken.
- Asthma is under-diagnosed and under-treated, creating a substantial burden to individuals and families and possibly restricting individuals' activities for a lifetime.

Source: WHO Fact sheet No. 307, August 2006
(<http://www.who.int/mediacentre/factsheets/fs307/en/index.html>)