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Short communication

Prevalence of childhood asthma in Istanbul, Turkey

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In order to determine the asthma prevalence in 6–12-year-old schoolchildren in Istanbul, we issued 2350 questionnaires, according to ISAAC criteria, in six randomly selected city primary schools to be completed at home by parents. A total of 2232 of the questionnaires were completed, an overall response rate of 94.9%, and 2216 questionnaires were taken into consideration. The prevalence of asthma was found to be 9.8% and wheezing 15.1%. To investigate the effect of socioeconomic status on the prevalence of asthma, we evaluated the heating system at home, the place of residence, the educational levels of the mother and father, the number of people living in the house, the sharing of bedrooms, and the annual family income. In conclusion, the prevalence of childhood asthma was not affected by any of these factors. Atopic family history, food allergy, eczema, and frequent otitis media and sinusitis attacks were evaluated and found to be significant in asthma prevalence.

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Asthma is the most common chronic illness of childhood (1). Serial studies from different parts of the world have reported an increased prevalence of bronchial asthma. There have been few epidemiologic studies carried out in Turkey, and this is the first survey on this subject done in Istanbul. Numerous surveys have been conducted in various countries, and there is a large body of literature on the subject. However, it is very difficult to compare the results of studies done at different times or in different places because of the absence of a standard definition of asthma which is suitable for epidemiologic studies (2). For this reason, we adopted the criteria of the International Study of Asthma and Allergies in Childhood (ISAAC) in our questionnaire (3, 4).

This study aimed to determine the prevalence of childhood asthma in schoolchildren in Istanbul and to establish the relation of different factors influencing the atopic status.

Material and methods

In order to determine asthma prevalence in 6–12-year-old schoolchildren, we distributed 2350 questionnaires to the children to be completed by their parents at home, in six schools randomly chosen from different regions of the metropolitan municipality of Istanbul between March and May 1995 (Fig. 1).

For the epidemiologic definition of asthma, self-reporting of diagnosed asthma with a physician's confirmation was used (5). In general, physicians used the terms "allergic bronchitis" or "spastic bronchitis" instead of "asthma". For this reason, both of these terms were accepted as asthma in evaluation.

Questions including those developed for the expanded ISAAC (Appendix) were used in the study. The risk factors which could influence asthma, sex, smoking at home, presence of domestic animals (cats, dogs, birds), stuffed toys, home dampness, and lack of breast-feeding, were assessed.

To investigate the effect of socioeconomic status on the prevalence of asthma, we evaluated the heating system in the home, place of residence, the educational levels of the mother and father, the number of people living in the house, the sharing of bedrooms, and the annual family income. As

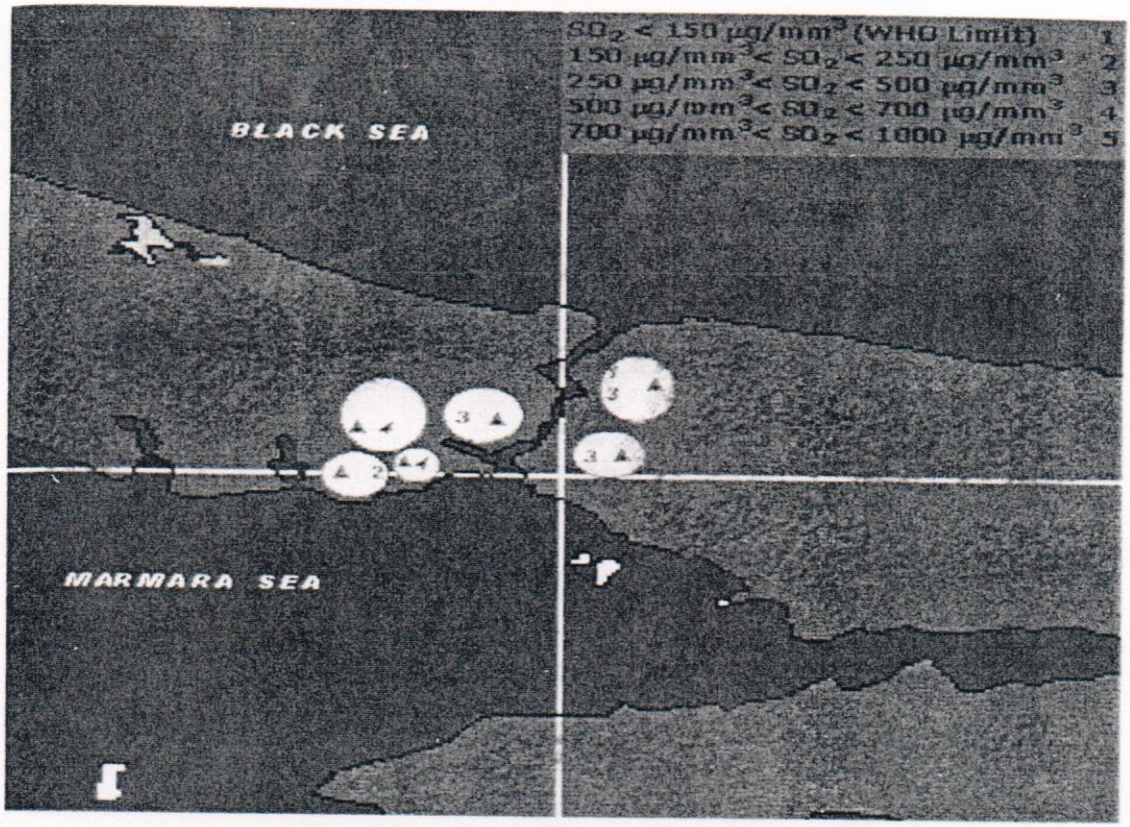

Fig. 1. Air pollution chart of Istanbul and regions of six primary schools chosen to study prevalence of asthma.

part of the questionnaire, atopic family history, the presence of food allergy and eczema, and frequent otitis media and sinusitis were taken into consideration.

Statistical analyses were performed with the SPSS for Windows statistics program. Statistical significance of differences was assessed by the chi-square test. The frequencies procedure was used for cross tabulation and odds ratios.

Results

In total, 2232 of the questionnaires were completed with an overall response rate of 94.9%, and 2216 questionnaires were taken into consideration. Because of illiteracy, 16 questionnaires were excluded. Of the 2216 children who participated in the study, 1115 (50.3%) were girls and 1101 (49.7%) were boys. There was no statistical difference between these two groups according to age (Table 1).

The self-reported prevalence of asthma is summarized in Table 2. A total of 334 (15.1%) children had a history of wheezing at any time, and 181 (8.2%) had had the same symptoms in the last 12 months. The total number of children diagnosed by a physician as having asthma was 218 (9.8%).

Table 1. Age and sex distribution of children participating in survey

	Girls		Boys		Total	
Age (years)	*n*	%	*n*	%	*n*	%
6	109	9.3	96	8.7	205	9.3
7	204	18.3	196	17.8	400	18.1
8	246	22.2	234	21.3	482	21.8
9	208	18.7	206	18.7	414	18.7
10	197	17.7	210	19.1	407	18.4
11	137	12.3	133	12.1	270	12.2
12	12	1.1	26	2.4	38	1.7
Total	1115	50.3	1101	49.7	2216	100.0

$\chi^2 = 6.945$; degrees of freedom (d.f.) = 6; $P > 0.05$ (NS).

The age-related prevalence of asthma is shown in Table 3, which indicates that there was no significant statistical difference between the prevalence rates of asthma at different ages. The risk factors which may affect the prevalence of asthma are indicated in Table 4. There was no statistical significance between asthmatics and nonasthmatics by sex, smoking at home, the presence of domestic animals at home, stuffed toys, home dampness, and breast-feeding. Family histories of asthma, food allergy, and eczema diagnosed by a physician and history of frequent otitis and sinusitis were evalu-

ated and found to be significantly higher in asthmatics. The effect of some socioeconomic factors on asthma prevalence is shown in Table 5, which indicates that there was no significant effect of these factors.

The comparison of international studies made by the ISAAC protocol is summarized in Table 6. The rates of wheezing ever and in the last year were found to be significantly lower than the other studies. Sleep disturbance, severe attacks limiting speech, wheezing after exercise, and waking with cough were similar to the central England results. Doctor-diagnosed asthma was found to be significantly higher than in the Bochum study (6) ($P<0.001$) and lower than in the other studies (Table 6).

Table 2. Prevalence of wheezing, asthma, and other symptoms

	n	%	95% CI
Wheeze ever	334	15.1	13.6–16.6
Wheezing in last year	181	8.2	7.1–9.3
Attacks of wheezing in last year			
1–3	117	5.2	4.2–6.0
4–12	49	2.2	1.6–2.8
>12	15	0.7	0.4–1.0
Sleep disturbed by wheezing in last year	103	4.6	3.8–5.4
Severe attacks of wheezing limiting speech in last year	89	4.0	3.2–4.8
Doctor-diagnosed asthma	218	9.8	8.6–11.0
Wheezing after exercise in last year	277	12.5	11.2–13.8
Waking with cough in last year	322	14.5	13.1–15.9

95% CI: 95% confidence interval.

Table 3. Prevalence of asthma according to age

	Prevalence of asthma	
Age (years)	(*n*)	%
6 ($n=205$)	(22)	10.7
7 ($n=400$)	(42)	10.5
8 ($n=482$)	(39)	8.1
9 ($n=414$)	(39)	9.4
10 ($n=407$)	(47)	11.5
11 ($n=270$)	(26)	9.6
12 ($n=38$)	(3)	7.9

$\chi^2=3.64$; degrees of freedom (d.f.)=6; $P>0.05$ (NS).

Discussion

Asthma is a serious problem in Turkey, as in the rest of the world. We investigated 2216 schoolchildren living in six randomly selected regions of Istanbul. The population from which the sample or cohort was derived is the city of Istanbul, the biggest city in Turkey, with more than 7 million inhabitants (7). Because of a high rate of immigration to Istanbul from other regions of Turkey, Istanbul has a heterogeneous population.

The overall prevalence of physician-diagnosed asthma was 9.8% (Table 3). In the first prevalence study made in 1966 in Ankara (Turkey), the cumulative prevalence was 2.1% (8). In a recent study in Ankara, this rate had increased to 8.3% (9). Another study in Ankara (10) found this ratio to be 6.9%, and in other regions of Turkey such as Bursa (11) and Izmir (12) the prevalences were 7.8% and 4.9%, respectively. Turkey is a large

Table 4. Risk factors affecting prevalence of asthma

Factors	Asthmatics ($n=218$) %	Nonasthmatics ($n=1998$) %	OR*	95% CI	Significance level *P*
Sex					
M	50.4	49.5	1.034	0.782–1.368	NS
F	49.6	50.5			
Smoking at home	63.2	69.1	0.763	0.570–1.022	NS
Domestic animals at home	21.7	26.4	0.772	0.550–1.082	NS
Stuffed toys	22.3	25.9	0.820	0.585–1.148	NS
Home dampness	20.6	18.1	1.176	0.827–1.670	NS
Breast-feeding	90.7	91.6	0.891	0.548–1.451	NS
Asthma in first-degree relatives	15.6	6.9	2.490	1.661–3.732	<0.001
Eczema diagnosed by physician	5.9	2.9	2.084	1.123–3.864	0.01729
Food allergy diagnosed by physician	12.8	4.2	3.316	2.109–5.213	<0.001
Frequent otitis history	13.3	7.6	1.864	1.219–2.850	0.0354
Frequent sinusitis history	22.9	6.2	4.497	3.124–6.474	<0.001

* OR: odds ratio.

Table 5. Evaluation of effect of socioeconomic status on asthma prevalence

		Asthma rate (%)	OR	95% CI	Significance level P
Heating system	Stove* ($n=1495$)	10.4	1.205	0.882–1.648	NS
	Central heating system ($n=681$)	8.8			
Residence	Lodger ($n=1401$)	8.7	0.814	0.601–1.102	NS
	Owner ($n=769$)	10.5			
Education level of mother	Primary school ($n=1472$)	9.1	0.869	0.625–1.207	NS
	High school or university ($n=542$)	10.3			
Education level of father	Primary school ($n=1247$)	8.8	0.823	0.606–1.117	NS
	High school or university ($n=742$)	10.5			
Number of people living in home	5 or more ($n=1058$)	9.0	0.830	0.626–1.100	NS
	4 or fewer ($n=1158$)	10.6			
Number of rooms in home	1–2 ($n=498$)	11.6	1.283	0.933–1.764	NS
	3 or more ($n=1718$)	9.3			
Sharing bedroom	Yes ($n=1802$)	10.3	1.288	0.865–1.916	NS
	No ($n=380$)	8.2			
Annual family income	< $3000 ($n=1231$)	10.6	1.149	0.862–1.530	NS
	> $3000 ($n=923$)	9.3			

* By stove we refer to method of heating often used in Turkey, consisting of Aga-like heating unit which burns wood or coal. It is not used for cooking.

country with different geographic regions. The different prevalence ratios obtained in these cities can be explained by the climate and the level of air pollution. Air pollution can undoubtedly trigger asthmatic attacks and affect lung function (13). Climate and air pollution are possibly important in causing variations over short periods of time (14). Sulfur dioxide has been shown to cause bronchospasm and asthma-like symptoms, even at low levels, with chronic exposure (5). However, one factor associated with urban living which could exacerbate existing asthma is particulate and nitrogen dioxide air pollution from motor vehicle emissions (15). Istanbul has a far greater number of motor vehicles than the other large cities of Turkey (16).

The frequency of asthma in children seems to be increasing in several countries, and prevalence rates differ among the countries and even in the same country (5). If we take into consideration the worldwide epidemiologic studies done in recent years, the asthma prevalence was higher in Scotland (14%) (17), England (13.1%) (14), Australia (46%) (18), and New Zealand (13.5–14.2%) (19, 20) than in Istanbul. On the other hand, the prevalence rate was lower in Sweden (5.7%) (21), Norway (8.0%) (22), the USA (3.6–9.5%), (23) and Latin America (0.4–4.3%) (24) than in our study group. This discrepancy in prevalence rates may be related to differences in racial composition, environment, climate, health facilities and methods of study. For standardization of the research method, we adapted the most expanded and recommended ISAAC questionnaire.

When symptom prevalence was evaluated, higher values were obtained for wheezing ever (15.1%), dry cough at night in the past 12 months (14.5%), and wheezing during or after exercise (12.5%). These symptoms are accepted as the most important ones in the diagnosis of asthma.

Our study differed from previous international studies. The rates of wheezing ever, wheezing in the last year, and doctor-diagnosed asthma were significantly lower than in England, New Zealand, and Australia (6). In these studies, the questionnaires were completed by the children themselves, whereas, in our study, the questionnaires were filled in by parents, and the prevalence of wheezing was relatively higher.

Among the risk factors affecting the prevalence of asthma, the male/female ratio was not statistically significant. Passive smoking was not an important risk factor, but this may be a triggering

Table 6. Comparison of international studies made by ISAAC protocol

ISAAC questions	Turkey Istanbul $n=2216$ %	Germany Bochum (6) $n=1928$ %	England West Sussex (6) $n=2097$ %	England North (14) $n=2067$ %	England Central (14) $n=1103$ %	England South (14) $n=2302$ %	New Zealand Wellington (6) $n=1863$ %	Australia Adelaide (6) $n=1428$ %	Australia Sydney (6) $n=1519$ %
Wheeze ever	15.1	33**	48**	22.5**	26**	22.1**	44**	40**	45**
Wheeze in last year	8.2	20**	29**	14.3**	17.2**	14.6**	28**	29**	30**
Attacks of wheezing in last year									
1–3	5.2	16**	20**	7.3*	7.2*	7.9**	17**	15**	–
4–12	2.2	3^{NS}	5**	4.3**	4.5**	4.0**	5**	7**	–
>12	0.7	1^{NS}	2**	2.2**	2.4**	2.1**	3**	5**	–
Sleep disturbed by wheezing in last year	4.6	6*	9**	4.5^{NS}	4.6^{NS}	3.8^{NS}	12**	15**	14**
Severe attacks of wheezing limiting speech in last year	4.0	6*	7**	2.1**	3.0^{NS}	2.2**	11**	10**	13**
Doctor-diagnosed asthma	9.8	4**	15**	12.9*	14.2**	12.8*	18**	22**	26**
Wheezing after exercise exercise in last year	12.5	26**	33**	10.0*	12.1^{NS}	9.9*	38**	37**	41**
Waking with cough in last year	14.5	31**	36**	12.4*	13.0^{NS}	12.3*	34**	27**	38**

NS: not significant; *$P<0.01$; **$P<0.001$.

mechanism in wheezing and dry cough as well as sleep disturbance. This finding agreed with other studies done in Turkey (9–11). Tobacco smoking also increases the severity of asthma. Passive smoking is a major public health problem in Turkey, and this must be remedied by an intensive education program.

It has been stated that from one-fourth to one-third of the allergic population in the USA are sensitive to dog and cat allergens (25). Keeping pets at home is not very common in Turkey. We noticed that the presence of stuffed toys, home dampness, and lack of breast-feeding did not affect the prevalence of asthma. Socioeconomic status was not associated with the prevalence either. In a study done in the UK, socioeconomic indicators analyzed in relation to the prevalence and severity of wheezing showed no significant effect (14). However, the presence of asthma in first-degree relatives, the presence of physician-diagnosed food allergy and eczema, and self-reported history of frequent otitis and sinusitis were very important and statistically significant risk factors in the prevalence of asthma. In our investigation, atopic family history, food allergy and eczema diagnosed by a physician, and frequent attacks of otitis media and sinusitis were significantly higher in asthmatics.

Allergy is increasingly being recognized as playing an important role in asthma. Asthmatics tend to be more atopic than nonasthmatics. Eczema has been reported to be associated with both the development and the persistence of asthma. Our results confirm these findings; physician-diagnosed food allergy and eczema were significant risk factors for asthma.

In addition, we found that frequent otitis and sinusitis were important risk factors in the prevalence of asthma. Asthmatics have been reported to have frequent viral infections, and these infections have been reported to enhance the release of inflammatory mediators from mast cells and basophils in the lung. Bacterial sinusitis is known to make asthma difficult to control until it is adequately treated. Bacterial respiratory infections are not major precipitants of asthma, but bacterial sinusitis is an exception to that generalization. Sinusitis and asthma may coexist as a complication of the same respiratory infection, and the antibiotic treatment of sinusitis reduces asthma severity (26).

In conclusion, asthma is an important public health problem in childhood in Turkey. Our results showed that the prevalence of asthma was influenced by the family history of asthma and the presence of food allergy and eczema. Frequent otitis and sinusitis are also important factors for asthmatic children in Turkey. Physicians must be aware that these conditions are more common in atopics than in nonatopics and that childhood asthma may complicate the clinical course in children having frequent otitis and/or sinusitis. The future of asthma epidemiology lies in

the development of prevention strategies. The challenge of the future is the development of intervention trials to find the factors which truly cause asthma.

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Appendix: questionnaire

Name: Sex: Born (year, month, day):

		Yes	No
1.	Has your child ever had wheezing or whistling in the chest at any time in the past?	( )	( )
2.	Has your child had wheezing or whistling in the chest in the last 12 months?	( )	( )
3.	How many attacks of wheezing has your child had in the last 12 months? 1–3 ( ) 4–12 ( ) More than 12 ( )		
4.	In the last 12 months, has your child's sleep been disturbed by wheezing?	( )	( )
5.	In the last 12 months, has the wheezing ever been severe enough to limit your child's speech to only one or two words at a time between breaths?	( )	( )
6.	Has your child ever been diagnosed by a doctor as having asthma (or allergic bronchitis or spastic bronchitis)?		
7.	In the last 12 months, has your child's chest sounded wheezy during or after exercise?	( )	( )
8.	In the last 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?	( )	( )