Prevalence and Severity of Asthma Symptoms in Children of Tehran

International Study of Asthma and Allergies in Childhood (ISAAC)

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ABSTRACT

This descreptive study was conducted to determine the prevalence of asthma and related symptoms among 6-7 and 13-14 year old school children in Tehran as a part of International study of Asthma and Allergies in childhood (ISAAC) phase III. The ISAAC written questionnaire was given to a total of 6127 students of 72 schools in urban area of Tehran. Simple random sampling was performed with a uniform distribution throughout 12 clusters of 2 divisions of the municipality. All 6-7 and 13-14 year old students were enrolled in this study. Results showed that 15% of the 6-7 year olds and 17% of the 13-14 year olds had positive history of wheezing among which 8.6% and 10.6% respectively had had recent attacks. Physician confirmed asthma was reported in 2.1% of the 6-7 year olds and 2.6% of the 13-14 age group. Severity of asthma assessed by frequency of speech limitation due to wheeze was positive in 1.5% of 6-7 aged group and 3% of 13-14 year olds. Exercise induced wheeze was detected in 2.3% of the 6-7year old group compared to 15.3% of the 13-14 year olds. Nocturnal cough was more prevalent among 13-14 year olds (18.4%) compared to only 7.2% in the 6-7 year olds. Overall, no significant change in prevalence of asthma symptoms has occurred since 1997 (the last phase of ISAAC) among children of Tehran. The results of our study suggest higher rates of confirmed asthma among 6-7 years old girls compared to boys. However, more extensive and precisely designed studies are needed to further confirm these findings.

Keywords: Asthma, Childhood, Symptoms

INTRODUCTION

Although many well-designed studies have provided convincing evidences for increasing prevalence of asthma in developed, mainly Western countries, some of the contributing factors to this trend have been hypothesized[1-4] and the global trend of asthma as well as its actual and major risk factors have still remained obscure.

This will not be revealed unless a systematic, comprehensive study is undertaken uniformly in different geographical regions and among different ethnical communities with varied genetic, socioeconomic and dietary backgrounds; many other contributing factors still remain unknown. ISAAC (International study of Asthma and Allergies in Children) has been designed with nearly all these criteria in order to reach an international scale of the problem.[5] This kind of systematic

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and uniform study serves another goal, too. It enables every country to obtain its own statistics and give the opportunity to confidently compare the results with other populations. It also provides a solid base for monitoring future trends in asthma and allergies in various settings simultaneously, as well as individually.

There are few reports regarding the asthma status in Iranian children[6,7] with not much consistent and comparable results due to lack of homogenity in their study designs and methods of patients evaluation. In this context, the need for a standardized comprehensive study was felt to accurately determine epidemiological aspects of asthma. Therefore we joined ISAAC project in phase one by implementing the study in two of our big cities (Tehran and Rasht).[9,17] In phase three, the study was completed in Tehran, a megalopolis that typifies polluted, crowded capitals of developing countries with several inherent characteristics acknowledged as precipitating factors for asthma and allergic disorders.

In this paper, we present the results of the ISAAC phase three carried out on children of two age groups; 6-7 and 13-14 year olds living in Tehran.

PATIENTS AND METHODS

This descriptive study is a part of the International Study of Asthma and Allergies in Childhood (ISAAC) which was performed in Tehran urban area during the years 2000-2001. A total of 72 public and private schools in urban areas of Tehran were selected by simple random sampling with a uniform distribution throughout 12 clusters of 22 divisions of the area. All first (6-7years) seventh and eighth grade students (13-14 years) in each school were enrolled in the study. As recommended by the ISAAC, a sample size of 3000 students for each group was necessary for the study. Accordingly, a total number of 3015 and 3125 next seven year old and 13-14 year old students respectively were questioned.

Asthma related symptoms were questioned using the same questionnaires as phase one. The 13-14 year-olds were assigned to complete the questionnaires at site, but the 6-7 year olds were asked to take the questionnaires home to complete by their parents. Data management, analysis, and control: Data, as recorded by children or parents, were entered in to computer by two individual operators. Double-entry was performed to check data entry. Epi-info version 6.00 and SPSS version 10.0 were used for entry and processing of data.

Initially, basic descriptive summaries of the data were obtained and thereafter, the effect of sex and age were assessed on all data series using cross-tabulation and chi-square statistical test.

RESULTS

A total of 6140 students participated in the study, consisting of 3015, 6-7 year old and 3125, 13-14 year old students. The 6-7 year old group consisted of 1368 (45.4%) females and 1647 (54.6%) males. This frequency was 1498 (47.9%) females and 1627(52%) males for the 13-14 year old group. The participation rate was 100% for the 13-14 year-old group and 81% for the 6-7 year olds. (3720 questionnaires were distributed from which 3015 were completed and returned).

Overall results

When we analyzed cumulative data of all children in both age groups, as shown in table 1, it was observed that a total of 984 (16.4%) of all children had a positive history of wheezing throughout their lives and that the relative number of wheezy girls (17.9%) was significantly higher than boys (15.2%) $p<0.005$. But estimation of the incidence of this symptom during the past 12 months resulted in no statistically significant difference between the two sexes (girls: 55.6%, boys: 53.6%, p value<0.960). When comparing the two age groups (6-7 and 13-14 years old), it was noted that 15.6% of 6-7year and 17.3% of 13-14 year old groups admitted positive history for wheezing ($p<0.07$). Considering current wheezing it was shown that 57.6% of 6-7 year olds versus 52.5% of 13-14 year olds with wheezing history had this symptom during the past 12 months (Table 1).

The number of attacks was 1-3 per week in 64.1%, 4-12 in 11% and more than 12 in 4.7% of the study population with positive response to “wheeze ever” which shows that the majority of the children with recent attacks have experienced, on average, 1 to 3 attacks per week.

Regarding the number of sleep disturbances, 62.7% of the total wheezy children reported no awakening with wheezing, 22% less than one night per week, and 14.4% one or more nights per week (Table 2).

Speech limitation due to wheezing was seen in 19.6% of wheezy children with no significant difference among the two sexes ($p<0.124$) or the two age groups ($p<0.076$).

The prevalence of exercise induced wheeze is shown in Table I; this symptom was significantly more prevalent in the 13-14 year old group than in the 6-7 year olds (16% vs 2.4%, $p<0.000$) but no difference was seen among the two sexes (8.7% vs 10.1%, $p<0.176$).

Cough was present in 13.4% of cases with a higher prevalence in the 13-14 year olds (19.1% vs 7.5%, $p<0.000$) compared to younger children but with no significant difference among the two sexes (13.5% vs 13.2%, $p<0.832$).

Table 1. Frequency of self-reported asthma related symptoms in children of Tehran by age and sex: ISAAC Phase Three*.

Gender / Age / Symptom	Girls			Boys			Total	
	6-7y	13-14y	total	6-7y	13-14y	total	6-7y	13-14y
Ever wheezing	236 (8.1%)	259 (8.4%)	495 (17.9%)	217 (7.5%)	272 (8.8%)	489 (15.2%)	453 (15.6%)	531 (17.3%)
Current wheezing	133 (29.6%)	166 (25.5%)	299 (55.6%)	126 (28%)	175 (26.9%)	301 (53.6%)	259 (57.6%)	341 (52.5%)
Sleep disturbance due to wheezing **	59 (22.2%)	55 (12.9%)	49 (14.3%)	61 (22.9%)	78 (18.2%)	51 (14.5%)	120 (45.1%)	133 (31.3%)
Severe wheeze limiting speech	25 (9.4%)	46 (15.6%)	71 (20.2%)	19 (7.1%)	47 (315.9%)	66 (19%)	44 (16.5%)	93 (21.5%)
Asthma ever	36 (1.2%)	44 (1.4%)	80 (2.9%)	28 (1%)	36 (1.2%)	64 (2%)	64 (2.2%)	80 (2.6%)
Exercise wheeze	43 (1.5%)	228 (7.6%)	271 (10.1%)	25 (5.9%)	250 (8.4%)	275 (8.7%)	68 (2.4%)	478 (16%)
Night cough	98 (3.4%)	262 (8.7%)	360 (13.2%)	118 (4.1%)	314 (10.4%)	432 (13.5%)	216 (7.5%)	576 (19.1%)

*All frequencies are presented in valid percent.

** Cases with awakening for more than once per night per week included

Table 2. Prevalence of sleep disturbance episodes due to wheeze attack in children of Tehran by age and sex: ISAAC Phase Three.

Gender / Prevalence	Boys		Girls		Total	
	6-7y	13-14y	6-7y	13-14y	6-7y	13-14y
Never	67 (25.2%)	141(32.9%)	77 (28.9%)	150 (35%)	144 (54.1%)	291 (68%)
Less than one night per week	38(14.3%)	50 (11.7%)	33 (12.4%)	32 (7.5%)	71 (26.7%)	82 (19.3%)
More than one night per week	23 (8.6%)	28 (6.5%)	26 (9.8%)	23 (5.4%)	49 (18.4%)	51 (11.9%)
Total	128(48.1%)	223(52.1%)	138(51.1%)	205(47.9%)	266 (100%)	428 (100%)

Confirmed asthma was detected in a total of 2.4% of cases with a significant higher rate among the girls (2.9% vs 2%, $p<0.023$) but with no predominance in any age group (2.2% v.s 2.6%, P<0.367) (Table 3).

6-7 year old group

The answer to the question "Have you ever had wheezing or whistling in the chest?" was positive in 453(15%) of the children, consisting of 236 (8.1%) females and 217 (7.5%) males. Apparently the number of positive response prevailed in the females, with a statistically significant difference (P<0.003,9 OR: 1.8, 95% CI). Two hundred fifty nine (8.6%) of the cases were reported to have these symptoms during the last 12 months, with no significant difference between two sexes ($p<0.9$). The number of attacks during the previous 12 months was 1-3 in 69.5%, 4-12 in 12.3% and more than 12 in 3.7% of the cases with ever wheezing.

A relatively small number of all parents (120;7.6%) reported sleep disturbance in their children during the past 12 months due to wheezing. Of those children, 71(26.7%) had less than one night per week awakening

Table 3. Prevalence of ever having doctor-diagnosed asthma in children of Tehran by age and sex: ISAAC Phase Three.

Gender / Age	Boys	Girls	Total
6-7 year old	28 (1%)	36 (1.2%)	64 (1.1%)
13-14 year old	36 (1.2%)	44 (1.4%)	80 (1.3%)
Total	64 (1.1%)	80 (1.3%)	144 (2.4%)

and 49(18.4%) reported more than one episode of sleep disturbance throughout a week. There was no difference observed between two sexes (Table II).

Severity of symptoms was assessed by questioning the speech limitation due to wheezing in the past 12 months. Results revealed that 44 cases consisting 1.5% of the total children and 16.5% of the wheezy children, had this severe form of symptom. But the difference among two genders was not significant ($p<0.57$).

According to what parents had reported, 64(2.2%) of the children, including 28 (1%) boys and 36 (1.2%) girls had a past history of confirmed asthma (table 3). Although the disorder was more prevalent in girls, the difference was not statistically significant ($p<0.07$).

Since wheezing may be apparent only in special settings, parents were questioned about this symptom in their children during performance of physical activities which revealed a frequency of 64(2.4%) positive replies, including 43 (1.5%) females and 25(0.9%) males. The difference between the two sexes was statistically significant with a dominance of females ($p<0.009$).

Dry night cough is a relatively sensitive indicator of airway hyperresponsiveness in children. The frequency of this symptom was 216 (7.5%) in this age group, with no statistically significant difference between the two sexes ($p<0.9$).

13-14 year old group

Results of questioning this age group showed that 531 (17.3%) of the students had experienced wheezing in their lifetime, which included 259(8.4%) females and 272(8.8%) males. Although the number of males seemingly prevailed, this difference was not statistically significant ($p<0.48$). Three hundred and forty one (10.9%) students reported to have had wheezing during the last 12 months, but no sex predominance was seen ($p<0.53$).

The number of attacks during the previous 12 months was 1-3 in 60.7%, 4-12 in 10.3%, and more than 12 in 5.3% of the cases with ever wheezing.

Regarding the number of sleep disturbances observed during the past 12 months, 133(4.3%) of all children reported to have night awakening with 82(19.2%) having this problem less than one night per week, and 51(11.9%) reported more than one episode of sleep disturbance throughout a week (Table 2).

Three percent of the total subjects and 21.5% (93 cases) of those who had wheezing and proceeded to this question in the questionnaire, consisting of 10.6% females and 10.9% males, claimed to have severe forms of symptoms with history of speech limitation due to dyspnea; no sex predominance was detected ($p<0.14$).

Exercise induced wheezing was positive in 478(16%), including 8.4%boys and 7.6% girls, with no gender predominance ($p<0.8$).

The question about dry night cough was positively replied by 576 (19%) of the cases, with no significant difference between the two sexes ($p<0.5$).

As shown in Table 3, past history of asthma was positive in 80(2.6%) cases, consisting of 1% boys and 1.2% girls with borderline, albeit no significant difference ($p<0.069$).

DISCUSSION

We report here, a rather small difference in results compared to what had been reached through the previous phase of ISAAC (phase I), according to which Tehran stood among centers with intermediate to low prevalence of asthma (5). Apparently, asthma-like symptoms are increasing in Iran similar to the rising trend observed in other parts of the world (1-4,8), albeit with much smaller pace than some developed countries. As our results indicate, the rate of current wheeze has increased slightly (from 5.5% to 8.6%) in 6-7 year olds, but showed slight decline among 13-14 year olds (from 12.4% to 10.9%) since 1994. The data also show that our rates are still well consistent with those of other countries in the region reported to be 10.7% in the last phase of ISAAC.[9]

Briefly, asthma questionnaire of ISAAC consists of three groups of asthma-related symptom inquires. first, the existence of asthma symptoms, second the severity of asthma symptoms and third the existence of asthma variants (night coughs, and exercise induced

dyspnea).[9]

As our results demonstrate, the overall number of girls with positive history of ever wheezing was the same as boys, but a significant higher rate of positive report by parents of 6-7 year old girls versus boys was observed. If wheeze is considered the main symptom of asthma, this finding is evidently distinctly in contrast to what is expected according to the current literature; that the prevalence of asthma in children before the adolescence is higher in boys than in girls.[10-12] We believe that this difference may be explained by an oversensitivity of girls to their symptoms and therefore, their higher rate of expression of complaints to parents. On the other hand, the equity of two sexes in responding to the question on current wheeze may further provide evidence for the fact that parents' recall bias may have played a major role in outnumbering girls to boys in the previous question.

Our other finding was that parents of 6-7 year old children reported less prevalence of "wheeze" ever than 13-14 year-olds although it did not reach statistical significance. The absence of such difference in the rate of reported recent wheeze, again may suggest the effect of recall bias that usually accompanies questionnaire-based studies. This is in contrast to what most clinical studies have reported, since up to 80% of asthmatic children become asymptomatic when they reach puberty.[11] But it has not yet been established that the decline in symptoms is real or the result of children denying their illness when they step into adolescence.

Asthma severity was assessed in ISAAC questionnaire by asking about night waking and wheeze limiting speech. As shown, no sex or age dominance was detected regarding these two indices of symptom severity. However, small, but not significant, higher rate of speech limitation was reported by 13-14 year olds compared to 6-7 year old group. When the proportion of wheezy children with this severe symptom was considered, less than one third of 6-7 year olds and approximately one fourth of the 13-14 year old group with wheeze history admitted that they had experienced this symptom during the past 12 months. It appears that the rate of this symptom has increased dramatically in 6-7 year olds compared to phase I (1.5% v.s 0.8%), but it has remained relatively constant for the older age group.

Parents of elementary students reported less prevalence of "exercise-induced wheezing" among their children as compared to our adolescent group. The same was also found in ISAAC phase I and was attributed to under reporting by parents and/or overreporting by adolescents or different interpretation of questions relevant to wheezing history. Considering sex ratio in each age group, it was noticed that parents had reported a higher rate of this symptom in their younger daughters, with complete contrast to what adolescents admitted, showing the dominance of boys over girls. This interesting finding may in part be due to higher sensitivity of girls and their overexpression of symptoms to their parents. In contrast, outnumbering girls by boys regarding this symptom in older children is probably the result of greater interest in and actual experience of males, especially in this age group, for performing sport activities. This is observed more markedly in Iran, where some cultural and religious beliefs further limit outdoor physical activities of female adolescents.

This finding is in accordance with the theory that childhood asthma does not simply disappear as the children grow, but it may transform into other unusual and more subtle forms as the bronchial hyperresponsiveness persists into adolescent.[13,14])

As another symptom indicative of variant forms of asthma, night cough was equally reported by both sexes in both age groups, but with significantly higher rate among adolescents. Although it was stated clearly in the question that this symptom should not be associated with common cold or chest infection, it is not hard to assume that children as old as 13-14 years old are unable to readily differentiate the cause of their night cough and have an accurate estimate of the frequency of truly hyperreactive symptoms.

It was to our amazement to find out that overall prevalence of confirmed asthma, verified by a physician, was significantly higher in girls, especially among younger children. This finding is in obvious contrast to what is generally cited in the literature, as the higher prevalence of asthma exists in boys compared to girls before age of 10 but vice versa thereafter.[15] Although little or no misinterpretation of this question by parents is expected to be involved, it is not commonly advisable to rely on physicians' diagnosis of asthma as a gold standard in epidemiological studies because of the wide variation reported in the criteria for making a diagnosis.[16] Therefore, the observed contradiction surely prompts further clinical investigations with more meticulously designed methodology, based on objective factors, to properly estimate and evaluate the status of asthma in Iran.

In an attempt to participate in an international effort to evaluate the epidemiology of asthma and allergies, we completed phase III of ISAAC. Our results suggest that not so significant change has occurred regarding the prevalence of asthma-related symptoms in our children and adolescents, and we still remain in low to intermediate category. But some of our findings were obviously inconsistent with general concept on prevalence of asthma and asthma-like symptoms which requires

more precise studies tailored to uncover local/regional contributing factors.

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