Smoking and asthma in 20–44-year-old adults in Urmia, Islamic Republic of Iran

M.H. Rahimi-Rad,[1] F. Gaderi-Pakdel[2] and S. Salari-Lak[3]

التدخين والربو لدى البالغين في الفئة العمرية 20 – 44 عاماً في أرميا بشمال غرب جمهورية إيران الإسلامية

محمد حسين رحيمي راد، فيروز قادري باكدل، شكل سالاري لك

الخلاصة: أجرى الباحثون دراسة مستعرضة في عام 2004، استخدموا فيها استبيان التحري الذي أعده الاتحاد الدولي لمكافحة السل وأمراض الرئة، مع إضافة أسئلة حول التدخين، لتقصِّي مدى انتشار التدخين والربو والأعراض المرتبطة به، بالنظر إلى العمر والجنس والسلوك التدخيني، وذلك في مدينة أرميا بجمهورية إيران الإسلامية. وفي إطار هذه الدراسة، تم مسح 2987 بالغاً في الفئة العمرية 20 – 44 عاماً. وبلغ معدل انتشار الأزيز 4.8٪، وضيق النَّفَس المصحوب بالأزيز 3.3٪، ونوبات الربو 1.2٪، واستخدام أدوية الربو 1.1٪، وحساسية الأنف 16٪. وبلغت نسبة المدخنين 16.4٪ من المشاركين في الدراسة. ولوحظ ارتفاع يُعْتَدُّ به إحصائياً في معدل انتشار أعراض الربو بين المدخنين بالمقارنة مع غير المدخنين. وكانت معدلات تشخيص الربو واستخدام أدوية الربو أقل من الناصف الوارد في مسح صحة الجهاز التنفسي الذي أعده الاتحاد الأوروبي.

ABSTRACT To investigate the prevalence of smoking, asthma and asthma-related symptoms in relation to age, sex and smoking behaviour in Urmia, we carried out a cross-sectional study in 2004 using the International Union Against Tuberculosis and Lung Disease questionnaire, which includes some questions on smoking. We surveyed 2987 adults aged 20–44 years. Prevalence of wheeze, breathlessness with wheezing, asthma attack, use of asthma medication and nasal allergy were 4.8%, 3.3%, 1.2%, 1.1%, and 16.0% respectively. Current smokers comprised 16.4% of participants. Prevalence of asthma symptoms was significantly greater in smokers than non-smokers. Rates for asthma diagnosis and asthma medication were lower than the European Community Respiratory Health Survey median.

Tabagisme et asthme chez l'adulte de 20 à 44 ans à Urmia, (République islamique d'Iran)

RÉSUMÉ Afin d'évaluer la prévalence du tabagisme, de l'asthme et des symptômes liés à l'asthme en fonction de l'âge, du sexe et du comportement tabagique à Urmia, nous avons conduit en 2004 une étude transversale sur la base du questionnaire de recherche sur les symptômes bronchiques de l'Union Internationale Contre la Tuberculose et les Maladies Respiratoires, qui comporte un certain nombre de questions sur le tabagisme. Notre enquête a porté sur un effectif de 2987 adultes âgés de 20 à 44 ans. Nous avons déterminé la prévalence de chacun des items, à savoir sifflements : 4,8 %, essoufflement avec sifflements : 3,3 %, crises d'asthme : 1,2 %, recours aux médicaments antiasthmatiques : 1,1 % et allergies nasales : 16,0 %. Les fumeurs réguliers représentaient 16,4 % des participants. La prévalence des symptômes liés à l'asthme s'est avérée significativement plus importante chez les fumeurs que chez les non-fumeurs. Nous avons constaté des taux de diagnostic et de médication de l'asthme inférieurs aux médianes établies dans le cadre de l'étude ECRHS (***European Community Respiratory Health Survey*** – enquête épidémiologique européenne sur la prévalence et les facteurs de l'asthme).

[1]Deparment of Medicine; [2]Department of Physiology; [3]Department of Epidemiology, Urmia University of Medical Sciences, Urmia, Western Azerbaijan, Islamic Republic of Iran (Correspondence to M.H. Rahimi-Rad: rahimirad@umsu.ac.ir).

Received: 07/06/05; accepted: 05/12/05

Introduction

The World Health Organization (WHO) has reported that around 300 million people around the globe suffer from asthma, and this number is rising [*1*]. Asthma is not just a public health problem for the industrialized countries, in developing countries, however, the incidence of the disease varies greatly. India has an estimated 15–20 million people who suffer from the condition; in the Western Pacific Region of WHO, the incidence varies from over 50% among children in the Caroline Islands to virtually 0% in Papua New Guinea. In Brazil, Costa Rica, Panama, Peru and Uruguay, prevalence of asthma symptoms in children varies from 20% to 30% [*1*]. Very little has been published about asthma status in the WHO Eastern Mediterranean Region, including the Islamic Republic of Iran. There are a few reports regarding Iranian adults, but there is a lack of consistency and comparability in the findings owing to lack of homogeneity in the study designs and methods [*2,3*].

In this context, it was felt there was a need for a standardized, comprehensive study to accurately determine epidemiological aspects of asthma in the Islamic Republic of Iran. The development of standardized questionnaires by the International Union against Tuberculosis and Lung Disease (IUATLD) and International Studies of Asthma and Allergies in Childhood (ISAAC) has allowed comparison of the prevalence of asthma and asthma-like symptoms between countries.

An ISAAC study has already been carried out in the Islamic Republic of Iran [*4*]. The IUATLD questionnaire was used in the European Community Respiratory Health Survey (ECRHS), involving 48 centres in 17 European and 5 non-European countries between 1990 and 1995 [*5*]. The prevalence of asthma varies not only between countries but also within large countries such as Canada [*6*]. Reported prevalence of asthma and asthma-like symptoms is higher in industrialized countries than in developing countries [*5*]

According to a WHO fact sheet, about a third of the adult male global population smokes [*7*]. Smoking-related diseases kill 1 in 10 adults globally, and cause 4 million deaths annually. By 2030, if current trends continue, smoking will kill 1 in 6 people. Smoking is on the rise in the developing world but falling in the more developed nations. Among Americans, smoking rates decreased by nearly half from the mid-1960s to the mid-90s, falling to 23% of adults by 1997. In developing countries, tobacco consumption is rising by 3.4% per year [*7*]. In the Islamic Republic of Iran, self-reported prevalence of smoking is 18.7%–26.0% in men and 1.3%–3.6% in women [*7–10*].

The aim of this study was to determine the prevalence of smoking, reported asthma attacks, asthma-like symptoms and nasal allergy in adults aged 20–44 years in Urmia, and to compare them with those reported in the European Community Respiratory Health Survey (ECHRS) and other studies.

Methods

Place of study

Urmia, previously Rezaieh, is the capital of West Azarbaijan province and has a population of 499 000. The city is situated at an altitude of 1340 m on the western side of Lake Urmia, a shallow saline lake in the northwest of the Islamic Republic of Iran, between Tabriz and the Turkish border. The city is situated in a fertile region where fruit (apples and grapes) and tobacco are grown. Many families have their own orchards.

Study design

This cross-sectional survey was carried out between January 2004 and July 2004 using random cluster sampling. In order to facilitate comparison of our findings with those of the European Community Respiratory Health Survey [*11*], sample size was set at 3000. Urmia city was divided into 11 areas; 5 areas were selected in the first stage based on random numbers. In the second stage 30 clusters were randomly selected, taking into consideration the population density of each area. After selecting the first family randomly from the family list, the next household to the right was selected, and this continued until the required number of samples was completed in each cluster.

All individuals 20–44 years old were invited to take part in the study. If the 20–44-year-old person was not at home, another appointment was made. After a maximum of 3 visits, 75 addresses were inaccessible. There were no refusals to participate, although 13 respondents were considered unreliable (inconsistent answers).

Interviews were conducted using a Farsi translation of the IUATLD questionnaire on bronchial symptoms with additional questions on smoking (cigarettes and cigars). The questionnaire had been validated and subsequently used extensively as the postal questionnaire of the ECRHS [*12*]. Other forms of smoking such as the water pipe (hookah) are not common in Urmia and were not covered in the study.

The following questions were used in the analysis (as in the ECRHS):

- 1 Wheeze: Have you had wheezing or whistling in your chest at any time in the last 12 months?
- 1.1 Breathless with wheezing: Have you been at all breathless when the wheezing noise was present?
- 1.2 Wheeze without cold: Have you had this wheezing or whistling when you did not have cold?
- 2 Shortness of breath at rest (not used in ECRHS): Have you had an attack of shortness of breath that came on during the day when you were at rest any time in the last 12 months?
- 3 Shortness of breath after exercise (not used in ECRHS): Have you had an attack of shortness of breath that came on following strenuous activity at any time in the last 12 months?
- 4 Chest tightness: Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?
- 5 Nocturnal shortness of breath: Have you been woken by an attack of shortness of breath at any time in the last 12 months?
- 6 Nocturnal cough: Have you been woken by an attack of coughing at any time in the last 12 months?
- 7 Asthma attack: Have you had an attack of asthma in the last 12 months?
- 8 Asthma medication: Are you currently taking any medication (including inhalers, aerosols or tablets) for asthma?
- 9 Nasal allergy: Do you have any nasal allergies, including hay fever?

We designated those who answered yes to either Question 7 or Question 8 (indicating that they had had an attack of asthma in the previous 12 months and/or that they were currently receiving medication for asthma) as “diagnosed current asthma”.

Current smokers were defined as those who were still smoking within 1 month prior to completing the questionnaire; nonsmokers were those who were lifelong nonsmokers and ex-smokers the remainder.

Statistical analysis

We used *SPSS* for Windows, version 11, and performed a descriptive analysis and frequency of each of variables. The chi-squared test was used for differences between groups. Odds ratios with 95% confidence intervals were determined. $P < 0.05$ was considered significant.

Ethics

The study was approved by the Research Committee of the Medical Sciences University of Urmia. All participants were assured that all personal information concerning their health status would be kept confidential and that information would be provided to a third party only on written request from the participant.

Results

The survey was completed by 3000 individuals; 13 questionnaires were incomplete and excluded from the analysis. Thus, results for 2987 individuals, 1422 (48%) men and 1565 (52%) women, were analysed.

Table 1 shows the distribution of the study population by sex and smoking habit. Relatively few women (3.6%) were smokers.

The prevalence of asthma-like symptoms and self-reported asthma attacks and use of asthma medications during the 12 months prior to the study are shown by sex and age group in Table 2. There was no statistically significant difference between males and females ($P > 0.05$).

Prevalence of all variables, with the exception of nasal allergy, was highest in the oldest group (Table 2).

The relationship between smoking and prevalence of reported symptoms is shown in Table 3. We found that 16.4% of the participants reported being current smokers; prevalence was about 10 times greater in men (30.5%) than in women (3.6%). Mean age at which smokers started to smoke was 19.9 years. Mean number of cigarettes smoked per day was 13.8 (standard deviation 10.4).

History of nasal allergy was strongly associated with respiratory symptoms ($P < 0.001$ for all variables) (Table 4).

To enable easy comparison of our results with those of the ECRHS, the median and values for selected centres are shown in Table 5 [*5*]. The prevalence of each of the symptoms was substantially lower in Urmia than in centres that took part in the ECRHS. For example, the prevalence of wheeze was 4.8% in Urmia compared to the ECRHS median of 20.7%.

Discussion

There have been no studies using a standardized questionnaire to determine the prevalence of asthma-like symptoms, reported asthma attacks and chronic respira-

Table 1 **Prevalence of smoking in 20–44-year-old adults in Urmia**

Smoking status	Males (*n* = 1422)		Females (*n* = 1565)		Total (*n* = 2987)	
	No.	%	No.	%	No.	%
Never smoked	942	66.2	1496	95.6	2438	81.6
Ex-smoker	47	3.3	12	0.8	59	2.0
Current smoker	433	30.5	57	3.6	490	16.4

Table 2 **Prevalence of respiratory symptoms in previous 12 months according to sex and age in 20–44-year-old adults in Urmia**

Question	Sex						Age (years)											
	Male		Female		Total		20–24		25–29		30–34		35–39		40–44		Total	
	(*n* = 1422)		(*n* = 1565)		(*n* = 2987)		(*n* = 871)		(*n* = 540)		(*n* = 448)		(*n* = 492)		(*n* = 630)		(*n* = 2981)[a]	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1 Wheeze	79	5.6	65	4.2	144	4.8	23	2.6	17	3.1	19	4.2	25	5.1	60	9.5	144	4.8
1.1 Breathless with wheezing	53	3.7	45	2.9	98	3.3	12	1.4	11	2.0	15	3.3	14	2.8	46	7.3	98	3.3
1.2 Wheeze without cold	58	4.1	44	2.8	102	3.4	14	1.6	10	1.9	14	3.1	29	4.1	44	7.0	102	3.4
2 Shortness of breath at rest	45	3.2	48	3.1	88	2.9	13	1.5	11	2.0	16	3.6	14	2.8	34	5.4	88	3.0
3 Shortness of breath after exercise	94	6.6	117	7.5	211	7.1	47	5.4	24	4.4	36	7.8	40	8.1	65	10.3	211	7.1
4 Chest tightness	64	4.5	85	5.4	149	5.0	26	3.0	20	3.7	26	5.8	25	5.1	52	8.3	149	5.0
5 Nocturnal shortness of breath	38	2.7	50	3.2	88	2.9	17	2.0	7	1.3	9	2.0	23	4.7	32	5.1	88	3.0
6 Nocturnal cough	146	10.3	163	10.4	309	10.3	69	7.9	47	8.7	50	11.2	52	10.5	91	14.4	309	10.4
7 Asthma attack	14	1.0	21	1.3	35	1.2	2	0.2	4	0.7	6	1.3	6	1.2	17	2.7	35	1.2
8 Asthma medication	13	0.9	19	1.2	32	1.1	3	0.3	4	0.7	7	1.6	5	1.0	13	2.1	32	1.1
7 or 8 Current asthma[b]	18	1.3	25	1.6	43	1.4	3	0.3	5	0.9	8	1.8	7	1.4	20	3.2	43	1.4
9 Nasal allergy	224	15.8	253	16.2	477	16.0	14	16.1	84	15.0	84	18.8	93	18.9	74	12.1	477	16.0

[a] ***Data missing for 6 participants.***

[b] ***Those who answered yes to question 7 and/or question 8 were designated as "diagnosed current asthma".***

Table 3 **Prevalence of asthma symptoms, self-reported asthma and nasal allergy in 20–44-year-old adults in Urmia according to current smoking status**

Question	Current smoker (*n* = 490)		Non-smoker (*n* = 2497)		OR (95% CI)
	No.	%	No.	%	
1 Wheeze***	53	10.8	91	3.6	3.2 (2.5–4.5)
1.1 Breathless with wheezing***	34	6.9	64	2.6	2.8 (1.8–4.3)
1.2 Wheeze without cold***	37	7.6	65	2.6	3.0 (2.0–4.6)
2 Shortness of breath at rest	22	4.5	66	2.6	1.7 (1.0–2.8)
3 Shortness of breath after exercise***	64	13.1	147	5.9	2.4 (1.7–3.2)
4 Chest tightness***	39	8.0	110	4.4	1.8 (1.2–2.7)
5 Nocturnal shortness of breath	20	4.1	68	2.7	1.5 (0.9–2.5)
6 Nocturnal cough*	94	19.2	215	8.6	2.5 (1.9–3.2)
7 Asthma attack	5	1.0	30	1.2	0.8 (0.3–2.1)
8 Asthma medication	7	1.4	25	1.0	1.4 (0.6–3.3)
7 or 8 Current asthma[a]	8	1.6	35	1.4	0.8 (0.3–1.8)
9 Nasal allergy	76	15.5	401	16.1	–

P < 0.05; ***P-value < 0.001.

[a]Those who answered yes to question 7 and/or question 8 were designated as "diagnosed current asthma".

OR = odds ratio; CI = confidence interval.

tory symptoms in adults in Urmia. The use of a standardized IUATLD questionnaire allowed comparison of our results with those obtained using the same questionnaire in other centres.

The ECRHS was the first study to assess the geographical variation in asthma and allergy in adults using the same instruments and definitions. The study showed that there are large geographical differences in the prevalence of asthma, atopy and bronchial responsiveness, with high prevalence rates in English-speaking countries and low prevalence rates in the Mediterranean region and Eastern Europe [*5,13*]. Comparison of our results with those from all 48 participating ECRHS centres shows that the prevalence of most asthma symptoms and of nasal allergy/hay fever were significantly lower in Urmia than the median for ECRHS centres. Prevalence of respiratory symptoms in Urmia was similar to Algeria and Bombay, but lower than centres in Europe, Australia and New Zealand. Practitioner-diagnosed asthma and use of asthma medications were also lower in Urmia. Under-diagnosis and under-treatment are common problems in relation to asthma, creating a substantial burden on individuals and families. Some of those affected may endure a lifetime of restriction of activities.

To the best of our knowledge, there has been no IUATLD study in Iranian adults. However, in 2 studies carried out with slightly different methodologies, the self-reported prevalence of asthma was 2.8% in Mashhad and 6.1% in rural areas of Isfahan [*2,3*].

The low frequency of reported asthma-like symptoms in the present study might be

Table 4 **Relationship between nasal allergy and asthma symptoms, self-reported asthma and asthma medication use in 20–44-year-old adults in Urmia**

Question	Nasal allergy				OR (95% CI)
	Yes (*n* = 477)		No (*n* = 2510)		
	No.	%	No.	%	
1 Wheeze	48	10.1	96	3.8	2.8 (1.9–4.0)
1.1 Breathless with wheezing	38	8.0	60	2.4	3.5 (2.3–5.4)
1.2 Wheeze without cold	35	7.3	67	2.7	2.8 (1.8–4.3)
2 Shortness of breath at rest	33	6.9	55	2.2	3.3 (2.1–5.1)
3 Shortness of breath after exercise	66	13.8	145	5.8	2.6 (1.9–3.5)
4 Chest tightness	54	11.3	95	3.8	3.2 (2.3–4.6)
5 Nocturnal shortness of breath	35	7.3	53	2.1	3.6 (2.3–5.7)
6 Nocturnal cough	99	20.8	210	8.4	2.8 (2.2–3.7)
7 Asthma attack	19	4.0	16	0.6	6.4 (3.3–12.6)
8 Asthma medication	16	3.4	16	0.6	5.4 (2.7–10.9)
7 or 8 Current asthma[a]	22	4.6	21	0.8	3.3 (2.4–4.5)

P-*value for all variables < 0.001.*
[a]*Those who answered yes to question 7 and/or question 8 were designated as "diagnosed current asthma".*
OR = odds ratio; CI = confidence interval.

due to misunderstanding of the questions. Although challenge testing for nonallergic bronchial hyperresponsiveness was not performed because of the lack of facilities in Urmia, the most probable explanation is that asthma prevalence is in fact low, in keeping with results of other studies in developing countries, e.g. Bombay (2.6%) and Algiers (2.4%) [*5,14*].

Asthma prevalence in developing countries, characteristically low for a long time, has recently been increasing following urbanization and industrialization. Possible explanations have been identified in the sudden exposure to pollution from industrial and motor vehicle exhaust emissions as a consequence of urbanization; changes in diet that may result in a loss of protection against allergic diseases caused by *Lactobacillus* spp. found in fermented milk; and in the decrease in *Ascaris lumbricoides* infections, considered by some responsible for protection against the development of asthma [*15*].

Prevalence of cigarette smoking and relation to asthma

It has been estimated that there are ~1.25 billion smokers worldwide, with approximately two thirds living in developing countries [*16*]. In Cambodia studies have shown that about 67% of men smoke in urban areas (Phnom Penh), while in rural areas, where most people live, the figure is about 86% [*7*]. In Malaysia about half of all men smoke; in the Philippines the figure is about 60%. In the Republic of Korea about 67% of men smoke, while among adult women the figure rose from 3.9% in 1989 to 6.7% in 1997. In China about 67% of men and 4% of women are smokers.

Table 5 **Prevalence of asthma-like symptoms, self-reported asthma and asthma medication use and nasal allergy in Urmia, selected ECRHS centres and the European Community Respiratory Health Survey (ECRHS) median (48 centres)**

Location	Wheeze %	Wheeze & breathless %	Wheeze, no cold %	Chest tightness %	Breathless at night %	Cough at night %	Asthma attack %	Asthma medication %	Nasal allergy %
Urmia[a]	4.8	3.3	3.4	5.0	3.0	10.4	1.2	1.1	16.0
Barcelona Spain[b]	19.2	5.6	11.0	7.0	4.6	28.2	22.1	2.2	13.1
Melbourne Australia	28.8	16.1	20.7	20.5	11.4	28.5	9.7	9.3	40.9
Wellington New Zealand[b]	27.3	16.0	18.0	18.1	10.4	31.2	8.6	9.8	36.6
Cambridge UK[b]	25.2	13.2	17.7	17.4	8.4	27.4	5.7	6.8	29.2
Paris France[b]	14.2	9.3	9.0	16.8	4.7	26.0	4.3	3.2	3.3
Goteborg Sweden[b]	23.2	12.3	13.5	14.7	7.1	28.2	3.1	4.8	22.2
Hamburg Germany[b]	21.1	8.0	13.5	9.6	5.0	25.8	3.0	3.4	23.0
Mumbai India[b]	4.1	3.0	2.0	7.0	6.8	11.2	2.6	2.8	10.1
Algiers Algeria[b]	4.2	3.3	2.8	6.4	4.4	6.0	2.4	2.5	9.5
Median[b]	20.7	9.8	12.7	13.5	7.3	27.9	3.1	3.5	20.9

[a] ***Current study.***
[b] ***Adapted from the ECRHS [5].***

In many developed countries, at least 1 in 4 adults smoke cigarettes. The rate varies between European countries, e.g. 38% in Germany, 30% in France, 29% in Italy and 18% in Sweden, and is higher in countries with lower incomes and among young adults, particularly females [*16*]. Overall in this study prevalence of cigarette smoking was lower than in the developed countries. Prevalence for females was very low, 3.6% compared to 21% in the United States of America (USA) and 25% in the United Kingdom [*16*]. Other studies of self-reported smoking in Iran also showed lower prevalence of smoking in women. In Isfahan the prevalence in women aged ≥ 19 years was 1.3% (8.7% in men) [*9*]. In Shiraz 26.0% of the men and 3.6% of the women reported being current smokers [*10*]. In Japan about 51% of men smoke, very high for a developed nation [*7*], and prevalence among women is almost 10%.

In the present study, smoking habits were important independent determinants of the prevalence of respiratory symptoms. The association between current smoking and asthma was less clear. In 2 previous case–control studies the prevalence of reported asthma was similar in current smokers and non-smokers [*17,18*], while a higher risk of current asthma was reported in smokers than in non-smokers in an Australian study [*19*]. In a 3-year follow-up study, Bjornsson et al. found that onset of asthma was more common in current smokers than in non-smokers, but this was mainly in nonatopic subjects [*18*]. In a Spanish study, however, smoking was associated with bronchial responsiveness only in nonatopic subjects [*20*], while Leynaert et al. reported that heavy smoking females had an increased risk of moderate to mild bronchial hyperresponsiveness, but no such association was found in males [*21*].

Relation between sex and asthma-like symptoms

There was no significant sex difference in this study. In adults, the female:male sex ratio for asthma admission in the USA is 3:1 [*15*]. In one study, females had a lower risk than males of asthma with onset before 15 years of age but a higher risk of adult onset asthma [*20*]. In several analyses of local data from the ECRHS, females had a higher prevalence of bronchial hyperresponsiveness than males [*13*].

Nasal allergy and asthma

In our study, individuals with nasal allergy were more likely to have current asthma and respiratory symptoms than those without. In the ECRHS study, the association between perennial nasal allergy and asthma remained significant after adjustment for possible confounders such as atopy, and was found in both atopic and nonatopic subjects. Nasal allergy was also found to be an independent risk factor for onset of asthma in a subgroup of Swedish participants 3 years after the first study [*13*].

Conclusion

These data form a reliable baseline for further comparative studies and should also incite new studies into possible causes of such low prevalence rates of asthma-like symptoms. Further studies are needed to investigate whether this low prevalence is related to low prevalence of smoking in women (mothers) (consequently less exposure of Iranians to smoke *in utero* or in neonates and infants) and/or the eastern and Islamic lifestyles. It also provides reliable data about smoking which may be useful for those carrying out interventions to reduce smoking rate.

Acknowledgements

The authors would like to thank all participants and members of the study research team for providing data for comparison. This study was made possible with support from Urmia University of Medical Sciences.

References

1. ***Asthma***. Geneva, World Health Organization, 2006 (Fact sheet No. 307) (http://www.who.int/mediacentre/factsheets/fs307/en/print.html, accessed 5 August 2007).

2. Boskabady MH, Kolahdoz GH. Prevalence of asthma symptoms among the adult population in the city of Mashhad (north-east of Iran). ***Respirology***, 2002, 7(3):267–72.

3. Golshan M, Esteki B, Dadvand P. Prevalence of self-reported respiratory symptoms in rural areas of Iran in 2000. ***Respirology***, 2002, 7(2):129–32.

4. Rahimi Rad MH, Hejazi ME, Behrouzian R. Asthma and other allergic disease in 13–14-year-old Iranian schoolchildren in Urmia: an ISAAC study. ***Eastern Mediterranean health journal***, 2007, 13(5):1005–16.

5. No authors listed. Variations in the prevalence of respiratory symptoms, self-reported asthma attacks, and use of asthma medication in the European Community Respiratory Health Survey (ECRHS). ***European respiratory journal***, 1996, 9(4):687–95.

6. Manfreda J et al. Prevalence of asthma symptoms among adults aged 20–44 years in Canada. ***Canadian Medical Association journal***, 2001, 164(7):995–1001.

7. ***Smoking statistics***. Geneva, World Health Organization, 2002 (http://www.wpro.who.int/media_centre/fact_sheets/fs_20020528.htm, accessed 5 July 2007).

8. Azizi F, Mirmiran P, Azadbakht L. Predictors of cardiovascular risk factors in Tehranian adolescents: Tehran Lipid and Glucose Study. ***International journal for vitamin and nutrition research***, 2004, 74(5):307–12.

9. Sarraf-Zadegan N et al. Tobacco use among Iranian men, women and adolescents. ***European journal of public health***, 2004, 14(1):76–8.

10. Ahmadi J et al. Prevalence of cigarette smoking in Iran. ***Psychological reports***, 2001, 89(2):339–41.

11. Burney PG et al. The European Community Respiratory Health Survey. ***European respiratory journal***, 1994, 7(5):954–60.

12. Ravault C, Kauffmann F. Validity of the IUATLD (1986) questionnaire in the EGEA study. International Union against Tuberculosis and Lung Disease. Epidemiological study on the genetics and environment of asthma, bronchial hyperresponsiveness and atopy. ***International journal of tuberculosis and lung disease***, 2001, 5(2):191–6.

13. Janson C et al. The European Community Respiratory Health Survey: what are the main results so far? European Community Respiratory Health Survey II. ***European respiratory journal***, 2001, 18(3):598–611.

14. Chowgule RV et al. Prevalence of respiratory symptoms, bronchial hyperreactivity, and asthma in a megacity. Results of the European community respiratory health survey in Mumbai (Bombay). ***American journal of respiratory and critical care medicine***, 1998, 158(2):547–54.

15. Viegi G, Annesi I, Matteelli G. Epidemiology of asthma. ***European respiratory monograph***, 2003, 23:1–25.

16. Thomson NC, Chaudhuri R, Livingston E. Asthma and cigarette smoking. ***European respiratory journal***, 2004, 24(5):822–33.

17. Piipari R et al. Smoking and asthma in adults. ***European respiratory journal***, 2004, 24(5):734–9.

18. Bjornsson E et al. Symptoms related to asthma and chronic bronchitis in three areas of Sweden. ***European respiratory journal***, 1994, 7(12):2146–53.

19. Abramson M et al. Risk factors for asthma among young adults in Melbourne, Australia. ***Respirology***, 1996, 1(4):291–7.

20. Sunyer J, Munoz A. Concentrations of methacholine for bronchial responsiveness according to symptoms, smoking and immunoglobulin E in a population-based study in Spain. Spanish Group of the European Asthma Study. ***American journal of respiratory and critical care medicine***, 1996, 153(4 Pt 1):1273–9.

21. Leynaert B et al. Is bronchial hyperresponsiveness more frequent in women than in men? A population-based study. ***American journal of respiratory and critical care medicine***, 1997, 156(5):14–1420.