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What is This?
A systematic review of recent asthma symptom surveys in Iranian children

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Asthma is the most prevalent chronic disease in children. To quantify the national prevalence of asthma symptoms in Iranian children, we conducted a systematic review and meta-analysis. After internet and hand searching for population-based prevalence estimates published from 1998 to 2003 from 142 articles, dissertations and reports of research projects, 19 of them were selected. All the selected studies on children had been performed by the International Study of Asthma and Allergies in Childhood (ISAAC) protocol. We analyzed the data using NCSS software. In the included 19 studies, 61,067 children in different age groups had been examined by the ISAAC protocol. The lowest prevalence of asthma symptoms was 2.7% in Kerman and the highest was 35.4% in Tehran (capital of Iran). Overall prevalence of asthma symptoms at a national level was estimated as 13.14% (95% CI: 9.97–16.30%). Based on this study, the prevalence of asthma symptoms in Iran is higher than that estimated in the international reports. This information can be used to help prioritize asthma prevention and control within the range of Iranian public health concerns.

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Key words: burden of asthma; ISAAC; meta-analysis; prevalence

Introduction

Pediatric asthma is a major clinical concern worldwide and represents a huge burden on family and society. It accounts for a large number of lost school days and may deprive the child of both academic achievement and social interaction. Childhood asthma also places strain on healthcare resources as a result of doctor and hospital visits and the cost of treatment. In Iran, asthma is an important cause of impaired quality of life, use of primary care, consumption of prescribed drugs, hospital admission, and mortality across the whole range of age, sex, ethnicity, socioeconomic status, and geographical location.1,2 Asthma is not just a public health problem for high income countries; it also occurs in developing nations and especially in polluted and heavy traffic cities. The prevalence of asthma is rising in many parts of the world, but it is unclear whether this is due to an actual increase in incidence or increase in allergic disorders.3

According to World Health Organization (WHO) estimates, 300 million people suffered from asthma and 255,000 people died of asthma in 2005.4 The prevalence rate of asthma increases as communities adopt western lifestyles and become urbanized.4 It has been estimated that there may be an additional 100 million people with asthma by 2025.3 Based on global burden of asthma, prevalence of current asthma symptoms in Iran was reported to be 5.5% in all age groups and approximately 10% in children.4

International surveys have been valuable sources for understanding and managing asthma. The International Study of Asthma and Allergies in Childhood (ISAAC) and other surveys have provided much needed information on the global patterns of asthma prevalence from childhood to adulthood and have generated new hypotheses for further testing and validation.5

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The prevalence of children’s asthma is a concern for both health authorities and the general population in terms of personal, social, and economic costs. For estimating the burden of asthma in children, a national health system requires many parameters. Prevalence of asthma is one indicator for this purpose. Many prevalence studies on asthma symptoms in childhood in Iran have been conducted, but few of these studies addressed the national prevalence of asthma symptoms alone. The present study attempts to estimate the prevalence of asthma symptoms in children at the national level by reviewing recent asthma symptom surveys in Iran. The aim of this study is to provide a clearer picture of the prevalence of asthma symptoms in children in Iran.

Methods

A review of asthma symptom surveys in Iran, conducted or published between 1998 and 2003, was undertaken by a general literature search. Keywords included “Asthma,” “Prevalence,” “Epidemiology,” “ISAAC,” and “Survey.” We searched the Iranian scientific and medical internet databases such as IRANDOC, IRANMEDEX, SID, and MAGIRAN for all documents such as Persian articles, dissertations, conference proceedings, and other reports about asthma. Then, we searched on PUBMED and Google for English articles and conference proceedings. The following initial selection criteria were used: observational survey design, patient reported outcomes, perceptions or data related to asthma management. Additional hand searching was performed on Persian dissertations and conference proceedings about asthma. Data from all studies were extracted in a systematic fashion into a large two-dimensional matrix. This approach simplified identification of subsets of surveys in which the methods, including design, populations, and outcomes, were sufficiently similar for possible pooled analysis. The following main criteria were used to structure the matrix: the period of data collection, the nature of data extraction (interview/self-reported questionnaire), and questionnaire type (standardized/ISAAC), location, design (cross-sectional/longitudinal), the sampling method, sample composition and size, and population demographics. After the “extraction phase”, appropriate data were selected. From a total of 142 surveys initially screened, 21 surveys (including some subpopulations of special studies) were selected. Two surveys were on adults and were excluded. Finally, 19 surveys, which were conducted on children less than 18 years using ISAAC protocol, were included in the study. A list and overview of the design of surveys reviewed are provided in Table 1.6-24 All studies were conducted in urban regions. We analyzed data using NCSS 2003 software (Number Cruncher Statistical System, Kaysville, Utah, USA).

### Table 1  Included studies on prevalence of asthma symptoms by first author or researcher, location, sample size, and percentages of prevalence

<table>
<thead>
<tr>
<th>Study number</th>
<th>Researcher/author</th>
<th>Place of study</th>
<th>Study or publication year</th>
<th>Sample size</th>
<th>Prevalence of asthma symptoms (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Janghorbani et al. [6]</td>
<td>Kerman</td>
<td>1998</td>
<td>2217</td>
<td>2.70</td>
</tr>
<tr>
<td>2</td>
<td>Heidarnazhad et al. [7]</td>
<td>Tabriz</td>
<td>2000</td>
<td>1147</td>
<td>3.95</td>
</tr>
<tr>
<td>3</td>
<td>Amra et al. [8]</td>
<td>Shahre Kord</td>
<td>1998</td>
<td>700</td>
<td>5.00</td>
</tr>
<tr>
<td>4</td>
<td>Abbasi et al. [9]</td>
<td>Guilan</td>
<td>2002</td>
<td>6060</td>
<td>5.60</td>
</tr>
<tr>
<td>5</td>
<td>Golshan et al. [10]</td>
<td>Borujerd</td>
<td>2000</td>
<td>1331</td>
<td>5.70</td>
</tr>
<tr>
<td>7</td>
<td>Golshan et al. [12]</td>
<td>Isfahan</td>
<td>2000</td>
<td>4069</td>
<td>7.30</td>
</tr>
<tr>
<td>8</td>
<td>Golshan et al. [13]</td>
<td>Isfahan</td>
<td>1999</td>
<td>3982</td>
<td>7.60</td>
</tr>
<tr>
<td>10</td>
<td>Mortazavi Moghadam et al. [15]</td>
<td>Birjand</td>
<td>2002</td>
<td>3540</td>
<td>10.10</td>
</tr>
<tr>
<td>11</td>
<td>Hatami et al. [16]</td>
<td>Bushehr</td>
<td>2002</td>
<td>2699</td>
<td>10.10</td>
</tr>
<tr>
<td>12</td>
<td>Boskabady et al. [17]</td>
<td>Mashad</td>
<td>1999</td>
<td>4781</td>
<td>15.85</td>
</tr>
<tr>
<td>13</td>
<td>Masjedi et al. [18]</td>
<td>Tehran</td>
<td>2001</td>
<td>6127</td>
<td>16.00</td>
</tr>
<tr>
<td>14</td>
<td>Zohal et al. [19]</td>
<td>Ghazvin</td>
<td>2003</td>
<td>5068</td>
<td>18.00</td>
</tr>
<tr>
<td>15</td>
<td>Golshan et al. [20]</td>
<td>Isfahan</td>
<td>1999</td>
<td>3986</td>
<td>19.60</td>
</tr>
<tr>
<td>16</td>
<td>Boskabady et al. [21]</td>
<td>Mashhad</td>
<td>2000</td>
<td>5534</td>
<td>21.70</td>
</tr>
<tr>
<td>17</td>
<td>Toootoonchi et al. [22]</td>
<td>Tehran</td>
<td>2001</td>
<td>611</td>
<td>21.90</td>
</tr>
<tr>
<td>18</td>
<td>Bazzzi et al. [23]</td>
<td>Gorgan</td>
<td>2003</td>
<td>2800</td>
<td>28.20</td>
</tr>
</tbody>
</table>

aAll studies were carried out by ISAAC protocol.
bOutliers (excluded from meta-analysis in second stage).
Forest plot was used for illustration of meta-analysis results. The size of the square represents the sample size of the corresponding study in the meta-analysis and the line represents the 95% confidence interval of an effect estimate. The pooled estimate is marked with a diamond. The confidence intervals of pooled estimates are displayed as a horizontal line through the diamond.25

Because the Cochran test showed heterogeneity, we used a random effect model. $Q$ is calculated by the formula given below:

$$Q = \sum W_i (\hat{P}_i - \bar{P})^2,$$

where $W_i = \frac{1}{\text{Var}(P_i)}$ and $\bar{P} = \frac{\sum_i W_i P_i}{\sum W_i}$.

$W_i$ is the weight, $\hat{P}$ is prevalence of asthma symptom in all population, and $P_i$ is prevalence of asthma symptom in the $i$th study. Analysis was conducted for four groups of data. At the first stage, all data were analyzed. In the second and third stages, outliers and data of Tehran surveys were excluded, respectively. Data of Tehran surveys were analyzed separately. Finally, we divided all the studies into three subgroups on the basis of the time of the study: before year 2000, 2000, and after 2000, and then we repeated the data analysis by this categorization.

Results

The 19 surveys reviewed included a total of 61,076 subjects less than 18 years from 13 provinces of Iran. The prevalence of asthma symptoms by ISAAC protocol varied from 2.7% in Kerman to 35.4% in Tehran. As shown in Table 1, prevalence of all asthma symptoms varied from 16 to 35.4% in all population of Tehran.

Prevalence of asthma symptoms is calculated as 13.14% (95% CI: 9.97–16.30%) of all studies (Table 1). Figure 1 gives the forest plot showing the prevalence of asthma symptom for each study and also pooled estimates for three situations. After deletion of outliers, analysis was repeated. In this situation, prevalence of asthma symptom was calculated as 9.56% (95% CI: 7.93–12.19%). In the last stage, data of Tehran was omitted and prevalence of asthma symptoms in all other regions of Iran was estimated as 11.07% (95% CI: 7.94–14.19%), which is shown in Figure 1. Prevalence of asthma symptom in Tehran only was calculated 24.41% (95% CI: 11.19–37.64%) using weighted mean of 8738 subjects in three surveys.

Prevalence of asthma symptom is calculated as 9.66% (95% CI: 1.99–17.32%), 9.52% (95% CI: 4.99–14.04%), and 18.11% (95% CI: 12.28–23.93%), respectively, for before year 2000, 2000, and after 2000. Figure 2 shows mean prevalence of asthma symptoms for each year from 1998 to 2003.
Discussion

Before discussing the findings, it is important to address methodological aspects of our study. The strength of this analysis is the relatively large number of studies nationally. All studies had followed the same protocol. The weaknesses of our study are that only one study (Masjedi, et al.19) is a true ISAAC study, but the other studies have used the ISAAC protocol and have not been part of the international ISAAC research program and have therefore not been part of the international data center checks of the data and methodology. One survey had been conducted in children aged 5 years (Tootoonchi22). The ISAAC protocol did not cover this age group. The present review of 19 patient surveys indicates that prevalence of asthma symptoms in Iranian children is between 2.7 and 35.4%. There are many differences in the prevalence of asthma in different regions in Iran, and it is similar to other studies that showed the existence of geographic differences, within and between countries.26

Although many environmental risk factors for asthma have been identified, such as animal, mite, other allergens, cigarette smoke, genetics, and air pollutants,27 the reasons for this variation in prevalence are unclear and likely to be related to several factors such as differences in lifestyle, diversity of climates, and herbaceous coverage in different parts of Iran. Iran’s climate ranges from arid or semiarid to subtropical along the Caspian coast and the northern forests. On the northern edge of the country (the Caspian coastal plain), temperatures nearly fall below freezing, and it remains humid for the rest of the year. The northern part of Iran is covered by dense rain forests called Shomal or the Jungles of Iran (Gorgan). Kerman is a sprawling city at the margin of Dasht-e Kavir, Iran’s largest desert. Tehran is the capital of Iran and the largest city in the Middle East and is the most populated city in Southwestern Asia with a population over 7 million, and most Iranian industries are headquartered in Tehran.

A number of protective factors against asthma onset have been identified including having been breastfed for more than six months and having older siblings. There are a number of groups at greater risk of developing asthma. Infants born at a low weight are also believed to be at increased risk of developing asthma during childhood or adolescence.1

The present analysis shows that the prevalence of asthma symptom in Iranian children is higher than in the international reports about Iran.4 Based on international evidence, the first hypothesis to explain the increasing prevalence of asthma symptom is the increasing proportion of population overweight or obese and this trend parallels the increasing prevalence rate of asthma.28 The second hypothesis has become known popularly as the “hygiene hypothesis.” Several studies have shown that having older or a greater number of siblings protects a child from developing asthma.29,30 In addition to the overweight/physical activity hypothesis and the hygiene hypothesis, many investigators have sought to identify specific environmental exposures associated with the development of asthma. With the exception of specific work-related exposures,31 there are no results for describing this at a national level in Iran. This condition has created a need for more information regarding asthma in Iranian children.

The prevalence of asthma symptom varies worldwide, possibly because of different exposure to respiratory infection, indoor and outdoor pollution, and diet. It is unclear why the variation in the prevalence of asthma is so large. The most comprehensive survey is the ISAAC (International Study of Asthma and Allergies in Childhood) program, the largest standardized international study of asthma prevalence in children ever undertaken. It obtained data on asthma prevalence in over 700,000 children from 156 centers in 56 countries worldwide, including 5873 children from Rasht and Tehran centers in Iran in 1998.5 In the first ISAAC program, prevalence of asthma symptom in Iranian children was reported as 10.9% and average of this prevalence in Middle East region is 10.7%, which varied from 7.5% in Morocco to 17% in Kuwait.5 This regional difference is due to special socioeconomic status, high urbanization, diversity of climates, and specific herbaceous coverage especially in the northern part of country and air pollution in industrialized and larger cities such as Tehran.

After 6 years, in the second ISAAC program, the prevalence of asthma symptoms in Iranian children was estimated as 13.2% (6065 subjects) in 2004. According to this report, the absolute yearly rate of increase in asthma symptoms in Iran is 0.38%.32 Pearce, et al. showed that mean yearly rate of increase in asthma symptoms in the world is 0.06% and 0.13% in 13–14 years and 6–7 years old children, respectively, from 1998 to 2004.33 It seemed that yearly rate of increase in asthma symptoms in
Iran is higher than the world trend. If the trend is indeed increasing, we would expect a 15% prevalence of asthma symptoms in Iranian children by 2012. As shown in Figure 2, the present meta-analysis showed the prevalence of asthma symptoms in Iranian children is an increasing pattern from 1998 to 2003, but slightly decreased at 2000 and 2002. According to this analysis, the prevalence of asthma symptoms in primary school age children is higher than that in junior high school age children in Iran, and it is similar to other international reports.

This meta-analysis showed the prevalence of asthma symptoms in Iran is higher than in the first report of ISAAC, but it is very close to recent ISAAC reports about Iran. According to this analysis, asthma symptoms impact nearly 1.5 million children in Iran, and if the trend is continued, nearly 3.2 million children will suffer from asthma symptoms in 2012.

The prevalence of asthma symptoms varies in different parts of Iran, but the reason for this variation in prevalence is unclear. As described previously, this national difference is probably due to indoor and outdoor pollution, industrialization, urbanized lifestyle, overweight and obesity in Tehran; specific herbaceous coverage and other allergens such as mites and animals in Gorgan with a higher prevalence; and low humidity and aridity in Kerman with lower prevalence of asthma symptoms.

This information can be used to help prioritize asthma prevention and control within the range of Iranian public health concerns, as well as to provide information needed for asthma prevention and control planning throughout the country. The public health community has not yet adequately focused on gaining an understanding of the asthma epidemic. Without this, prevention is not possible. Unfortunately we have large gaps in knowledge about the prevalence, severity, and morbidity of asthma in the general population to accurately assess the burden of asthma and make international comparisons.

References


