

# Asthma prevalence in Iranian guidance school children, a descriptive meta-analysis

Jafar Hassanzadeh<sup>1</sup>, Abolfazl Mohammadbeigi<sup>2</sup>, Ali Mousavizadeh<sup>3</sup>, Mojtaba Akbari<sup>4</sup>

<sup>1</sup>Department of Epidemiology, School of Health and Nutrition, Research Centre for Health Sciences, Shiraz University of Medical Sciences, Shiraz, Iran. <sup>2</sup>PhD student, Department of Epidemiology, Qom University of Medical Sciences, Qom, Iran. <sup>3</sup>PhD student, Department of Epidemiology, Yasuj University of Medical Sciences, Yasuj, Iran. <sup>4</sup>Vice chancellor for research, School of medicine, Isfahan University of Medical Sciences, Isfahan, Iran.

**Background:** The morbidity and mortality of asthma have risen among children, especially those under 18, during the past 3 to 4 decades. There are various single studies in different target populations of Iran, which have reported different estimations. The present study designed in order to estimate a pooled prevalence among Iranian guidance school children. **Materials and Methods:** After searching for relevant articles in international and local databases from 1997 to 2009, we found 16 relevant articles and studies having the inclusion criteria. The outcome measure was the prevalence of asthma, and forest plot was used for presenting the findings of the meta-analysis. Heterogeneity between the studies was evaluated by the Cochran test. Moreover, the random effects model was used for estimation of pooled measures in Stata software (version 10). **Results:** From all the entered studies, 10 articles were published in English and the rest in Persian language. The pooled estimates for females, males and both genders were calculated as 3.9% (95% CI: 3.2% - 4.6%), 5% (95% CI: 4.2% - 5.8%), and 4.4% (95% CI: 3.7% - 5.1%), respectively. **Conclusion:** The prevalence of asthma among Iranian children varied from 1.26% to 11.6%, which is possibly due to the difference in sex, ethnicity race, and socio-economic level of Iranian population. Also, the prevalence of asthma among Iranian guidance school children was lower in comparison to the other neighborhood countries.

**Key words:** Asthma, children, ISSAC, Iran, meta analysis, prevalence

## INTRODUCTION

The prevalence of allergic diseases has an upward trend in children, in the world. Among the wide spectrum of such diseases, asthma is the most common, dangerous, and life-threatening chronic disease.<sup>[1]</sup> The morbidity and mortality of asthma have risen in children during the past 3 to 4 decades.<sup>[1-4]</sup> However, some decreasing trends have been observed in developing countries with the number of asthma-related deaths declining in recent years.<sup>[2]</sup> Moreover, it has affected all age groups, especially those younger than 18 years old.<sup>[1]</sup>

The ISAAC program was a worldwide strategy for determination of the prevalence of asthma in developed as well as developing countries.<sup>[5]</sup> This program provides a simple and unique method for measuring asthma and allergic diseases in childhood, which is appropriate for any place and language.<sup>[6]</sup> It has also facilitated an estimation and comparison of the prevalence of asthma by using a standard questionnaire for data collection in both international and regional

levels.<sup>[5]</sup> Phase one of the ISAAC was developed based on the considerable interest, for an estimation of the current prevalence and projection of future trend of asthma as well as other allergic diseases in western and developing countries.<sup>[6]</sup>

An increasing trend of prevalence of asthma started from the 1970s, and now, the worldwide prevalence of this disease has been estimated to be 4% to 7%.<sup>[7]</sup> The results of the first International Study of Asthma and Allergies in Childhood (ISAAC) showed that the prevalence of asthma symptoms in different countries varied from 1.6% to 36.8%,<sup>[1,5]</sup> but this is related to age, race, gender, and residency place.<sup>[1]</sup> There are many studies on an evaluation of asthma prevalence among Iranian children in different cities.<sup>[5,8-33]</sup> These studies show that the prevalence of asthma varied from 1%<sup>22</sup> to 9.8%<sup>5</sup> and 35.4%<sup>12</sup> in ISSAC and non-ISSAC questionnaire based surveys. Another meta-analysis study estimated the prevalence of asthma in Iranian primary school age children as 3.9%, which ranged from 3.2% to 4.7%.<sup>[34]</sup> Also, in some studies, these estimates were different regarding sex.<sup>[5,12]</sup>

**Address for correspondence:** Dr. Abolfazl Mohammadbeigi, Department of Epidemiology, Health School, Qom, Iran.

E-mail: beigi60@gamil.com

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Meta-analysis is a method, which increases the power and precision of single studies by raising the sample size.<sup>[35]</sup> An application of meta-analysis for combining the results of observational studies gives a reference estimate, which is appropriate for health professionals as well as for policy makers.<sup>[36,37]</sup> Therefore, concerning the variety of studies conducted on different target populations with a considerable heterogeneity, the present study aims to estimate an overall prevalence of asthma in Iranian guidance school children. [Figure 1]

## MATERIALS AND METHODS

We searched for relevant articles in international databases, including Medline, Pub-med, ISI, Google Scholar, and Scopus, and local databases such as, Scientific Information Database (SID), Iranmedex, and Irandoc, from 1997 to 2009. The key words of the research were asthma, prevalence, children, Iran, and ISSAC. After fulfilling a complete search, 63 related articles were founded. Reference lists of the searched articles were reviewed to identify additional eligible studies, as well. The inclusion criteria were utilizing the ISSAC questionnaire as the data collection instrument, a sample size equal to at least 1000 individuals, and guidance school children as the target population. These criteria were selected based on the recommendations of ISSAC program.<sup>[6]</sup> It is suggested that a 3000-subject sample size is required for an estimation of severe asthma, but based on the population size, and limited resources as well as equipments of the research, it could decline to a 1000-subject one. Some studies, which had not reported the total prevalence of asthma, were excluded from the study. Therefore, the studies without the qualification criteria, such as the ones published in two languages or double report in congresses or journals, were excluded from the study.

In the second stage, all the articles found were reviewed by two reviewers independently based on both inclusion and exclusion criteria. In this stage, we read and summarized favorable studies, and finally 16 relevant articles were selected and applied in the analyzes. It should be noted that we recalculated the prevalence in one study.<sup>[11]</sup> Also, regarding a study, which had been published 3 times,<sup>[23-25]</sup> we used the results of the one which was more comprehensive compared to the others.<sup>[23]</sup>

An outcome measure was the prevalence of asthma, reported in the studies based on the question "ever asthma". The standard error of prevalence was calculated by binomial probability distribution. In addition, the heterogeneity between the studies was evaluated by the Cochran test. Moreover, random effect model with DerSimonian-Laird method was used for

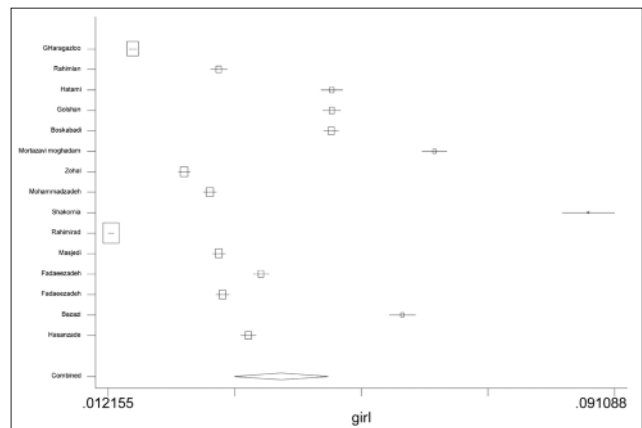


Figure 1: Forest plot of Asthma prevalence in Iranian female children

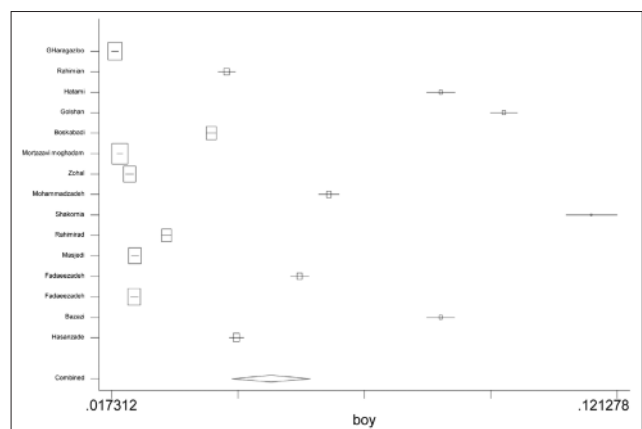


Figure 2: Forest plot of Asthma prevalence in Iranian male children

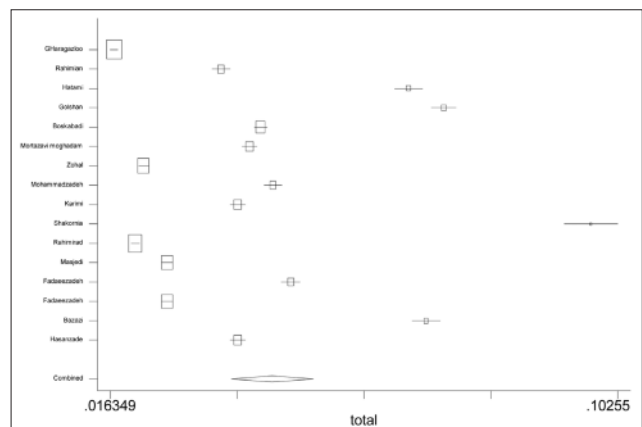


Figure 3: Forest plot of Asthma prevalence in Iranian guidance school children

estimation of pooled measures, which calculates the pooled estimate and confidence interval, based on the weighted least square (weighting is given by the reciprocal sum of between and within study variances).<sup>[38]</sup> Publication bias was appraised by funnel plot and Begg as well as Egger regression tests. All the analyzes were performed through the Stata software (version 10). In addition, the significant level for the Cochran test was considered as 0.05.

## RESULTS

From the 63 studies which were found, 16 were relevant and had been published. From the 16 published articles, 10 were published in English and the rest in Persian. 10 study subjects (62.5%) were between 13 and 14 years old, while the age of the participants in other studies varied from 11 to 16 years old. Table 1 shows the details of the study subjects based on the total prevalence of asthma, regarding sex, and sample sizes.

15 studies were used in the calculation of the pooled estimate for males and females, while 16 studies were utilized for the overall estimation. Plot 1 shows the pooled estimate of the females. It is obvious that the prevalence of asthma varied from 1.26% to 8.7% in the study subjects, and the pooled estimate was equal to 3.9% (95% CI: 3.2% - 4.6%). The range of the prevalence of asthma and the pooled estimate of the males are presented in plot 2. The range of the prevalence of the disease between studies in males was wider than that of the females and varied from 1.8% to 11.6%. The pooled estimate was calculated as 5% (95% CI: 4.2% - 5.8%). Also, the total prevalence of asthma among the Iranian guidance school children can be observed in plot 3, varying from 1.7% to 9.8%. Moreover, the pooled estimate of the meta-analysis was equal to 4.4% (95% CI: 3.7% - 5.1%).

## DISCUSSION

The overall pooled estimate among the Iranian guidance-school children is equal to 4.4%, whose confidence interval changes from 3.7% to 5.1% in different places. The pooled prevalence estimate was higher in males, comparison to females. In another systematic review, conducted on Iranian people younger than 18 in 2003, the pooled estimate was

equal to 13.14% (95% CI: 9.97 - 16.30%).<sup>[16]</sup> This difference is due to investigating the prevalence, based on “history of wheezing in the past 12 months” replaced by “ever asthma”.<sup>[11,15,19,39]</sup> Also, Entezari’s study<sup>[16]</sup> reported that, all the single studies have been conducted based on the ISSAC protocol; however, one of the studies did not have this criterion.<sup>[10]</sup> This study reported the prevalence as 39.5%, which highly affects the pooled estimate. However, ascertainment methods and case definitions could change the asthmatic patients as well as the prevalence of asthma in different observational researches.<sup>[41]</sup> In order to decrease the controversies among the studies, based on different case definitions, such as parental reports of past asthma diagnosis, history of wheezing, asthma medication use, and documentation of asthma diagnoses as well as medication in the medical chart. Nevertheless, in the present study, only single studies, which applied the ISSAC instrument for data collection, were used.

In another study, conducted on Asian and European primary school children in Southampton,<sup>[42]</sup> it was found that the number of children with “diagnosed as asthma” was 6.2%. Although the study participants were migrants, they were from a wide range of Asian countries and were comparable with our subjects. This implies that the prevalence of asthma in Iranian children was less than the Asian children.

Pal *et al.* conducted a systematic review and meta-analysis on Indian children by using 15 relevant articles, selected among 300 published articles and scientific meetings from 1966 to 2008. They estimated the mean prevalence and overall weighted mean prevalence to be equal to 7.24% and 2.74%, respectively. In addition, in comparison to 6-7 years old children, the prevalence of childhood asthma was less

**Table 1: Characteristics of single studies included in the Meta analysis**

Author	City	Year	Sample size	Girl prevalence	Boy prevalence	Total prevalence
Gharagazloo <i>et al.</i> <sup>[17]</sup>	Kashan	2003	2533	1.6	1.8	1.7
Rahimian <sup>[27]</sup>	Yazd	1997	1900	2.94	4.1	3.52
Hatami <i>et al.</i> <sup>[28]</sup>	Boshehr	1998	2699	4.7	8.5	6.7
Golshan <i>et al.</i> <sup>[19]</sup>	Esfahan	1999	3924	4.7	9.8	7.3
Boskabadi <i>et al.</i> <sup>[15]</sup>	Mashhad	2000*	5534	4.69	3.78	4.19
Mortazavi moghadam <i>et al.</i> <sup>[31]</sup>	Birjand	2002	3540	6.3	1.9	4
Zohal <i>et al.</i> <sup>[39]</sup>	Ghazvin	2003	2550	2.4	2.1	2.2
Mohammadzadeh <i>et al.</i> <sup>[32]</sup>	Babol	2003	2889	2.8	6.2	4.4
Karimi <i>et al.</i> <sup>[20]</sup>	Yazd	2003	3060	---	---	3.8
Shakornia <i>et al.</i> <sup>[5]</sup>	Ahvaz	2007	1450	8.7	11.6	9.8
Rahimirad <i>et al.</i> <sup>[40]</sup>	Uromieh	2007*	3000	1.26	2.86	2.06
Masjedi <i>et al.</i> <sup>[9]</sup>	Tehran	2000	3125	2.94	2.21	2.6
Fadaeezadeh <i>et al.</i> <sup>[24]</sup>	Rasht	2002	3009	3.6	5.6	4.7
Fadaeezadeh <i>et al.</i> <sup>[24]</sup>	Tehran	2002	3125	3	2.2	2.6
Bazazi <i>et al.</i> <sup>[26]</sup>	Gorgan	2003	2800	5.8	8.5	7
Hasanzadeh <i>et al.</i> <sup>[30]</sup>	Shiraz	2009	3000	3.4	4.3	3.8

among the 13–14 years old ones.<sup>[7]</sup> The ISSAC screening committee study also reported the prevalence of asthma in Eastern Mediterranean region countries, such as Kuwait (17.5%), Lebanon – Beirut city (11.6%), Oman- Al-Khod city (20.7%), and Pakistan-Karachi city (7.3%).<sup>[6]</sup> Therefore, the overall prevalence of asthma in Iranian children is founded to be lower compared to the neighborhood countries' children because the upper limit of the pooled estimate is lower than the estimated prevalence of these countries.

The results of a systematic review on 48 single full studies since 1990 to 2008 showed no evidence of declining asthma prevalence in the international trend of the disease in adults and children; however, in this review, a gap was observed in the literature in Africa as well as in some parts of Asia.<sup>[43]</sup> Therefore, any reduction in health care and health utilization might have undesirable results related to the future of the disease.

According to our results, the prevalence of asthma varied from 1.26 to 11.6 in Iranian children. Because of the different socio-economic and geographic factors, sex, ethnicity, and race of Iranian population, we observed heterogeneity among the studies. In order to reduce the within sex heterogeneity variance, the data were separately analyzed, based on sex.

Although we searched all the published and non-published studies to remove the publication bias, the funnel plot had an asymmetric shape. However, it may be a sign of publication bias. In addition, it should be noted that the funnel plot is useful in case there is a wide range of studies with different sample sizes.<sup>[38]</sup> Moreover, regarding the ISSAC recommendations, only the studies with larger than 1000 sample sizes were included in the present study.<sup>[6]</sup> Also, it should be emphasized that a skewed funnel plot may be created by factors other than the publication bias. For example, it has been shown that if the quality of the studies varies with the study size, a funnel plot may give the visual impression of publication bias while it is really confounded by the study quality. Also, differences in the underlying risk among the population of the primary studies and chance are other factors, which can cause the skewed funnel plot.<sup>[38]</sup> However, we assumed that difference in the underlying risk among the studies populations causes the skew of funnel plot.

Nevertheless, the studies which had been conducted on the 6-7 year old children were excluded from the present study because the children's age was a source of heterogeneity, especially in children's asthma, and at the same time, ISSAC designed two different questionnaires for the two age groups. Therefore, a limitation of the current study can be the fact that it cannot estimate the pooled estimate for all the Iranian children.

The results of this study showed that the prevalence of asthma in Iranian children ranges from 1.26 to 11.6. It is possibly due to different socio-economic and geographic factors, sex, ethnicity, and race of Iranian population. However, the overall prevalence of asthma in Iranian children is founded to be lower than the children in neighborhood countries.

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