

# Asthma in Iranian Schoolchildren: Comparison of ISAAC Video and Written Questionnaires

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## Abstract

**Background:** The international study of asthma and allergies in childhood (ISAAC) is used to define the prevalence and severity of asthma in different regions. In this study we followed the performance of the ISAAC video and written questionnaires (VQ and WQ) to classify asthma in 13-14 yr-old schoolchildren.

**Methods:** The present study was carried out on 3540 schoolchildren 13 to 14-yrs-old using the VQ and WQ. The students were also asked to answer a separate question if they had ever been clinically diagnosed as asthmatic. The Kappa index was used to find degree of agreement between VQ and WQ regarding asthma symptoms. The sensitivity, specificity and Youden's index of both questionnaires were also determined.

**Results:** The most frequent asthma symptom was wheeze after exercise in both VQ (15%) and WQ (23%). Correlations between positive responses to the corresponding questions in the VQ and WQ were significant ( $P < 0.001$ ). The sensitivity of both questionnaires to the question of asthma diagnosis by physician ranged between 0.16 and 0.68. Except for wheeze limiting speech and current wheeze, the WQ had higher value of Youden's index (0.25 - 0.46). The specificity of questions in VQ for asthma diagnosis by physician was ranged between 0.84 and 0.99.

**Conclusion:** Both WQ and VQ had low sensitivity, but WQ showed higher value of Youden's index and the VQ exhibited good specificity. Therefore, one may consider the WQ for prevalence and VQ for relative risk studies.

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**Keywords** • Asthma • ISAAC • prevalence • childhood

## Introduction

**A**sthma has been a major public health issue worldwide. Attempts were made to standardize the methods used for comparing the prevalence and severity of asthma. In this context, the two international studies on asthma in children, the international study of asthma and allergy in childhood (ISAAC), and in young adults, the European community respiratory health survey (ECRHS) have recently been recommended for comparing the prevalence of self reported asthma and asthma-like symptoms worldwide.<sup>1,2</sup> A striking feature of both protocols is the high rate of asthma symptoms in countries where the predominant language is English.<sup>1</sup>

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The geographic variability might be affected by some language bias because the questionnaires that used for these surveys were originally prepared in English.<sup>1,2</sup>

To overcome problems that associated with the written questionnaire (WQ), ISAAC has developed and validated a video questionnaire (VQ) to study the prevalence of asthma symptoms in 13 to 14-yr-old children.<sup>3-8</sup> Some studies have compared VQ and WQ for estimation of prevalence of asthma.<sup>1</sup> Recent studies also have compared the results of the ISAAC core questions with other indicators of asthma and showed an acceptable level of sensitivity and specificity for multicenter international comparisons.<sup>5,7,9</sup> However, the data of each region must be checked for the validity of both types of questionnaires provided by ISAAC.

We therefore, examined the performance of the ISAAC VQ and WQ to predict asthma diagnosis in epidemiological studies in schoolchildren aging 13 to 14 yrs. We also investigated the degree of agreements between the two questionnaires.

### Subject and Methods

Approval for this study was first obtained from the Research Committee of Birjand University of Medical Sciences, followed by permission from every school manager. The present study was performed on 3540 schoolchildren (51% males and 49% females) aged 13-14 yrs, in the city of Birjand, East of Iran. A minimum of 3000 children is needed to evaluate the ISAAC study version.

The study was made for each class separately and the students were informed about the objectives of the study and asked first to complete WQ. The WQ was translated by the researcher to Farsi, then translated back into English by an independent translator and then converted into Farsi with some modifications and re-evaluated by a small group of the students. Different symptoms of asthma were then shown, using five sequences of the VQ. The students recorded their experience on a sheet after each sequence during the observation of the video scenes. The questionnaires were reviewed and attempts were made for

assurance of completeness of WQ and VQ. As recommended by the ISAAC committee, the responses to the wheeze at rest, wheeze during exercise, and nocturnal wheeze were combined when measuring current wheeze as defined for prevalence of any wheeze in the past 12 months. Finally, on a separate sheet a question was asked if the student had ever been diagnosed by a physician as asthmatic, depending on these answers, they were placed into asthmatic and non-asthmatic groups. The subjects were then analyzed in terms of their responses to both questionnaires.

### Statistical analysis

The Kappa statistic was used to measure the degree of agreements between the two questionnaires regarding to asthma symptoms. The diagnostic performance was defined as indices of sensitivity and specificity of each question in the VQ and WQ, in relation to self-reported asthma diagnosis by a physician. To evaluate the accuracy of these questions for self-reported asthma diagnosis by physician, the Youden's indices of both questionnaires were also determined as the following:<sup>10</sup>

$$\text{Youden's Indices} = \text{Sensitivity} + \text{Specificity} - 1$$

### Results

The past prevalence of diagnosed asthma by the physician was 2.3% (asthmatic group). The most frequent asthma symptom was wheeze after exercise in both VQ and WQ (Table 1). Except for wheeze limiting speech, the prevalence of asthma symptoms was higher according to WQ than VQ version ( $P < 0.05$ ) (Table 1). Correlations between positive responses to the corresponding questions in the VQ and WQ were weak with Kappa indices of less than 0.4; however, they were statistically significant (Table 1). The sensitivity of both questionnaires to the question of asthma diagnosis by physician was low ranging between 0.16 and 0.68. Except for wheeze limiting speech and current wheeze, the WQ value ranged between 0.25 and 0.46, as indicated by Youden's index (Table 2). Nocturnal wheeze

**Table1:** Differences between the prevalence and the degree of agreement of self-reported asthma symptoms based on VQ and WQ.

Symptoms	Differences in prevalence		P value	Degree of agreement	
	VQ (%)	WQ (%)		KP	P value
WH at rest	197 (5.6)	254 (7.2)	0.01	0.28	0.001
WH after exercise	527 (15%)	829 (23.5%)	0.00	0.37	0.001
NW	48 (1.4%)	123 (3.5%)	0.00	0.17	0.001
NC	333 (9.4%)	779 (22%)	0.00	0.3	0.001
WH limiting speech	156 (4.4%)	150 (4.3%)	0.78	0.28	0.001
Current WH	636 (18%)	895 (25.4%)	0.00	0.40	0.001

WH = Wheeze; NW=Nocturnal wheeze; NC = Nocturnal cough

in VQ had 99% specificity for asthma diagnosis by physician. The specificity of VQ for asthma diagnosis by physician was generally high ranging between 0.84 and 0.99 (Table 2).

**Table 2:** Sensitivity (SN), Specificity (SP), and Youden's index (YI) for items of self-reported asthma diagnosis in terms of Video (VQ) and Written (WQ) questionnaires (Q). KP=Kappa index

symptoms	Type Q	SN	SP	YI
WH at rest	WQ	0.52	0.94	0.46
	VQ	0.37	0.95	0.32
WH after exercise	WQ	0.68	0.77	0.46
	VQ	0.49	0.86	0.35
NW	WQ	0.29	0.97	0.26
	VQ	0.16	0.99	0.15
NC	WQ	0.54	0.78	0.33
	VQ	0.40	0.92	0.32
WH limiting speech	WQ	0.36	0.96	0.32
	VQ	0.48	0.96	0.34
Current WH	WQ	0.44	0.81	0.25
	VQ	0.60	0.84	0.44

For more abbreviations see the legend of Table 1.

## Discussion

Asthma is a syndrome without a single defining laboratory test and with no consensus on a gold standard objective for its definition. Various approaches to its diagnosis include objective measures of the disease, such as airway hyper-responsiveness, pulmonary function tests and serum IgE.<sup>11</sup> Diagnosis of asthma by a physician is also considered as a gold standard for epidemiologic definition of asthma.<sup>12</sup> All of these methods potentially introduce an observational bias with subsequent erroneous classification into epidemiological surveys.<sup>11</sup> This bias is greatest before the age 6 yrs and after the age of 40 yrs, when other conditions that mimic asthma with significant frequency and when parental history, such as smoking and gender may greatly influence diagnosis labeling by clinician.<sup>11</sup>

In 1991 the ISAAC protocol was formed to standardize the methodology of epidemiological research of asthma and other atopic disorders that have attracted large scale participation from all part of the world.<sup>1</sup> ISAAC protocol was used on 463801 schoolchildren aged 13-14 yrs in 155 centers from 56 countries worldwide.<sup>1</sup> Comparison of the results from the ISAAC study, showed that variations in the prevalence of asthma symptoms between countries were more than 15-fold.<sup>1</sup> Because the questionnaires were designed in English language, one may attribute these geographic variations to some language biases, although very few problems were perceived in translating the questionnaires.<sup>1,2</sup> A high prevalence of asthma symptoms was also observed in Spanish and Portuguese speaking centers in South

America.<sup>1</sup> The VQ completed for the 13-14-year-old groups in 99 centers from 42 countries showed a similar pattern of prevalence of asthma symptoms but with a lower rate.<sup>1</sup> In addition, the magnitude of the differences in prevalence of asthma symptoms between countries is so remarkable that they cannot be explained on the basis of language biases.<sup>1,2</sup>

In the present study, we used the ISAAC protocol to find the symptoms suggestive of asthma in our region. Except for wheeze limiting speech, our study showed a higher prevalence of asthma symptoms in WQ than VQ (Table 1). However, in the present study the prevalence of asthma symptoms was not as high as it was in some western countries.<sup>1</sup>

The ISAAC WQ and VQ are rather simple, but subjective measures in epidemiological studies used in large-scale population based studies around the world.<sup>1</sup> Recent studies have compared the results of the ISAAC core questions with objective measures of asthma and showed an acceptable level of sensitivity and specificity for multicenter international comparisons.<sup>5,7,9</sup> Physician diagnosis may have limitations in terms of objective measures of asthma, however, it is primarily a critical element in the evaluation of asthma.<sup>11</sup> The question about physician-diagnosed asthma has previously been shown to have good specificity, although it may have lower sensitivity compared to a physician's opinion.<sup>13</sup> Therefore, in our study questions about asthma diagnosis by physician was taken as a objective measure for defining asthma.

In respect of the sensitivity, the present study showed a slightly better performance of WQ in predicting asthma diagnosis than VQ (Table 2). Except for "wheeze limiting speech", the WQ had higher Youden's index than VQ. Conversely, "current wheeze" in the VQ gave a higher value of Youden's index for asthma diagnosis than "current wheeze" in the WQ. However the highest value for Youden's index in both questionnaires was 0.46, which was not significant. In contrary to these results for sensitivity and Youden's index, the specificity of questions ranged from 0.77 for "wheeze after exercise" in WQ to 0.99 for "nocturnal wheeze" in VQ (Table 2). Our study also showed that the specificity of questions in VQ were better than corresponding questions in the WQ.

The response to video scene "nocturnal wheeze" in the VQ had the highest specificity (99%) for asthma diagnosis. A pilot study performed among New Zealand adolescents showed that the overall sensitivity and specificity for the prediction of bronchial hyper-responsiveness were similar in the VQ and

WQ.<sup>14</sup> Similar results were also obtained from a study conducted in Hong Kong.<sup>15</sup> However, our results were in agreement with a study performed in Italy, showing the specificity of any questions in VQ was better than corresponding questions in WQ.<sup>16</sup> Although, using clinical asthma as a gold standard, the overall accuracy of VQ was low in terms of sensitivity than WQ.<sup>16</sup>

In a group of Korean school children, the questions "nocturnal cough" and "nocturnal wheeze" in the VQ and questions "wheezing at rest" and "wheezing after exercise" in the WQ had a higher Youden's index for bronchial hyperactivity.<sup>17</sup> One problem in using the "presence of bronchial hyperactivity" as a gold standard for asthma was that many people reported no respiratory complaints.<sup>13</sup> Therefore, one explanation for these differences may be due to the poor specificity but better sensitivity of bronchial hyperactivity than physician's opinion in diagnosis of asthma.<sup>13</sup>

The second objective of this study was to assess the concordance between WQ and VQ in regard to asthma symptoms. This showed a weak agreement between the questions of two questionnaires. The results of our investigation was in agreement with those reported in Finland,<sup>18</sup> New Zealand,<sup>19</sup> Canada,<sup>20</sup> and Poland,<sup>21</sup> indicating that there was a weak concordance between corresponding questions in WQ and VQ. A study, conducted in a population of young people from a mixed ethnic background in Sydney (an area with a high proportion of people from a non-English speaking backgrounds) in Australia, compared the WQ and VQ for the detection of airway hyper-responsiveness to hypertonic saline, showed a good correlation between the two questionnaires for wheeze with a Kappa value of 0.42.<sup>22</sup> However, this was in contrast with the results of a study conducted on a group of 13-14-yr-old Korean school children that showed a poor agreement between the responses of the two questionnaires.<sup>19</sup> The prevalence of asthma symptoms in childhood is 30%-40% in Sydney of Australia that shows a good agreement between the two questionnaires.<sup>23</sup> The prevalence of asthma symptoms were not high in our region as was reported from Sydney.<sup>23</sup> One exception is New Zealand with high prevalence of asthma symptoms and a poor agreement between the two questionnaires.<sup>1,14</sup>

## Conclusion

The present analysis suggested that the WQ with higher values of Youden's index may be

preferred for the determination of prevalence of asthma symptoms in different populations. Conversely when the aim of the study is to estimate the relative risks, VQ as a more specific method may be more useful in cohort and case-control studies.

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