

# The Validity of the ISAAC Written Questionnaire and the ISAAC Video Questionnaire (AVQ 3.0) for Predicting Asthma Associated with Bronchial Hyperreactivity in a Group of 13-14 Year Old Korean Schoolchildren

To validate the prevalence rate of symptoms of asthma produced by the phase I ISAAC (International Study of Asthma and Allergies in Childhood) study, hypertonic saline challenge test was carried out during the phase II study at a year after the phase I study. For the phase II study, six middle schools from three cities in the phase I study were selected. Finally, 499 children who responded to both studies were analyzed. All subjects were asked to complete the written questionnaire (WQ) first, followed by a video questionnaire (AVQ 3.0) during the phase I study. Of the 499 children, only 19 (3.8%) were positive to the hypertonic saline bronchial challenge test. The degree of agreement between responses to the two corresponding questions "wheezing at rest" and "nocturnal wheeze" in the AVQ 3.0 and WQ were moderate and weak with a Kappa indices of 0.45 and 0.23, respectively. The question on "severe wheeze" in the AVQ 3.0 had the highest Youden's index among the five questions related to asthma symptoms in the previous 12 months, but its specificity was low whereas its sensitivity was 1.0. There was no consistency of priority between the two questionnaires in predicting bronchial hyperreactivity in a group of Korean schoolchildren. Therefore we need to develop more appropriate WQ or AVQ to compare the prevalences of asthma to other countries.

**Key Words :** Asthma; Prevalence; Bronchial Hyperreactivity; Questionnaires, Written and Video; Child

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## INTRODUCTION

Asthma has become a major public health issue worldwide because of its reported increases in prevalence, morbidity and mortality (1). The prevalence of asthma is also increasing in Korea (2-4). The Nationwide Study of Asthma and Allergies in Korean Children connecting with ISAAC (International Study of Asthma and Allergies in Childhood) was conducted to investigate the prevalence of asthma and allergy (phase I) (5, 6), and to examine the validity of this index (phase II). The phase III study, which aimed to determine the environmental and genetic risk factors of this disease, has been completed. ISAAC and we have reviewed our data from phase I.

Data are currently available from many countries around the world, but direct comparisons among studies are often limited by differences in the methodologies used (7). In an attempt to overcome this limitation, a standardized protocol has been developed for ISAAC, which is currently under way in more than 40 countries (8).

The ISAAC protocol for measuring asthma prevalence and

severity in 13-14 yr old schoolchildren comprises a self-completed written questionnaire (WQ) and a video questionnaire (AVQ 3.0). Use of the latter instrument is an attempt to overcome translation problems associated with the written questionnaire, as populations with different cultural and language backgrounds may vary widely in their interpretation of the same questions. The ISAAC video questionnaire comprises five scenes of young people of different ethnic origins manifesting the clinical features of asthma.

Lai et al. (7) have compared the AVQ 3.0 with WQ for estimating asthma associated with bronchial hyperreactivity (BHR) to methacholine using the data measured from a group of Chinese schoolchildren in Hong Kong. However, we have not yet checked the validity of these two types of questionnaires with our data for measuring asthma prevalence. Each country needs to check the validity of both types of questionnaire provided by ISAAC with its own local data. In this study, we have therefore compared the ability of AVQ 3.0 with that of Korean-translated ISAAC WQ to predict BHR to hypertonic saline in a group of Korean schoolchildren.

## MATERIALS AND METHODS

### Subjects

A total of 7,198 middle school students in 10 middle schools in Seoul and 24 in provincial areas were recruited randomly for sampling according to our sample frame. Three odd numbered classes were selected from the second and third grades, starting from the first class. All children in the selected classes, including those younger or older than the 13-14 age range, were surveyed in phase I. We eliminated some of the children who were out of the 13-14 age range from the data file. The response rates of Seoul and the provincial area were 95.6% and 98.3%, respectively. To validate the prevalence rate produced by the phase I study, we carried out a hypertonic saline challenge test during the phase II study. For the phase II study, we selected six schools from three cities among the middle schools which had been selected in the phase I study. Finally, we analyzed 499 children who responded to both studies.

### ISAAC International Video Questionnaire (AVQ 3.0)

The video questionnaire comprised five video sequences of young people with various asthmatic symptoms. The first three sequences showed various scenes of wheezing, and the final two displayed other asthmatic symptoms, such as moderate wheezing at rest (a Caucasian girl), wheezing after exercise (an African black boy), waking at night with wheezing (a Caucasian girl), waking at night with coughing (a Chinese boy), and a severe attack of asthma with wheezing and breathlessness at rest (an Indian girl). After each sequence, the students were asked if they have had the same experience shown in the video and, if so, the frequency of such symptoms was documented. Each question corresponding to a scene was printed on a one-page answer sheet which was completed during the viewing of the video. The whole video took about 7 min to show and the term 'asthma' was not mentioned during the presentation.

### ISAAC Written Questionnaire (WQ)

The ISAAC WQ on asthma included five questions which correspond to the five sequences depicted in the video questionnaire. They were:

1. Have you ever had wheezing or whistling in the chest?
2. Have you had wheezing or whistling in the chest in the last 12 months?
3. In the last 12 months, has your chest sounded wheezy during or after exercise?
4. In the last 12 months, how often, on average, has your sleep been disturbed due to wheezing?
5. In the last 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest

infection?

6. In the last 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?

These questions were translated into Korean by a person who is fluent in both English and Korean following the guidelines laid down by ISAAC. This was then back-translated into English by another bilingual person. The translated questionnaire was tested out in a small group of middle school children for modifications.

### Bronchial challenge

A bronchial challenge was carried out to all subjects with inhaled 4.5% hypertonic saline according to the protocol of the ISAAC study. After measuring normal resting spirometric function, the subjects inhaled doses of 0.9% saline for 30 sec using Pari Inhaler Boy (Pari Werk Gum BH, Germany), and one minute later, three measurements of FEV1 were recorded. The highest of these measurements was chosen as a baseline level. The next challenge period followed within three minutes of the end of the previous challenge. If the FEV1 fell less than 10%, the exposure time was doubled, i.e., 1, 2, 4, and 8 min time intervals, and spirometry was performed 60 sec after each of these intervals of the challenge with the aerosol. If the fall in FEV1 was between 10 and 15% the exposure time was kept the same. If the fall in FEV1 was greater than 15% or more than 23 mL of solution had been delivered to the inspiratory port of the valve, the challenge was stopped.

### Study design

In accordance with the ISAAC methodology, all subjects were asked to complete the WQ first, followed by the AVQ 3.0 during the phase I study. One year after the phase I study, we conducted the hypertonic saline bronchial challenge procedure with the selected children. Consent was obtained from the parents for both studies.

### Statistical analysis

For video questionnaire, we analyzed data from the answers to the sub-questions relating to symptoms experienced in the previous year and data from responses to the question "asthma ever". The Kappa index was used to find degree of agreement between the ISAAC AVQ 3.0 and WQ on asthma symptoms in the past 12 months. The sensitivity and specificity as the indices of diagnostic performance of each question in the AVQ 3.0 and WQ in the patients with BHR, and in the patients without BHR, respectively, were determined. The accuracy of these questions for diagnosis of BHR, combining sensitivity and specificity, was determined with the Youden's index (sensitivity+specificity-1) (9).

## RESULTS

Of the 499 children, only 19 (3.8%) were positive to the hypertonic saline bronchial challenge test. Correlations between responses to the two corresponding questions “wheezing at rest” and “nocturnal wheeze” in the AVQ 3.0 and WQ were moderate and weak with Kappa indices of 0.45 and 0.23, respectively, but were statistically significant at the level of 0.05. However, the questions “wheezing after exercise” and “severe wheeze” had weak degree of agreement between the two types of questionnaires. The degree of agreement of nocturnal cough between the questionnaires was poor (Table 1). The question on “severe wheeze” in the video questionnaire had the highest Youden’s index among the five questions related to asthma symptoms in the past 12 months and “asthma ever” in the two questionnaires gave a fair Youden’s index (Table 2). However, the specificity for the question on “severe wheeze” was low while its sensitivity was 1.0. The sensitivity, specificity, and Youden’s index of the question on “wheezing at rest” and “asthma ever” in the WQ were acceptable. In addition, there was no consistency for priority between the two questionnaires. But there was a significant difference, however, between the sensitivities of two questionnaires on each corresponding question ( $p < 0.05$ ).

## DISCUSSION

There is no universally accepted definition of asthma and

**Table 1.** Correlations between the ISAAC AVQ 3.0 and WQ on asthma symptoms in the past 12 months

Question	Kappa index	<i>p</i> -value
1. Wheezing at rest	0.45	0.0001
2. Wheezing after exercise	0.17	0.0918
3. Nocturnal wheeze	0.23	0.0418
4. Nocturnal cough	-0.11	0.1446
5. Severe wheeze	0.08	0.3520

Kappa index <0.4=weak degree of agreement, 0.4-0.75=moderate degree of agreement, >0.75=strong degree of agreement.

identification of asthma by questionnaires remains an important issue. In recent years, some studies have compared results of the ISAAC core wheezing questions with other indicators of asthma (7, 10-12), and have shown an acceptable level of sensitivity and specificity for the purpose of multicenter international comparisons.

This study helps to evaluate the effectiveness of AVQ 3.0 and WQ in estimating the prevalence of asthma using BHR to hypertonic saline as an objective marker of asthma. We have found that there are moderate and weak degree of agreement between the questions of the two questionnaires on “wheezing at rest” and “nocturnal wheeze” during the previous 12 months. However, the degree of agreement between the two questionnaires on other questions were rather poor. Although BHR may have some limitations as an objective measure of asthma (7, 13-19), it has been considered as one of the criteria for defining asthma epidemiologically (20). Therefore, BHR was taken as a criteria for defining asthma in this study.

The question “asthma ever” in WQ had the highest Youden’s index in one study (7), while the question “severe wheeze” in AVQ 3.0 had the highest predictor of BHR in the present study. Generally the Youden’s index (sensitivity+specificity-1) is the best single measure of validity for comparing differences in the prevalences of asthma between populations (21). BHR has a similar or higher specificity, but much lower sensitivity and Youden’s index, than the symptom questionnaire (21). The prevalences of asthma symptoms by the video questionnaire were generally lower than those by the written questionnaire for comparable questions, except that “severe asthma” on the video questionnaire usually exceeded “severe wheezing limiting speech” on the written questionnaire. These finding may be explained by the fact that signs obvious enough to be visible or audible on a video are likely to represent more severe symptoms than those by the written questionnaire (22). But all these results were from the centers of countries with high prevalences of symptoms of asthma in the ISAAC studies. The prevalences of symptoms of asthma were not so high in Korea compared to western countries (5, 6). The prevalences of asthma symptoms by AVQ were also lower than those by

**Table 2.** Sensitivity, specificity, and Youden’s index with 95% confidence intervals for BHR of each of the five questions relating to asthma symptoms within the previous 12 months in the AVQ

Question	Questionnaire	Sensitivity	Specificity	Youden’s index
1. Wheezing at rest	WQ	0.44 (0.40, 0.49)	0.79 (0.75, 0.83)	0.24 (0.00, 0.47)
	AVQ 3.0	0.17 (0.13, 0.20)	0.91 (0.89, 0.94)	0.08 (-0.10, 0.25)
2. Wheezing after exercise	WQ	0.35 (0.31, 0.40)	0.79 (0.75, 0.92)	0.14 (-0.09, 0.37)
	AVQ 3.0	0.75 (0.64, 0.86)	0.32 (0.20, 0.43)	0.07 (-0.38, 0.51)
3. Nocturnal wheeze	WQ	0.45 (0.38, 0.52)	0.56 (0.49, 0.63)	0.01 (-0.29, 0.31)
	AVQ 3.0	0.25 (0.14, 0.36)	0.68 (0.57, 0.80)	-0.07 (-0.51, 0.38)
4. Nocturnal cough	WQ	0.24 (0.20, 0.27)	0.90 (0.87, 0.93)	0.14 (-0.07, 0.34)
	AVQ 3.0	1.00 (1.00, 1.00)	0.21 (0.08, 0.33)	0.21 (0.08, 0.33)
5. Severe wheeze	WQ	0.27 (0.22, 0.31)	0.90 (0.87, 0.93)	0.17 (-0.06, 0.39)
	AVQ 3.0	1.00 (1.00, 1.00)	0.37 (0.17, 0.57)	0.37 (0.15, 0.59)
6. Asthma ever	WQ	0.61 (0.57, 0.65)	0.63 (0.59, 0.68)	0.24 (0.01, 0.47)
	AVQ 3.0	0.33 (0.29, 0.38)	0.86 (0.83, 0.89)	0.20 (-0.02, 0.42)

WQ in Korea (data not shown).

However, the questions "asthma ever" and "wheezing at rest in the last year" in WQ also gave fair indices on sensitivity, specificity, and Youden's index in this study. It was generally observed that both questionnaires were more specific than sensitive on BHR. It is, therefore, recommended that every country participating in the ISAAC study should conduct this kind of analysis, because there may be discrepancies or similarities of results among countries.

Our data indicate that the negative respondents by BHR were greater than the positive respondents by BHR in the positive respondents by WQ. That means the percentage of positive respondents from each question in WQ was much higher than the prevalence rate in BHR, resulting in a poor predictability of the questions.

We have shown that there is no priority between two types of questionnaires in predicting BHR in a group of Korean schoolchildren. The highest Youden's index was 0.37, which was not substantially high. Also the ability of AVQ 3.0 and WQ in estimating asthma associated with BHR was not good in our study. The overall pattern of international differences of AVQ 3.0 and WQ shown by ISAAC studies was similar with a good degree of agreement (22).

There are considerable variations of asthma symptom prevalences within regions (5). The high prevalence in English-speaking countries, especially in those most accustomed to using "wheezing" as a term in surveys, suggests there may be some language bias associated with the written questionnaire, as suggested by the findings of the ECHRS (European Community Respiratory Health Survey) (5, 22, 23), or that the population has a higher awareness of asthma. The validity of the questionnaire might vary among cultures and languages. Therefore we need to develop a more appropriate and acceptable WQ to compare the prevalences of asthma among countries.

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