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Prevalence and Severity of Symptoms of Asthma, Allergic Rhinitis, and Eczema in 10- to 15-Year-Old Schoolchildren in Central Taiwan

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SUMMARY The International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was distributed through 14 schools and was completed by 11,874 students out of which are parents of 4,167 children aged between 10 and 12 years old and 7,677 older children aged between 13 and 15 years in central Taiwan. The overall cumulative and 12-month prevalence of wheezing, rhinitis, and eczema were 7.4%, 43.0%, and 7.2%, respectively. It was shown that boys had significantly higher prevalence of wheezing and rhinitis ($p < 0.001$ and $p = 0.001$) when compared to girls in central Taiwan. The study also found that prevalence rates among younger children with symptoms of wheezing, rhinitis, and recurrent itchy rash in the past 12-month (8.2%, 44.4%, and 8.8%) were higher than that among older children (6.9%, 42.2%, and 6.3%, respectively). In conclusion, boys had significantly higher prevalence of wheezing and rhinitis than girls while younger children tend to have higher prevalence of the disorders than those that are older in age.

Allergic conditions constitute a serious public health problem in the modern society. Asthma, as an example, is one of the common chronic diseases observed during childhood, exerting considerable amount of impact on the child's quality of life. Many studies have shown an increase in the prevalence of asthma and other allergic conditions such as allergic rhinitis and atopic eczema in the child population within Europe[1-3] and in Asia.[4,5] Asthma has also been regarded as one prevalent chronic disease among children in Taiwan.[6] Our previous study indicated that the prevalence of asthma between children of 7 and 15 year old in northern Taiwan was 1.3% in 1974 and 5.1% in 1985.[6] Prevalence of asthma in children has also been increasing in northern Taiwan.[7] Although advances in disease treatment and management have been promoted, the morbidity and mortality rates of asthma have still risen throughout different parts of the world.[8-10] This trend of increasing prevalence and severity of asthma and allergies depicts considerable social and economic burdens of various levels, including those on patients, families, and societies.

Standardized questionnaire has been used as

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a tool to determine asthma prevalence for populations of different locations. In 1992, the International Study of Asthma and Allergies in Childhood (ISAAC) was developed[11] to gain insight into the epidemiology of asthma and other allergic diseases. ISAAC is a standardized methodology and practical tool for use in different areas and languages to compare the prevalence and severity of asthma and atopic diseases in different populations.[2-5,12-14] Comparison of prevalence rates between geographic regions and different time frames may help to identify factors that contribute to the development of these conditions in individuals.

ISAAC was first developed from merging of two multi-national collaborative projects investigating variations in childhood asthma at the population level.[15] This type of questionnaire design is comprised of three distinct phases. ISAAC Phase one was designed to measure the prevalence of childhood asthma, allergic rhinitis, and atopic eczema for international comparisons, allowing it to be suitable for studies conducted in different geographical locations and languages.[16,17] ISAAC Phase two would involve studies in informative centers of etiological factors. ISAAC Phase two aims to identify determinants of observed differences in prevalence rates such as the role of atopic sensitization and bronchial responsiveness, the influence of indoor exposures and lifestyle factors.[18] ISAAC Phase three was designed to investigate the effects of season variation on asthma, allergic rhinitis, and atopic eczema. In this particular phase, standardized prevalence data can be collected in a manner allowing depiction of trend for symptom prevalence as well as a comprehensive “world map”.

The purpose of this study was to investigate the prevalence of asthma, allergic rhinitis, and atopic eczema of school-age children in central Taiwan. Phase three surveys adhering to ISAAC protocols were used in this study in order to investigate the prevalence and severity of asthma, allergic rhinitis, and atopic eczema in children between 4th and 9th grades in central Taiwan.

MATERIALS AND METHODS

Study population and procedures

Data was collected through cluster sampling from a total of nine elementary schools and five junior high schools in central Taiwan. For the younger children population (10- to 12-year-old), questionnaires were completed at home by their parents, whilst the older children population (13- to 15-year-old) completed the questionnaires by themselves at school. For the former cohort, a total of 5,125 schoolchildren were recruited in this study, out of which 4,197 were returned and completed, yielding a response rate of 81.9%. A total of 8,350 schoolchildren were recruited for the latter group, out of which 7,677 returned and completed, yielding a response rate of 91.9%. The average response rate was 88.1%. As a result, valid questionnaires were collected from a total of 11,874 schoolchildren participants aged between 10 and 15 years. This study was approved by the Taichung City Ministry of Education and China Medical University Hospital (Institute Review Board, IRB).

Questionnaires

As mentioned previously, ISAAC is a standardized questionnaire designed to evaluate the prevalence and severity of symptoms of asthma, allergic rhinitis, and atopic eczema.[13] More specifically, researchers can conveniently use ISAAC to investigate the prevalence and severity of asthma, allergic rhinitis, and atopic eczema among children of different geographic locations within Taiwan. Chinese version of the questionnaire had been translated as a validity check according to defined guidelines.[1,8,15,17] In this project, ISAAC protocols were followed accordingly to investigate the prevalence and severity of asthma, allergic rhinitis, and atopic eczema in children between 10- and 15-year-old in central Taiwan.

Statistical analysis

Collected data was coded and processed using SPSS 12.0 for Windows. Description data was represented in frequency and percentage values by gender. The Chi-square test was used to compare prevalence of asthma, allergic rhinitis, and atopic eczema between genders. Estimates of the odds ratio (OR), standard errors, and 95% confidence intervals (95% CI) were based on the asymptomatic likelihood theory. A p value < 0.05 was set to determine level of significance.

Power calculations

With a sample size of 3,000 for each age group, the power to detect the difference in one year prevalence of wheezing and severe asthma between two populations was set at 99% and 90%, respectively, at the 1% level of significance.

RESULTS

Demographic characteristics of the responders

A total of 13,475 schoolchildren were recruited initially in this survey. The response rate of younger children (10- to 12-year-old) was 81.9% (n = 4,197) and the response rate of the older children (13- to 15-year-old) was 91.9% (n = 7,677). The younger children cohort has a mean age of 11.34 years with an almost equal distribution of age between boys and girls (boy = 11.33 years, girls = 11.34 years). The older children group, on the other hand, has a mean age of 14.15 years (boy = 14.29 years, girls = 14.06 years).

Overall cumulative prevalence of the children

The overall cumulative and 12-month prevalence of wheezing, rhinitis, and eczema in the younger children group were 7.4%, 43.0%, and 7.2%, respectively. Boys was observed having a higher reported prevalence of wheezing and rhinitis in the past 12 month period while compared to girls ($p < 0.001$ and $p = 0.001$, respectively). This trend, however, was not seen in the case of rhinitis in older children aged between 13-15 years. In this survey, atopic eczema was found to be a common problem in our population. A 7.2% prevalence of rash was also observed in the past 12 months. There were no significant gender differences for itchy rash or eczema ($p = 0.520$). The results indicated that the prevalence of “asthma ever” and “wheezing ever” was 14.6% and 15.2%. Boys tend to have higher reported prevalence than girls ($p < 0.001$). Overall cumulative prevalence of asthma, allergic rhinitis, and atopic eczema of the younger children is shown in Table 1. For the current status, boys had significantly higher rates of wheezing, exercise-induced wheezing, and nocturnal cough than girls within the past 12 months, indicative of a significant higher prevalence in boys than girls. The prevalence rate of “eczema ever” was 18.4%. Although atopic eczema was also a common problem, no significant gender difference was observed for itchy rash or eczema in this population.

Severity of the asthma, rhinitis, and eczema in children

Table 2 shows the levels of severity of symptoms for current wheezing, allergic rhinitis, and atopic eczema observed in the older children cohort, previously reported experiencing each specific allergic disorder. In this survey, limited speech was observed in approximately 18.9% of current wheezers in past 12 months (n = 530) who had severe wheezing. 63.2% of children with asthma had 1 to 3 attacks, 16.4% of children with asthma had 4 to 12 attacks, and 4.2% of these children suffered more than 12 attacks, all within the past 12-month period. In our study population, boys and girls possess no significant differences with regards to these findings. Furthermore, 6.8% of children with asthma experienced sleep disturbance caused by wheezing (more than one night per week). Again, no significant difference was obtained in this figure between boys and girls. Most problems seen in the older children were nasal problem and eczema. Analysis of the different symptoms of these two allergic diseases indicated that boys and girls did not exhibit any significant differences in severity.

Seasonal variation of asthma and rhinitis symptoms in children

Fig. 1 revealed similar pattern of symptoms between children aged 10-12 years and 13-15 years, which peaked in winter (November, December, and January). The pattern of seasonal variation of rhinitis had a more significant peak occurred from November to February as shown in Fig. 2.

DISCUSSION

The ISAAC questionnaire provides a simple standard means to help examine the worldwide prevalence of self-reported symptoms of asthma, allergic rhinitis, and atopic eczema in children. It has been previously tested and validated.[12] Its validity and repeatability have been confirmed in relation to bronchial hyperreactivity.[19] Lai and colleagues found that consistent responses to the questions about

wheezing ever and any wheeze within the past 12 months had a sensitivity of 85%, specificity of 91%, and positive and negative predictive values of 61% and 94%, respectively.

This study reports the results of an ISAAC questionnaire survey conducted in the central Taiwan involving 11,868 schoolchildren. It shows that currently boys seem to have higher reported asthma prevalence than girls. There was no significant gender difference, however, in younger children for the severity distribution of wheezing and atopic eczema symptoms in the past 12 months, including the number of severe wheezing that limited speech, wheezing attacks, and night awakening by rash except that boys had more daily activity affected by rhinitis. Among the older children, there was no significant gender difference for the severity distribution of wheezing and atopic eczema symptoms in the past 12 months, including the number of severe wheezing, rhinitis, and atopic eczema symptoms that limited speech, daily activity affected by rhinitis, and atopic eczema symptoms.

The previous studies have found that the prevalence of asthma increased significantly in Taiwan during the past 20 years.[6-8] According to the study report by Yan and his colleagues,[8] the prevalence of wheezing, rhinitis and eczema symptoms in the past 12 months in 1994 and 1995 and 2001 and 2002 in Taipei was 5.2% and 7.1%, 28.8% and 43.6%, 1.4% and 4.1%, respectively. The present study repeated survey using similar protocol in the same country at different region. Liao *et al.*[15] surveyed the prevalence of asthma, rhinitis, and eczema among schoolchildren 6 to 8 years of age in west Taiwan. Our results have determined the prevalence of asthma ever, rhinitis, and atopic eczema for schoolchildren in 4 to 6 grade in central Taiwan. Comparing the prevalence of asthma, rhinitis, and eczema between children in central and west Taiwan, similar results were shown such that children self-reported asthma and allergies of boys was higher in asthma and rhinitis than girls.

A worldwide trend has indicated increases in the prevalence of asthma.[1,7,20,21] Many studies have similar observation, the current prevalence of asthma boys tended to have higher reported prevalence than girls. This was consistent with other studies.[7,14,22]

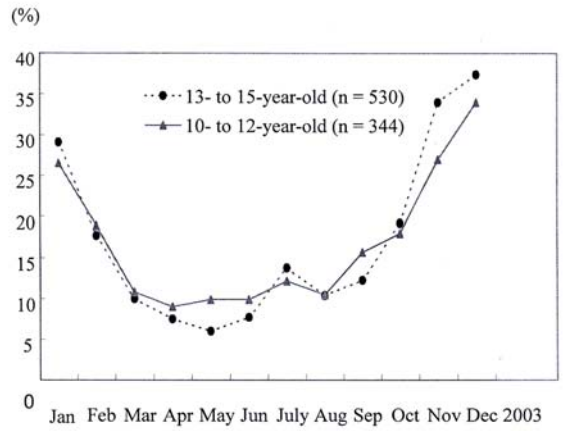

Fig. 1 Seasonal variations of wheezing symptoms.

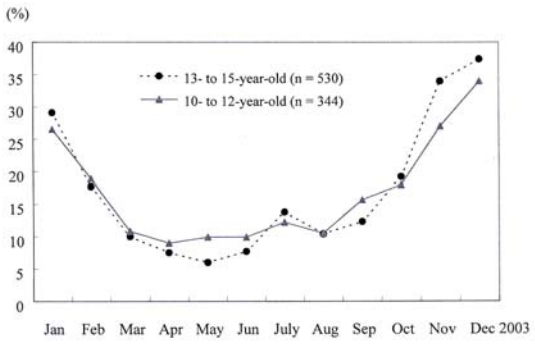

Fig. 2 Seasonal variations of rhinitis symptoms.

This study also shows higher rate of asthma attacks in winter season (November, December and January), especially in December in central Taiwan. There is a little difference between northern Taiwan and central Taiwan. Two peaks of asthma attacks of asthmatic children lived in northern Taiwan; one in winter and the other in summer season.[23,24] The possible reason may be from the warmer weather and drier condition in central Taiwan, compared to northern Taiwan, where generating only one prevalence peak in central Taiwan.

This trend of increasing prevalence and severity of asthma and allergies depicts considerable social and economic burdens on patients, families, and societies. Medical system, schools, and families need to cooperate to care for children with asthma,

allergic rhinitis, and atopic eczema. Parents and school teachers need to understand the risk factors at home and school in order to teach children with asthma on how to avoid risk factors and adapt to living with their disorders.

Our study provides an up-to-date description of the scale and distribution of asthma, rhinitis, and eczema in 10-15 year-old children residing in central region of Taiwan. The study provides a suitable baseline for monitoring future trends in the prevalence, and severity of asthma among the same children population in central Taiwan.

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