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Changing Prevalence of Asthma and Allergic Diseases among Kuwaiti Children

An ISAAC Study (Phase III)

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Asthma · Epidemiology · Allergic rhinitis · Eczema

Abstract
Objectives: To estimate the prevalence of asthma and allergic diseases in 13- and 14-year-old schoolchildren and to compare it with previous phase I data. ***Subjects and Methods:*** A survey of 2,922 third and fourth grade students from randomly selected intermediate level schools across Kuwait was conducted. Supervised, self-administered, written and video questionnaires of the International Study of Asthma and Allergies in Childhood (ISAAC) was used. ***Results:*** Of the 2,922 students, 2,882 (96.3%) completed the questionnaires. The prevalence (95% CI) in the written questionnaire for wheeze ever, current wheeze (within the last 12 months) and physician diagnosis of asthma were 13.4, 7.6 and 15.6%, respectively. The prevalence (95% CI) for symptoms of allergic rhinitis (AR) ever, current symptoms of AR, and diagnosis of AR was 41.4, 27.6 and 22.2%, respectively. The prevalence (95% CI) for itchy rash ever, current itchy rash, and diagnosis of eczema was 10.6, 8.3 and 12.8%, respectively. Comparing to ISAAC phase I data (1995–1996), the prevalence of current wheeze has decreased from 16.1 to 7.6% ($p < 0.001$). Current symptoms of AR decreased from 30.7 to 27.6 ($p = 0.008$) and current itchy rash decreased from 17.5 to 10.6% ($p < 0.001$). However, physician diagnoses of asthma and eczema remained the same as in the previous study, but physician diagnosis of AR increased from 17.1 to 22.2% ($p < 0.001$). ***Conclusion:*** The findings show that there is a decrease in the self-reported symptoms of allergic diseases over a 5-year period while physician diagnoses of these diseases remained the same over the same period.

Introduction

There is an international variation in the prevalence of asthma and allergic diseases. Although there is considerable concern over the increase in prevalence of asthma and allergic diseases in childhood over the last decade [1], it is not clear whether or not this increase still exists. The International Study of Asthma and Allergies in Childhood (ISAAC) has established a standardized methodology to compare prevalence and severity of asthma and atopic diseases in children both within and between countries. The phase I study of the prevalence of asthma and allergic diseases was done in 1995–1996 [2, 3]. Since then no other study has been done. Hence we studied the prevalence of asthma and allergic diseases among children aged 13 and 14 years in 2001–2002 using the ISAAC phase III protocol and compared the findings with those of the previous study.

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Table 1. Percent responses to the key questions of the written questionnaire

	Boys (n = 1,423)		Girls (n = 1,459)		Total (n = 2,882)		p value
	%	95% CI	%	95% CI	%	95% CI	
Wheeze ever	15.2	13.4–17.1	11.7	10.1–13.3	13.4	12.2–14.6	0.001
Wheeze in the last 12 months	9.3	8.1–11.1	5.9	4.7–7.1	7.6	6.6–8.6	0.001
Severe wheeze in the last year	5.5	4.3–6.7	2.9	2–3.8	4.2	3.5–4.9	0.001
Diagnosis of asthma	19.6	17.5–21.7	11.6	10–13.2	15.6	14.3–16.9	0.001
Exercise-induced wheeze in the last year	16.4	14.5–18.3	11.7	10.1–13.3	14	12.7–15.3	0.001
Nocturnal cough in the last year	37.9	35.4–40.4	30.6	28.2–34	34.2	32.5–35.9	<0.001
Symptoms of rhinitis ever	46.1	43.5–48.7	37	34.5–39.5	41.4	39.6–43.2	<0.001
Symptoms of rhinitis in the last year	31.1	28.7–33.5	24.1	21.9–26.3	27.6	26–29.2	<0.001
Itchy and red eye in the last year	14.8	13–16.6	10.4	8.8–12	12.6	11.4–13.8	0.001
Diagnosis of allergic rhinitis	23.9	21.7–26.1	20.6	18.5–22.7	22.2	20.7–23.7	0.043
Itchy rash ever	10.9	9.3–12.5	10.3	8.7–11.9	10.6	9.5–11.7	0.614
Itchy rash in the last year	8.6	7.1–10.1	8	6.6–9.4	8.3	7.3–9.3	0.828
Diagnosis of eczema	11.7	10–13.4	13.8	12–15.6	12.8	11.6–14	0.122

p value for male vs. female.

Subjects and Methods

Sampling Methods

Schoolchildren aged 13 and 14 years were targeted for the study using the ISAAC protocol. A list of intermediate level schools from each of the five governorates in Kuwait was obtained from the Department of Education. Eight schools, four for boys and four for girls, from each governorate were selected using random table. The third and fourth grades were included in the study as they contain the majority of children aged 13–14 years. Approvals to conduct the survey were obtained from appropriate authorities in the Ministry of Health and Ministry of Education. The study was carried out in 2001–2002.

Questionnaires

The ISAAC written and video questionnaires were used. Phase III written questionnaire is a repetition of phase I. It included questions on past and current wheezing episodes, wheezing frequency, sleep disturbance, speech limitation during attacks, exercise-induced wheezing and persistent cough unrelated to respiratory infections. Other questionnaires focused on the presence and severity of rhinitis and atopic eczema. The video questionnaires comprised five areas related to asthma symptoms and severity, including: moderate wheezing at rest, wheezing and shortness of breath after exercise, nocturnal wheezing, nocturnal cough, and severe wheezing and shortness of breath at rest. To avoid potential bias, the written questionnaires were completed before the video questionnaires.

Statistical Analysis

The data were entered into a computer according to the ISAAC Committee instructions. A second person rechecked 20% of the data entries from each school. The data were analyzed using SPSS software version 12. The prevalence of each symptom was calculated with 95% CI. A comparison between the frequency of symptoms was made using χ^2 test, and p value <0.05 was considered significant.

Results

Of the 2,922 Kuwaiti students, 2,882(96.3%) completed the questionnaires. Missing data for the key questions, e.g. presence of symptoms ever or physician diagnosis of any of the conditions ranged from 3.9% for wheeze ever to 14.6% for physician's diagnosis of eczema. The responses to the written questionnaire, based on gender, are given in table 1. The overall prevalence rates (95% CI) for wheeze ever, wheeze within the last year, and physician diagnosis of asthma were 13.4% (12.2–14.6), 7.6% (6.6–8.6), and 15.6% (14.3–16.9), respectively. The prevalence rates for symptoms of asthma and that included asthma were greater in boys than girls and the differences was statistically significant (p = 0.001). The most significant differences in wheeze ever, wheeze in the last 12 months, severe wheeze in the last year, diagnosis of asthma, exercise-induced wheezing in the last year, and nocturnal cough in the last year were greater in boys than girls and the differences were statistically significant (p = 0.001).

Rhinitis was the most common allergic disease affecting both boys and girls. The overall prevalence rates (95% CI) for symptoms of allergic rhinitis (AR) ever within the last year and physician diagnosis were 41.4% (39.6–43.2), 27.6% (26–29.2) and 22.2% (20.7–23.7), respectively. Also boys had higher prevalence rates than girls for symptoms of AR ever within the last year and the differences were statistically significant ($p < 0.001$).

Table 2. Responses to the video questionnaire

	Boys (n = 1,423)		Girls (n = 1,459)		Total (n = 2,882)		p value
	%	95% CI	%	95% CI	%	95% CI	
Combined wheezing ever by video	35.6	33.1–38.1	20.5	18.4–22.6	27.6	25.9–29.2	<0.001
Combined wheezing in the last year	24.3	22.7–25.9	12.6	10.9–14.3	18.4	17–19.8	<0.001
Wheeze at rest ever	18.1	16.1–20.1	10.3	8.7–11.9	13.9	12.6–14.2	<0.001
Wheeze at rest in the last year	11.4	9.7–13.1	5.6	4.4–6.85	8.4	7.4–9.4	<0.001
Wheeze at rest ≥1 per month	9.4	7.9–10.9	4.4	3.3–5.5	6.8	5.9–7.7	<0.001
Wheeze during exercise ever	27.6	25.3–29.9	13.5	11.7–15.3	20.1	18.6–21.6	<0.001
Wheeze during exercise in the last year	18.5	16.5–20.5	9	7.5–10.5	13.7	12.4–15	<0.001
Wheeze during exercise ≥1 per month	15.8	13.9–17.7	7.1	5.8–8.4	11.4	10.2–12.6	<0.001
Nocturnal wheeze ever	12.1	10.4–13.8	4.7	3.6–5.8	8.2	7.2–9.2	<0.001
Nocturnal wheeze in the last year	7.1	5.8–8.4	2.4	1.6–3.2	4.7	3.9–5.5	<0.001
Nocturnal wheeze ≥1 per month	6.4	5.1–7.7	1.9	1.2–2.6	4.1	3.4–4.8	<0.001
Nocturnal cough ever	22.9	20.7–25.1	28.4	26.1–30.7	25.8	23.9–27.7	0.001
Nocturnal cough in the last year	14.1	12.3–15.9	17.5	15.6–19.4	15.8	14.5–17.1	0.010
Nocturnal cough ≥1 per month	12.4	10.7–14.1	13.8	12–15.6	13.1	11.9–14.3	0.289
Severe asthma attack ever	10.7	9.1–12.3	5.8	4.6–7	8.1	7.1–9.1	<0.001
Severe asthma attack in the last year	7	5.7–8.3	3.4	2.5–3.4	5.2	4.4–6	<0.001
Severe asthma attack ≥1 per month	6.1	4.8–7.4	3.2	2.3–4.1	4.6	3.8–5.4	<0.001

'Combined' is defined as a positive response to any of the first three wheeze sequences in the video questionnaire (wheeze at rest, wheeze during exercise, or nocturnal wheeze). p value for male vs. female.

The overall prevalence rates for itchy rash ever, rash within the last year and physician diagnosis of eczema were 10.6% (9.5–11.7), 8.3% (7.3–9.3) and 12.8% (11.6–14), respectively. There was no statistically significant difference between boys and girls ($p \geq 0.122$).

For responses to video questionnaires (table 2), boys also had higher prevalence rates than girls for wheeze at rest, exercise-induced wheeze, and nocturnal wheeze ($p < 0.001$). However, nocturnal cough ever was more commonly reported by girls than boys ($p \leq 0.001$).

When the current data were compared to ISAAC phase I data (table 3), the prevalence rates for wheeze ever and current wheeze in the past year decreased from 25.9 to 13.4% ($p < 0.001$) and from 16.1 to 7.6% ($p < 0.001$), respectively. The prevalence rates for exercise-induced wheeze in the past year and nocturnal cough decreased from 22.4 to 14.0% ($p < 0.001$) and from 38.4 to 34.2%, respectively ($p = 0.001$). The reduction in the prevalence was observed for both boys and girls as exemplified in the prevalence of current wheeze: from 18 to 9% for boys and 14.3 to 5.9% for girls. Similar reductions were observed among both boys and girls in exercise-induced and severe wheeze. Despite a significant decrease in the self-reported symptoms of asthma, the rate of physician diagnosis of asthma remained basically the same ($p = 0.196$).

Equally the prevalence rates for current symptoms of AR in the current study compared to phase I decreased from 30.7 to 27.6% ($p = 0.008$), itchy rash ever and current itchy rash from 17.5 to 10.6% and from 12.6 to 8.3%, respectively ($p < 0.001$). However, the rate of physician diagnosis of AR increased from 17.1 to 22.2% ($p = 0.001$), but no statistically significant change occurred in the rate of physician diagnosis of eczema ($p = 0.101$).

Discussion

The ISAAC phase III study provides for the first time the trend in the prevalence rates of asthma and allergic disease in children in Kuwait. It uses core questionnaires to assess the prevalence and severity of asthma and allergic diseases in a defined population. The validity and repeatability of the ISAAC questionnaires used in this study had been reported in relation to bronchial hyperreactivity [4] and physician-diagnosed asthma [5].

Our data show that the prevalence rates of asthma and respiratory symptoms were higher in boys than girls (table 1) as reported in the previous ISAAC phase I survey [3], thereby indicating that the gender difference is a consistent finding and also similar to findings reported in

Table 3. Prevalence (%) of asthma and allergic disease in schoolchildren in Kuwait in 1995–1996 (phase I) and 2001–2002 (current study)

	1995–1996 (n = 3,110)		2001–2002 (n = 2,822)		p value
	%	95% CI	%	95% CI	
Wheeze ever	25.9	24.5–27.4	13.4	12.2–14.4	<0.001
Current wheeze in past year	16.1	15.8–17.4	7.6	6.6–8.6	<0.001
Diagnosis of asthma	16.8	15.5–18.1	15.6	14.3–16.9	0.196
AR ever	43.9	42.2–45.6	41.4	39.6–43.2	0.06
Current AR in past year	30.7	29.1–32.4	27.6	26–29.2	0.008
Diagnosis of AR	17.1	14.8–18.4	22.2	20.7–23.7	<0.001
Itchy rash ever	17.5	16.2–18.8	10.6	9.5–11.7	<0.001
Current itchy rash	12.6	11.4–13.8	8.3	7.3–9.3	<0.001
Diagnosis of eczema	11.3	10.2–12.4	12.8	11.6–14	0.101
Exercise-induced wheeze in the past year	22.4	20.9–23.9	14.0	12.7–15.3	<0.001
Nocturnal cough in the past year	38.4	36.7–40.1	34.2	32.5–35.9	0.001
Itchy red eye in the past year	16.2	14.9–17.5	12.6	11.4–13.8	<0.001

p value for trends.

other countries: Hong Kong [6], United Kingdom [7], and New Zealand [8]. The study in New Zealand showed that the higher prevalence of asthma in boys aged 13 years was partly due to a higher rate of sensitization to indoor allergens as assessed by skin prick test. Because we did not perform sensitization assessment, it is difficult to attribute the gender difference in Kuwait's population to indoor allergens. However, the difference in symptoms like exercise-induced asthma could be due to difference in lifestyle as boys tend to exercise more than girls in Kuwait. Previous studies in Kuwait showed a very high prevalence of allergic sensitization to airborne allergens among blood donors and asthmatic patients [9–11]. The atopic asthmatics were sensitized to pollens from local trees and plants, namely, prosopis (Mesquite) tree, *Chenopodium album* (saltbush), and Bermuda grass. It is generally believed that this high prevalence of sensitization is mainly due to plantation and cultivation process of foreign trees to the urban area of Kuwait [11–13]. In contrast to our study, significantly higher rates of asthma symptoms were found in girls in Israel, the United Kingdom, Australia and Germany [14, 15].

When the current study is compared to the previous one (1995–1996) [3], a demonstrable trend toward lower prevalence was observed (table 3). The observed decrease in trend could not be attributed to artifact because: (a) A similar ISAAC protocol was used for both surveys. The study population in both studies consisted of 13- to 14-year-old children living in Kuwait and both studies had similarly high response rates. (b) The change in symptoms of the three disease entities we assessed were less susceptible to change in diagnostic behaviors of health care providers. (c) A similar trend in the decrease of prevalence rates was observed for both boys and girls.

It is somewhat surprising that the physician diagnosis of allergic diseases remained the same. This could be due to underreporting of symptoms by the students or overdiagnosis by physicians in phase III survey. Overdiagnosis by the physician may be a result of a worldwide health professional targeted education regarding allergic diseases in general and asthma in particular. This highlights the importance of doing a similar study experimentally using spirometry and skin prick test or allergen-specific IgE to complement the written questionnaire.

A probable explanation for the decrease in symptoms is a period effect in which a decrease in exposure to environmental factors results in a decrease in the risk to susceptible subjects. During the first Gulf war more than 750 oil wells were set on fire in Kuwait by the fleeing Iraqi army. Significant air pollution occurred in Kuwait and surrounding countries [16, 17]. Some of the people who were exposed to the pollution from these oil fires were reported to have had respiratory symptoms [18]; however, the long-term health effects of these oil fires remain controversial [19]. The reported respiratory symptoms could partially explain the higher symptoms during the first survey, which was done in 1995, compared to the second survey in 2002. Decrease in allergen exposure could be

the other probable reason. Epidemiological studies have shown that a twofold reduction in allergen exposure at community level would significantly reduce rates of sensitization in early childhood [20], halve the risk of asthma in sensitized children [21] and similarly reduce its severity [22].

In contrast to our study, a trend towards an increase in asthma and asthma-related symptoms has been observed in other countries: Israel [14], England, Wales and Scotland [24–27], USA [28], Australia [29], New Zealand [30]. However, signs indicating a halt in the rising trend in asthma prevalence have been observed in recent studies [31–35]. Possible explanations for the changing prevalence of asthma symptoms include changes in environmental influences such as indoor environmental factors, outdoor air pollution, infections burden in early childhood and duration of breast-feeding. The worldwide results of ISAAC phase III trial showed mixed changes in the trend of prevalence of allergic diseases among the 106 centers in 56 countries; however, there were more decreases in the prevalence of asthma symptoms in the 13- to 14-year age group at high prevalence [36]. Our results show an example of a decrease in most symptoms of allergic diseases, especially asthma.

Our investigation, like others [32–34], did not allow a study of changing trends by specific risk factors. It is possible that a combination of various factors such as nutrition, microbial exposures, early life infections, housing conditions, exposure to outdoor pollutants, allergen exposure and others, may have affected the temporal trend [37–39].

In conclusion, this study shows a trend in the decrease of prevalence rates of asthma and allergic diseases in a nationwide sample of 13- to 14-year-old schoolchildren in Kuwait.

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