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Original Article

Prevalence of asthma, rhinitis and eczema among 13–14-year-old schoolchildren in Tochigi, Japan

Kumiya Sugiyama, Takako Sugiyama, Masao Toda, Tatsuo Yukawa, Sohei Makino and Takeshi Fukuda

Department of Pulmonary Medicine and Clinical Immunology, Dokkyo University School of Medicine, Tochigi, Japan

ABSTRACT

To analyze the prevalence and severity of asthma, rhinitis and eczema in children living in different countries, the International Study of Asthma and Allergies in Childhood (ISAAC) was developed. The ISAAC Phase One study evaluated approximately 720 000 children in 56 countries, including Japan. In late 1995 and early 1996, we administered the ISAAC questionnaire to 4466 schoolchildren aged 13–14 years of age in 24 schools in Utsunomiya City and Tochigi City (both in Tochigi Prefecture, Japan). With regard to asthma, the reported prevalence of wheezing in the preceding 12 months was 8.4%, of frequent wheezing attacks 0.6% and of wheezing with sleep disturbance 0.5%. The prevalence in the preceding 12 months of rhinitis was 42.1% and of rhinoconjunctivitis was 21.5%. Nasal symptoms were most frequent in April (19.9%) and least frequent in July (5.6%). The prevalence of atopic eczema in the prior 12 months was 9.6% and atopic eczema with sleep disturbance was 0.6%. All prevalence values were slightly increased in Utsunomiya City, the largest city in Tochigi Prefecture, in comparison with Tochigi City. In conclusion, in Japanese cities, 33.3% of children had some allergic symptoms and 2.4% of children reported severe allergic symptoms.

Key words: asthma, childhood, eczema, International Study of Asthma and Allergies in Childhood, prevalence, rhinoconjunctivitis.

Correspondence: Kumiya Sugiyama, Department of Pulmonary Medicine and Clinical Immunology, Dokkyo University School of Medicine, Mibu, Tochigi, Japan 321–0293.

Email: sugiyama@dokkyomed.ac.jp

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INTRODUCTION

Recently, it has been reported that the prevalence of allergic diseases among children in Japan is increasing.¹ Asthma is one of the most important allergic diseases and has the risk of causing death.² In addition, for many children, their activities are limited by asthmatic attacks, contributing, for instance, to their absence from school.³ Rhinitis and eczema, while not causing deaths, affect children, including decreasing their ability to concentrate on their studies. Although allergic diseases may cause problems, the prevalence of allergic diseases in Japanese schoolchildren has not been determined.

There has also been considerable concern that the prevalence of asthma and allergic diseases is increasing in Western and developing countries.^{4,5} The International Study of Asthma and Allergies in Childhood (ISAAC) developed from the merging of two multinational collaborative projects (Auckland, New Zealand and Bochum, Germany), which aimed to analyze these disorders.^{6,7}

In ISAAC Phase One studies, the aims were: (i) to describe the prevalence and severity of asthma, rhinitis and eczema in children living in different centers and to make comparisons within and between countries; (ii) to obtain baseline measures for the assessment of future trends in the prevalence and severity of these diseases; and (iii) to provide a framework for further etiological research into lifestyle, environmental, genetic and medical care factors affecting these diseases.⁸

The Phase One ISAAC evaluations were administered to approximately 720 000 children in 155 centers of 56 countries between 1994 and 1995.^{9–12} In Japan, Fukuoka and Tochigi Prefectures were enrolled in this study. We report on results of the ISAAC Phase One study performed in Tochigi, Japan.

METHODS

Subjects

According to the ISAAC protocol, all second-grade junior high school students (13–14 years of age) in Utsunomiya City and Tochigi City, including Mibu town, were our study targets. The ISAAC questionnaires were distributed in 16 of 22 schools in Utsunomiya City and in eight of nine schools in Tochigi City via the educational committee from September 1995 to March 1996 and were refused by seven schools. The total number of students sampled was 4466 (3157 students from Utsunomiya City and 1309 students from Tochigi City).

Study area

Tochigi Prefecture is located 100 km north of Tokyo and has approximately 2 000 000 inhabitants. Utsunomiya City is located in the center of Tochigi Prefecture and has approximately 440 000 inhabitants and is the largest city in Tochigi Prefecture. 'Utsunomiya' station of the Tohoku Shinkansen is in the center of the city and the 'Utsunomiya' interchange of the Tohoku highway is in the suburbs. Although there are many inhabitants and large commercial areas in the center, there are both industrial areas and farmlands in the suburbs. Utsunomiya City is a typical large city in the country.

Tochigi City is located in the south of Tochigi Prefecture and has approximately 85 000 inhabitants, making it the third largest city in Tochigi Prefecture. There is a small castle in the town center and the commercial activities are mainly agriculture. Tochigi City is a typical small city.

Questionnaires

The ISAAC Phase One written questionnaires for 13–14-year-olds were used (Tables 1–3).⁷ The questionnaires were translated into Japanese by our group. The Japanese questionnaires were translated back to English by another group, which confirmed that the Japanese language questionnaires had been correctly translated.

Data analysis

Data were analyzed for the entire group as well as separately by gender and by city area (Utsunomiya City or Tochigi). Percentages and 95% confidence intervals (CI) of positive responses were calculated.

RESULTS

Observations with missing and inconsistent data

Among personal information, data were missing or inconsistent for 599 of 4466 students (13.4%). There were 341 students (7.6%) with a missing interview date and these answers were included in the results. There were 414 students (9.3%) with a missing date of birth, 61 students (1.4%) with missing values for age and 97 students (2.2%) with inconsistent age and birthdate. These answers were included in the results, because all students in the second grade in junior high school are 13 or 14 years of age under Japanese law. There were 26 students (0.6%) with missing values for sex. These answers were included in results for the total population and for analysis by location, but were omitted in analyses by gender. In answers to questions about allergic symptoms, an average of 0.7% (CI 0.2–2.4%) had missing and inconsistent data.

Prevalence of symptoms of wheezing and asthma

As shown in Table 1, the percentage of children who had wheezing in the past was 18.8%, while that of children who had wheezing in the preceding 12 months was 8.4% (frequency of mild, moderate and severe wheezing: 5.5, 1.6 and 0.6%, respectively). In comparisons between Utsunomiya and Tochigi, frequencies of severe wheezing attacks and sleep disturbances were increased in Utsunomiya compared with Tochigi. In contrast, the prevalence of a dry cough was increased in Tochigi. In comparisons between boys and girls, the frequencies of each symptom, except exercise-induced wheeze, were increased in boys compared with girls.

Prevalence of symptoms of rhinitis

The percentage of children who had rhinitis in the past was 48.5%, while the percentage who had rhinitis or rhinoconjunctivitis in the past 12 months was 42.1 and 21.5%, respectively (Table 2). The months with the most prevalent nasal symptoms were April (19.9%) and March (17.8%), while those with least prevalence were July (5.6%) and December (6.0%). In comparisons between Utsunomiya and Tochigi, the prevalences of nasal symptoms were increased in Utsunomiya compared with Tochigi. The prevalences of nasal symptoms between boys and girls were similar.

Table 1 Questionnaires and crude prevalence rates of symptoms of wheezing and asthma

Question	Total (n = 4466)	Area			Sex	
		Utsunomiya (n = 3157)	Tochigi (n = 1309)	Boys (n = 2219)	Girls (n = 2221)	
1. Have you ever had wheezing or whistling in the chest any time in the past?	18.8 (17.6–19.9)	19.1 (17.7–20.05)	17.6 (15.6–19.7)	20.3 (18.6–22.0)	17.2 (15.6–18.7)	
2. Have you had wheezing or whistling in the last 12 months?	8.4 (7.5–9.2)	8.1 (7.2–9.1)	7.2 (5.8–8.6)	8.8 (7.6–10.0)	6.9 (5.9–8.0)	
3. How many attacks of wheezing have you had in the last 12 months?						
	1 to 3	5.4 (4.6–6.2)	5.7 (4.5–7.0)	5.9 (4.9–6.9)	5.0 (4.1–6.0)	
	4 to 12	1.6 (1.2–2.0)	1.7 (1.3–2.2)	2.0 (1.4–2.6)	1.2 (0.8–1.7)	
More than 12	0.6 (0.4–0.9)	0.8 (0.5–1.1)	0.2 (0.0–0.5)	0.7 (0.4–1.1)	0.5 (0.2–0.8)	
4. In the last 12 months, how often, on average, has your sleep been disturbed due to wheezing?						
	Less than one night/week	2.0 (1.6–2.4)	2.1 (1.6–2.6)	1.7 (1.0–2.4)	2.3 (1.7–3.0)	
	One or more nights/week	0.5 (0.3–0.7)	0.7 (0.4–1.0)	0.1 (0.0–0.2)	0.6 (0.3–1.0)	
5. 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?	1.3 (0.9–1.6)	1.4 (1.0–1.8)	0.9 (0.4–1.4)	1.4 (0.9–1.8)	1.2 (0.7–1.6)	
6. Have you ever had asthma?	12.0 (11.1–13.0)	11.4 (10.3–12.5)	13.6 (11.7–15.5)	13.9 (12.4–15.3)	10.3 (9.1–11.5)	
7. In the last 12 months, has your chest sounded wheezy during or after exercise?	11.3 (10.4–12.2)	11.3 (10.2–12.4)	11.2 (9.5–12.9)	11.4 (10.1–12.8)	11.2 (9.9–12.5)	
8. In the last 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?	5.7 (5.1–6.4)	4.7 (3.9–5.4)	8.3 (6.8–9.8)	6.3 (5.3–7.3)	5.3 (4.3–6.2)	

Data are percentages with 95% confidence intervals given in parentheses.

Table 2 Questionnaires and crude prevalence rates of symptoms of rhinitis

Question	Areas			Sex	
	Total (n = 4466)	Utsunomiya (n = 3157)	Tochigi (n = 1309)	Boys (n = 2219)	Girls (n = 2221)
1. Have you ever had a problem with sneezing, or a runny, or blocked nose when you did not have cold or the flu?	48.5 (47.1–50.0)	51.5 (49.8–53.3)	41.3 (38.7–44.0)	49.0 (46.9–51.1)	48.2 (46.1–50.0)
2. In the last 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you did not have a cold or the flu?	42.1 (40.7–43.6)	44.5 (42.8–46.3)	36.4 (33.8–39.0)	42.8 (40.8–44.9)	41.6 (39.6–43.7)
3. In the last 12 months, has this nose problem been accompanied by itchy–watery eyes?	21.5 (20.3–22.7)	22.6 (21.1–24.0)	18.9 (16.7–21.0)	20.5 (18.8–22.2)	22.6 (20.8–24.3)
4. In which of the past 12 months did this nose problem occur					
January	8.2 (7.4–9.0)	7.7 (6.8–8.6)	9.4 (7.8–11.0)	8.5 (7.3–9.6)	8.0 (6.8–9.1)
February	10.9 (10.0–11.8)	10.6 (9.5–11.7)	11.7 (9.9–13.4)	11.0 (9.7–12.3)	10.9 (9.6–12.1)
March	17.8 (16.6–18.9)	18.4 (17.0–19.7)	16.3 (14.3–18.3)	17.8 (16.2–19.4)	17.8 (16.2–19.4)
April	19.9 (18.7–21.1)	21.3 (19.9–22.7)	16.5 (14.5–18.5)	20.2 (18.6–21.9)	19.7 (18.1–21.4)
May	14.1 (13.1–15.2)	15.4 (14.2–16.7)	11.0 (9.3–12.7)	15.1 (13.6–16.6)	13.3 (11.9–14.7)
June	7.7 (6.9–8.5)	8.9 (7.9–9.9)	4.7 (3.5–5.8)	8.4 (7.3–9.6)	7.0 (5.9–8.0)
July	5.6 (4.9–6.3)	6.6 (5.8–7.5)	3.2 (2.3–4.2)	6.3 (5.3–7.3)	5.0 (4.1–5.9)
August	6.2 (5.5–6.9)	7.4 (6.5–8.3)	3.1 (2.2–4.1)	7.1 (6.0–8.2)	5.2 (4.3–6.1)
September	9.6 (8.8–10.5)	11.2 (10.1–12.3)	5.9 (4.6–7.2)	9.7 (8.5–11.0)	9.6 (8.4–10.8)
October	6.7 (5.9–7.4)	6.1 (5.2–6.9)	8.1 (6.6–9.6)	7.3 (6.2–8.4)	6.1 (5.1–7.1)
November	7.1 (6.4–7.9)	6.4 (5.5–7.2)	8.9 (7.4–10.5)	7.6 (6.5–8.7)	6.7 (5.7–7.7)
December	6.0 (5.3–6.7)	7.3 (6.3–8.2)	10.8 (9.2–12.5)	9.1 (7.9–10.3)	7.6 (6.5–8.7)
5. In the last 12 months, how much did this nose problem interfere with your daily activities?					
A little	22.1 (20.8–23.3)	23.0 (21.6–24.5)	19.7 (17.6–21.9)	22.9 (21.1–24.6)	21.4 (19.7–23.1)
A moderate amount	6.2 (6.6–6.9)	6.6 (5.7–7.4)	5.3 (4.1–6.5)	6.1 (5.1–7.1)	6.3 (5.3–7.4)
A lot	1.3 (1.0–1.7)	1.4 (1.0–1.8)	1.1 (0.5–1.6)	1.2 (0.8–1.7)	1.4 (0.9–1.9)
6. Have you ever had hayfever?	33.3 (31.9–34.6)	35.9 (34.2–37.6)	26.9 (24.5–29.3)	32.4 (30.4–34.3)	34.3 (32.3–36.3)

Data are percentages with 95% confidence intervals given in parentheses.

Table 3 Questionnaires and crude prevalence rates of symptoms of eczema

Question	Areas			Sex	
	Total (n = 4466)	Utsunomiya (n = 3157)	Tochigi (n = 1309)	Boys (n = 2219)	Girls (n = 2221)
1. Have you ever had an itchy rash which was coming and going for at least 6 months?	14.0 (13.0–15.0)	14.7 (13.5–15.9)	12.3 (10.5–14.1)	12.2 (10.8–13.5)	15.8 (14.3–17.3)
2. Have you had this itchy rash at any time in the last 12 months?	13.0 (12.0–14.0)	13.6 (12.4–14.8)	11.6 (9.9–13.3)	11.3 (9.9–12.6)	14.7 (13.2–16.2)
3. Has this itchy rash at any time affected any of the following places: The folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?	9.6 (8.7–10.4)	9.9 (8.9–11.0)	8.7 (7.2–10.2)	8.0 (6.9–9.2)	11.2 (9.9–12.5)
4. Has this rash cleared completely at any time during the last 12 months?	9.4 (8.6–10.3)	9.9 (8.9–11.0)	8.3 (6.8–9.7)	8.6 (7.4–9.7)	10.2 (9.0–11.5)
5. In the last 12 months, how often, on average, have you been kept awake at night by this itchy rash? Less than one night/week One or more night/week	1.9 (1.5–2.3) 0.6 (0.4–0.8)	2.2 (1.7–2.7) 0.8 (0.5–1.1)	1.1 (0.6–1.7) 0.2 (0.0–0.5)	1.6 (1.1–2.1) 0.7 (0.3–1.0)	2.2 (1.6–2.8) 0.5 (0.2–0.8)
6. Have you ever had eczema?	32.8 (31.5–34.2)	32.9 (31.2–34.5)	32.8 (30.2–35.3)	30.5 (28.5–32.4)	35.3 (33.4–37.3)

Data are percentages with 95% confidence intervals given in parentheses.

Prevalence of symptoms of eczema

Table 3 presents the prevalence of symptoms of eczema. The percentage of children who had itchy rash in the preceding 12 months was 13.0%, while the prevalence of children who had itchy rash in typical sites for atopic eczema in the past 12 months was 9.6%. The percentage of children who had never been cleared of this rash in the past 12 months was 3.3% (CI 2.8–3.8%). The percentage of eczema symptoms was slightly increased in Utsunomiya compared with Tochigi. Although the percentage of eczema symptoms was increased in girls, the percentage of severe symptoms with sleep disturbance did not show any gender differences.

DISCUSSION

Since the ISAAC Phase One was performed in 1995, results have been published from many countries. In addition, the ISAAC Steering Committee has published three worldwide reports,^{9–12} even though all regional results were not available. Because we were not able to complete our analysis before those reports were published, our results were not included. Therefore, in the present report, we compared our results with those for 13–14-year-old children in other countries.

In questionnaires for asthma,^{9,10} the prevalence values for asthmatic symptoms within the previous 12 months in Western Europe and America were approximately 10% and higher values (above 20%) were present in North America, Oceania and England. The prevalence values in Asia and Eastern Europe were approximately 8% and lower values (under 5%) were found in China, Indonesia and Russia. Japan is located in Asia-Pacific, for which the average prevalence value of asthmatic symptoms was 8.0% and these overall results in Asia-Pacific were very similar to our results in Japan. These findings suggest that the prevalence values for asthmatic symptoms tend to be high in advanced countries, like North America and England. Living in an advanced country may be one risk factor for asthma, although other risk factors, for example household smoking, air pollution and foods, may also contribute to the prevalence of asthmatic symptoms.^{13–15}

For rhinitis, one worldwide report has been published.¹¹ Among the higher prevalence values for rhinitis in the prior 12 months, Argentina and Paraguay were over 60%. In New Zealand, Australia, Canada, Hong Kong and Singapore the prevalence rates of rhinitis were

approximately 40%, frequencies very similar to our results in Japan. Our evaluated prevalence values for rhinitis symptoms were in excess of those for asthma and did not differ in the two geographic areas we studied. In Japan, it is already known that the percentage of patients with allergies to pollen is higher than patients with allergies to house dust or mite.¹⁶ In Tochigi Prefecture, with its high prevalence of rhinoconjunctivitis, there exist the biggest Japanese cedar-covered mountains in Japan, a major source of pollen aeroallergens. The seasonality of Japanese cedar pollen was demonstrated in Tochigi Prefecture in 1995 just before our study (H Yoshida, pers. comm.). Pollen distribution started on 15 February 1995, peaked on 28 March and ended on 9 May 1995, as assessed by the Department of Otorhinolaryngology at Dokkyo University School of Medicine (Tochigi, Japan). These data are very similar to the variation in monthly prevalence for rhinitis observed; in addition, the prevalence of nasal symptoms in many other countries also increases in the spring, the season with increased pollen levels. Thus, the heightened prevalence of rhinoconjunctivitis is likely to be attributable to environmental exposure to pollen.

In questionnaires for eczema,¹² prevalence values for atopic eczema in the past 12 months in Oceania, Africa, North America and Western Europe were found to be 11.5, 10.9, 9.1 and 8.8%, respectively, with the highest values (above 15%) found in Finland and England. In contrast, lower frequencies were reported in Asia (4.3%). These findings for eczema were very similar to the results for asthma.

The present study was also performed in Fukuoka Prefecture, which has one of biggest cities in Japan. In Fukuoka, the prevalence values for asthmatic and atopic eczema symptoms in the past 12 months were 13.4 and 10.5%, respectively, and these results were higher than the results in Tochigi Prefecture. In our results, the prevalence values in Utsunomiya city, the biggest city in Tochigi Prefecture, were higher than those in Tochigi City, suggesting that factors associated with the nature or the scale of a city contribute to the prevalence of allergic diseases. This finding suggests that a big city may be a risk factor for allergic diseases, not only in advanced countries.

Our survey results indicate that 33.3% of children have allergic symptoms that interfere with their daily activity or sleep and 2.4% of children are reported to have severe allergic or asthmatic symptoms in Japan. Overall, 49.4% of children did not have any symptoms in the past 12 months. The Japanese Ministry of Education, Science and Culture has reported that the prevalence of asthma

in schoolchildren has been increasing recently.¹ The ISAAC Phase Three study, to be performed in 2001, plans to add questions about environments. These questions may further identify relationships between allergic diseases and environmental exposure.

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