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Prevalence of asthma and wheeze in Hong Kong schoolchildren: an international comparative study

R. Leung*, J. Bishop**, C.F. Robertson+

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ABSTRACT: Comparison of asthma prevalence between populations is difficult because of lack of uniformity of methodology and agreement on the definition. This study aims to determine and compare the prevalence of wheeze and respiratory symptoms in Hong Kong schoolchildren with that in Melbourne children by using identical questionnaires.

Schools were randomly selected in different regions of Hong Kong and three age groups (7, 12 and 15 yrs) were chosen for the study. The Chinese version of the questionnaire used in a recent Melbourne survey was distributed to children for completion by their parents. A total of 1,800 questionnaires was issued and 1,689 returned (response rate = 94%).

The prevalence of wheeze in the past 12 months was 7 (5.1–8.0), 5 (3.0–6.7) and 4 (1.7–5.6) % for 7, 12 and 15 year olds, respectively. The prevalence of a history of asthma in the respective age groups was 10 (7.1 –12.9), 8 (7.5–9.2) and 7 (5.0–9.6)%, respectively. Whilst a history of wheeze ever was more common in boys than in girls and 12 yr olds (14% *vs* 5%), wheeze in the past 12 months was more common in boys than in girls aged 7 yrs (9 *vs* 4%).

We conclude that the prevalence of wheeze and asthma in school children was low in Hong Kong compared to Melbourne. Environmental differences between the two regions may be important in the pathogenesis.

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*Dept of Respiratory Medicine, St. Vincent's Hospital, Fitzroy, Australia. **Clinical Epidemiology and Biostatistics Unit, Royal Children's Hospital, Parkville, Australia. +Dept of Thoracic Medicine, Royal Children's Hospital, Parkville, Australia.

Correspondence: R. Leung
Dept of Respiratory Medicine
St. Vincent's Hospital
Fitzroy
Victoria 3065
Australia

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The prevalence of a history of wheeze and asthma in children ranges 12–23% in Western countries [1–4]. Recent studies have shown that the prevalence of asthma has been increasing both in children [5] and young adults [6]. Reasons proposed for the increase in asthma prevalence include heightened community awareness of asthma symptoms, a change in diagnostic labelling patterns amongst health professionals, and increase in the severity of illness amongst the same number of asthmatics, thus, enhancing awareness of symptoms. However, the parallel increase in the prevalence of hay fever [5, 6] and eczema [6] suggests a more broadly based change in reactivity, possibly due to increased exposure to allergens and other environmental factors.

In Asian countries, childhood asthma is 3–4 times less common and affects 2% of 11–17 year olds in Guangzhou [7], 5% of 7–15 year olds in Taipei [8], 7% of 10–20 year olds in Hong Kong [9] and 9% of 7–12 year olds in Kuala Lumpur [10]. The marked difference in asthma prevalence between western and Asian countries could result from a combination of racial predisposition and environmental factors. Comparison of prevalence rates between different populations is difficult because there is no "gold standard" for defining asthma and no uniformity of methodology between studies. Few studies have attempted to use an identical instrument to study disease prevalence across populations. In 1991, ROBERTSON *et al.* [1] studied 10,981 Melbourne schoolchildren with a respiratory symptoms questionnaire, and found that the prevalence of a history of wheeze or asthma ever was 46, 40, and 41% in 7, 12 and 15 year olds, respectively.

The questionnaire was translated into six different languages for children of different ethnic background who might have difficulty in comprehending the English questionnaire. The Spanish and German versions have been used to compare the prevalence of childhood asthma between Melbourne (Australia) St. Gallens (Switzerland) and La Serena (Chil) [11]. This study employed the Chinese version of the questionnaire to determine and compare the prevalence of wheeze and respiratory symptoms suggestive of asthma in Hong Kong schoolchildren of similar age with that in Melbourne schoolchildren.

Subjects and methods

A four page respiratory symptoms questionnaire was issued to schools for distribution to parents. The questionnaire was validated and previously used in the Melbourne survey [1]. The Spanish and German

versions of the questionnaire have also been used to study children in La Serena (Chile) and St. Gallens, (Switzerland) [11]. The Chinese version of the same questionnaire was employed in the current study, and all versions had been retranslated to English for validation.

A total of six schools were randomly selected by The Education Department of Hong Kong from the urban districts of Hong Kong for the study. The investigators were blind to the randomization procedure. In accordance with the Melbourne survey, identical age groups were selected for study from each school. Grades where the average age was 7, 12 and 15 yrs were used, which corresponded to Primary 2, Form 1 and Form 4, respectively. All children within each grade were asked to participate. Selected children were all of ethnic Chinese background. Data were collected in the spring of 1992 (April/May). As part of an international survey on respiratory symptoms in children, only questionnaire res-ponses were collected; skin prick test and lung function were not performed.

Statistical analysis

Questionnaire responses were coded and entered into a database on a microcomputer. The statistical package SAS was used to categorize and analyse the data. Because subjects were sampled in their class groups, the standard errors of estimates would be underestimated if cluster sampling was not adjusted for. We adjusted for sample size used for calculating standard error using the simple estimate of the intraclass correlation coefficient [12]. Chi-squared analyses of contingency tables and test chi-squared test for trend were used to assess the differences in the prevalence rates.

Results

A total of 1,800 questionnaires were issued and 1,689 (94%) were completed and returned. Table 1 shows the questionnaire responses. A history of "wheeze ever" was more commonly reported in the 7 year olds than in the other age groups (p=0.01). On the other hand, the 15 year olds were more likely to have respiratory symptoms in the past 12 months of exercise-induced wheeze (p<0.001), morning tightness (p<0.01) and wheeze with allergens (p<0.01) than the 7 year olds. If a history of wheeze or asthma ever were combined to indicate the total asthma burden, this was reported in 16% of 7 year olds, 12% of 12 year olds, and 10% of 15 year olds.

Table 2 gives the respiratory symptoms with significant sex difference. Boys were more likely than girls to have a history of wheeze in the past 12 months in 7 year olds (p<0.001), night cough in 12 year olds (p<0.05).

Table 1. – Respiratory symptoms in Hong Kong schoolchildren in 3 age groups

	7 yrs (n=519)			12 yrs (n=623)			15 yrs (n=547)		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever had wheeze*	80	15	10.8–20.0	64	10	8.4–12.1	56	10	6.1–14.3
Ever had asthma	52	10	7.1–12.9	52	8	7.5–9.2	40	7	5.0–9.6
Symptoms in past 12 months									
Wheeze	34	7	5.1–8.0	30	5	3.0–6.7	20	4	1.7–5.6
Sleep disturbance	25	5	4.5–5.1	22	4	1.3–5.8	13	2	0.8–4.0
Severe episode	12	2	1.7–2.9	14	2	1.2–3.3	9	2	0.8–2.4
Exercise-induced wheeze***	28	5	4.5–6.3	92	15	8.9–20.7	100	18	11.7–24.9
Night cough	65	13	11.4–13.6	64	10	5.3–15.2	66	12	6.8–17.4
Morning mucus	71	14	1.2–15.2	92	15	12.4–17.1	89	16	10.3–22.3
Morning tightness**	11	2	1.1–3.2	19	3	2.6–3.5	3	6	0.1–11.4
Wheeze with allergens**	13	3	0.7–4.3	17	3	0.7–4.8	31	6	3.1–8.2

95% CI: 95% confidence interval. *: p<0.05; **: p<0.01; ***: p<0.001, Chi-squared for trend in proportion.

Table 2. – Respiratory symptoms with significant sex difference

Respiratory symptoms	7 yrs				12 yrs				15 yrs			
	M (n=293)		F (n=226)		M (n=360)		F (n=263)		M (n=257)		F (n=297)	
	n	%	n	%	n	%	n	%	n	%	n	%
Ever had wheeze	49	(17)	31	(14)	***50	(14)	14	(5)	32	(12)	24	(8)
Ever had asthma	*37	(12)	15	(7)	**38	(11)	14	(5)	24	(9)	16	(5)
Symptoms in past 12 months												
Wheeze	***26	(9)	8	(4)	20	(6)	10	(4)	13	(5)	7	(2)
Severe attack	7	(2)	5	(2)	10	(3)	4	(2)	*6	(2)	3	(1)
Exercise-induced wheeze	13	(4)	**15	(7)	60	(17)	32	(12)	44	(17)	56	(19)
Night cough	36	(12)	29	(13)	*49	(14)	15	(6)	22	(9)	44	(15)

M: male; F: female; *: p<0.05; **: p<0.01; ***: p<0.001, Chi-squared test significance.

Table 3. – Frequency of respiratory symptoms in the past 12 months

	Wheeze in the past 12 months						No wheeze in the past 12 months					
	7 yrs (n=34)		12 yrs (n=30)		15 yrs (n=20)		7 yrs (n=495)		12 yrs (n=593)		15 yrs (n=527)	
	n	%	n	%	n	%	n	%	n	%	n	%
Frequency of wheeze												
<4 episodes	21	62	18	60	14	70						
4–12 episodes	13	38	10	33	3	15						
>12 episodes	0	0	2	7	3	15						
Exercise-induced wheeze	9	26	19	63	11	55	19	4	73	12	89	17
Night cough	17	50	13	43	6	30	48	10	51	9	60	11
Morning mucus	14	41	22	73	8	40	57	12	70	12	81	15
Morning tightness	4	12	7	23	5	25	7	1	12	2	26	5

and severe attach in 15 year olds ($p<0.05$). Boys in the 12 year old age group were also more likely to report a history of wheeze ever ($p<0.01$), and a history of asthma ever ($p<0.001$) than girls of the same age.

In children who reported wheezing in the last 12 months, 88% of the 7 year olds, 97% of the 12 year olds and 75% of the 15 year olds also reported asthma. Two thirds of these children experienced less than four episodes of wheezing attacks in the past 12 months, irrespective of age. Exercise-induced wheeze was more common in the 15 year olds regardless of the history of wheeze in the past 12 months (table 3). In those who reported not to have wheezed in the past 12 months, morning tightness was more commonly noted amongst the 15 year olds ($p<0.01$).

Discussion

We have shown that the prevalence of wheeze and respiratory symptoms suggestive of asthma is 2–3 times lower in Hong Kong compared to Melbourne [1] and other western populations [1–4]. Allowing for the difference in methodology used, these prevalence rates are not different from previous studies in the same region [9, 13]. By using the Spanish and German versions of the questionnaire, it was found that the prevalence of a history of wheeze in 12 year olds was 13% in Switzerland, which was much lower than the 37% for Australia and 46% for Chile, but was similar to the 10% for Hong Kong (table 4). Unfortunately, it was not possible to compare results in Hong Kong children with those in the Melbourne children who used the Chinese version of the questionnaire, as the latter was a small group and the data were not analysed independently.

The result of our study adds to a mounting body of evidence of regional difference in asthma prevalence. Some of the reasons proposed for the difference in prevalence include differences in community awareness, asthma severity and environmental factors. If community awareness were a major source of the difference in prevalence rates, one would expect milder disease with less frequent wheezing episodes in Melbourne and more severe disease with frequent wheezing in Hong Kong. This was not seen, and about two thirds of children who reported wheeze in the past 12 months both in Melbourne and Hong Kong had less than four episodes of wheeze, whilst 5–10% in both cities had more than 12 episodes. Nevertheless, a significant proportion of children with symptoms suggestive of asthma did not report wheeze in the past 12 months. This could be due to misinterpretation of the questions by the parents who have an average literacy rate of 85%, which is lower than that in Australia [14]. Video questionnaire has been shown to be more reproducible than written questionnaire and to have equivalent sensitivity and specificity with respect to bronchial hyperresponsiveness testing [15]. This method should be particularly useful in overcoming language barriers in ethnic populations, but it has not yet been widely tested in countries with different culture and language.

We could not ascertain the severity of asthma based on the use of asthma drugs, as medications are not labelled

Table 4. – Comparison of prevalence (95% CI) of respiratory symptoms in 12 year olds

Respiratory symptoms	Melbourne*	Hong Kong	St. Gallen*	La Serena*
Subjects n	2899	623	1393	1820
Wheeze in past 12 months %	22 (19.4–22.4)	5 (3.0–6.7)	6 (4.7–7.3)	21 (18.5–22.7)
Ever had wheeze %	37 (32.6–40.4)	10 (8.4–12.1)	13 (11.7–15.1)	46 (43.5–48.3)
Ever had asthma %	23 (20.3–26.00)	8 (7.5–9.2)	6 (4.7–7.1)	8 (6.6–9.4)

95% CI: 95% confidence interval. *: Data from ROBERTSON *et al.* [11].

in Hong Kong and the subjects are often unaware of what is prescribed. Otherwise, it would have provided an indirect measure of asthma severity for comparison with the other three populations.

Australia has one of the highest prevalences of childhood asthma in the world, suggesting the existence of local factors important in the pathogenesis. The relevance of environmental factors is best illustrated by migrant studies. Previous studies showed that both adults and children born outside Australia had significantly less respiratory illness, asthma, and lower bronchial hyperreactivity when compared to those born in Australia [16–18]. A recent study by LEUNG and coworkers [19] showed that many South-East Asian immigrants from countries including Hong Kong developed asthma after arrival in Australia, and the prevalence of asthma increased with the length of stay. The risk for asthma in these immigrants was 1.4 for those who had lived in Australia for 6–10 yrs and was 2.1 for more than 10 yrs compared to those who had stayed for 5 years or less [l9]. Interestingly, South-East Asian children born in Australia had similarly high prevalence of wheeze and asthma as their non-Asian counterparts, indicating that infants and young children are particularly prone to the important environmental factors.

What environmental or westernization factors exist in Australia and trigger asthma, and what local factors in Hong Kong and other Asian countries could protect against asthma, remains largely unknown. The two regions differ immensely in culture, dietary factors, housing styles and aeroallergen load. These and other undefined factors could be responsible for the regional difference in the prevalence of wheeze and respiratory symptoms suggestive of asthma, and deserves further investigation.

Although questionnaire responses are subjective and can be influenced by a variety of cultural and sociological factors, standard respiratory questionnaires have provided useful estimation of asthma prevalence in the past [20]. Bronchial hyperresponsiveness was not tested in this study, because it was logistically prohibitive, and although it would provide an objective measure supportive of the diagnosis of asthma, it lacks both sensitivity and specificity [21, 22].

Within its limitations, our study has demonstrated a low prevalence of wheeze and asthma in schoolchildren in Hong Kong and marked regional difference in prevalence rates of respiratory symptoms. A change in the pattern of wheeze and asthma often occurs after migration, and well-planned migrant surveys to compare change in environmental factors could aid in the identification of important local factors and give valuable clues to the increase in asthma prevalence in many countries today.

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