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# Increase in asthma and a high prevalence of bronchitis: Results from a population study among adults in urban and rural Vietnam

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## KEYWORDS

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Prevalence;  
Risk factors

## Summary

**Background:** While a large amount of data about the epidemiology of asthma, COPD, chronic bronchitis and respiratory symptoms are available from developed countries, the information about these diseases in developing countries in south-east Asia are scarce.

**Aim:** Assess the prevalence of respiratory diseases and symptoms and their relation with demographic data including smoking habits among adults in rural and urban Vietnam.

**Methods:** A random sample of subjects aged 21–70 years were invited; 3008 subjects living in an inner city area of Hanoi and 4000 in a rural area of Bavi in northern Vietnam. An internationally used questionnaire was delivered by field workers to the study subjects. The questionnaire was completed by the subjects, or when necessary, by the field workers after reading the questions for the study participants.

**Results:** The response rate was 92% in Bavi and 70% in Hanoi. Of men in Bavi 67.8% (Hanoi 49.7%;  $p < 0.001$ ) were smokers, while of women 4.2% were smokers in Hanoi (Bavi 1.2%;  $p < 0.001$ ). The prevalence of ever asthma was in Hanoi 5.6% (Bavi 3.9%;  $p = 0.003$ ) with

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no major gender difference. The most common symptom was longstanding cough (Hanoi 18.1%, Bavi 12.0%;  $p < 0.001$ ) followed by sputum production, while the prevalence of symptoms common in asthma was considerably lower. Although the large difference in smoking habits, respiratory symptoms tended to be only slightly more common in men than women. Family history of asthma and chronic bronchitis, respectively, were strongly associated with both diseases.

*Conclusions:* The prevalence of asthma in adults may have increased in both urban and rural Vietnam, as the few previous estimates have found 2% of adults having asthma. Half of men in Hanoi and two-thirds in Bavi were smokers versus a few percent of women in both areas. Bronchitic symptoms were common in both men and women.

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## Introduction

During the second half of the past century the prevalence of asthma and allergic diseases increased considerably in most developed countries,<sup>1,2</sup> and today asthma and allergic diseases are the most common chronic non-communicable diseases among children, teenagers and adults up to middle-age.<sup>3</sup> Over the past decades, the prevalence of asthma has increased also in developing countries.<sup>4</sup>

There are still scarce information about the prevalence of asthma and other obstructive airway diseases from several developing countries including the countries in south-east Asia. The information is limited and of varying quality and results are often conflicting. According to a recent study conducted in a highland city of the southern part of Vietnam, the prevalence of symptoms common in asthma was low, and the prevalence of asthma was estimated at 2%.<sup>5</sup> In 2001, according to the ISAAC study protocol among children aged 6–11 years in schools in Hanoi, the prevalence of 'doctor-diagnosed asthma' was 14% and similar to westernized countries.<sup>6</sup>

As a consequence of the tobacco epidemic, COPD has become an increasing demand all over the world.<sup>7,8</sup> Smoking is today particularly common among men in developing countries.<sup>8</sup> Following a network study in 11 Asian countries, the prevalence of COPD in Vietnam was estimated as the highest based on information about smoking habits.<sup>9</sup> However, there are no data at all from Vietnam about the prevalence of COPD based on population studies using spirometry.

The lack of data of adults, the indices of increase in asthma and the smoking epidemic strongly motivate a population study in Vietnam. We thus conducted a cross-sectional questionnaire survey in one urban and one rural area of Vietnam. The main aim of the study was to assess the prevalence of respiratory symptoms and diseases and their relation with mainly demographic data including smoking habits.

## Material and methods

The area of Vietnam is nearly 300,000 km<sup>2</sup> and the population was 86 million in 2006. Mountains consist 3/4 of the area while lower areas are located along the Pacific sea-side of the country. In 1986 an economic reform started in

Vietnam. A market economy was introduced with privatisation in all economic sectors and opened the country to the outside world. As a consequence, the economy has rapidly developed and resulted in dramatic economic and social changes as well as increased air pollution. These changes may affect health and quality of life. The distance between rural and urban areas has widened. In 2002, 29% of the population lived below an internationally accepted poverty line. The literacy is close to 100%.

The study was performed in one rural and one urban area. The choice of the areas was based on geography and air pollution: Hoankiem is an inner city district of Hanoi with an area of 5.29 km<sup>2</sup> and a population of 180,000 in 2006; Bavi is a district of the Hatay province 60 km west of Hanoi covering 410 km<sup>2</sup> including lowland, highland and mountains and has 235,000 inhabitants. The major population in Bavi are farmers (81%), and their income are based on agriculture production and livestock breeding.<sup>10</sup>

## Study sample

The study sample was 7008 subjects aged 21–70 years (born 1937–1986). Among them, 4000 subjects were randomly chosen from 51,000 inhabitants living in Bavi. The sampling in Bavi was based on 67 clusters sampled by an epidemiologic field laboratory.<sup>10</sup> In Hoankiem also 4000 subjects were randomly selected from the 108,000 subjects aged 21–70 years. However, all subjects from two communes were excluded as only a small proportion (<10%) were possible to trace. The reminding 3008 subjects were living in 16 inner city communes of Hanoi with 62,960 subjects aged 21–70 years.

## Questionnaire

The questionnaire included questions about respiratory symptoms and diseases including asthma, chronic bronchitis, COPD, allergic and chronic rhinitis, use of asthma medication, profession, smoking habits and a number of exposures and life style factors, such as diet and the stuff for cooking. The questions about symptoms and diseases were taken from the FinEsS-study version<sup>11</sup> of the Swedish OLIN-questionnaire.<sup>12</sup> The questionnaire has been used in a large number of Swedish and Northern European studies

since 1985.<sup>11–16</sup> It was translated from English into Vietnamese and back to English before printing of its final version. An informing letter was used to explain the study to the participants.

### Pilot study and field survey

From the original sample of 4000 subjects in each area, a random sample of 250 subjects per area was invited to a postal survey. Fifty completed questionnaires were received from Bavi and only one from Hanoi. Of the 51 returned questionnaires, five were completed by other persons than invited. We thus concluded that a postal survey is not useful in Vietnam.

Instead of a postal survey, we decided to use the facilities of the Bavi epidemiology field laboratory.<sup>10</sup> The laboratory has well-trained field workers who delivered the questionnaires to the participants and asked them to complete the questionnaire. In case a participant could not complete the questionnaire, the field worker made a structured interview by reading the questions without any other interfering or explanation to the subjects under study. In Bavi 46 field workers delivered the questionnaire, and about 80% of the questionnaires were completed by surveyors. Six field work supervisors checked the work of the field workers every week. In Hoankiem, 4–14 staff persons in each of the communes' health care units delivered the questionnaires, and a majority of the questionnaires were completed by the participants by themselves. The field work was performed at the same time in both areas from September 2007 to January 2008.

### Ethics

The ethical issue was approved by Committee of Hanoi Medical University in July 2006.

### Definitions

*Physician-diagnosed asthma:* - "Have you been diagnosed as having asthma by a doctor?"

Similar to asthma, the criteria of chronic bronchitis was based on the two questions:

*Ever asthma:* - "Have you ever had asthma?"

*Physician-diagnosed chronic bronchitis:* - "Have you been diagnosed as having chronic bronchitis, COPD or emphysema by a doctor?"

*Ever chronic bronchitis:* - "Have you ever had chronic bronchitis, COPD or emphysema?"

*Longstanding cough:* - "Have you had longstanding cough during the last years?"

*Sputum production:* - "Do you usually have phlegm when coughing, or do you have phlegm in your chest which is difficult to bring up?"

*Chronic productive cough:* - "Have you had sputum production on most days during at least 3 months at least 2 successive years?"

*Dyspnea* (i.e. dyspnea grade II): - "Do you get short of breath when you walk with other people of your own age on level ground at normal pace?"

*Recurrent wheeze:* - "Do you usually have wheezing, whistling, or a noisy sound in your chest when breathing?"

*Any wheeze:* - "Have you had wheezing or whistling in your chest at any time in the last 12 months?"

*Wheeze apart from cold:* "Yes"—answer to *any wheeze* and to -"Have you been at all breathless when the wheezing noise was present?" and to -"Have you had this wheezing or whistling when you did not have a cold?"

*Attacks of shortness of breath (Attacks of SOB):* - "Have you had asthma symptoms during the last 12 months (intermittent breathlessness or attacks of shortness of breath; the symptoms may exist simultaneously with or without cough or wheezing)?"

*Woken by chest tightness:* - "Have you woken up with a feeling of tightness in your chest at any time during the last 12 months?"

*Hay fever:* - "Have you ever had allergic rhinitis (hay fever) or allergic eye catarrh?"

*Family history of asthma:* - Does any of your parents, brothers or sisters have or have had asthma?

*Family history of chronic bronchitis:* - Does any of your parents, brothers or sisters have or have had chronic bronchitis, COPD or emphysema?

*Family history of obstructive lung disease (OLD):* "Yes"—answer to any of the two questions about family history of asthma and family history of chronic bronchitis.

### Statistical analysis

The data were analysed by using Statistical Package for Social Sciences (SPSS) version 16.0. Uni-variate analyses were performed using the Chi-square test. One way analysis of variance (ANOVA) was used for test of trends. A  $p$ -value  $< 0.05$  was considered statistically significant. Risk factors for diseases and symptoms were calculated using multiple logistic regression analysis and results were expressed as odds ratios (OR) with 95% confidence intervals (95% CI). Independent variables significantly associated with the studied diseases or symptoms were included in the

**Table 1** Study sample. Invited and participants by area, age and sex.

Study population	Bavi				All	Hanoi				All
	21–45 y		46–70 y			21–45 y		46–70 y		
	Men	Women	Men	Women		Men	Women	Men	Women	
Invited	1281	1334	690	695	4000	792	858	692	666	3008
Participants	1146	1212	645	664	3667	563	586	500	466	2115
In (%) of the invited	89.5	90.9	93.5	95.5	91.7	71.1	68.3	72.3	70.0	70.3

**Table 2** Smoking habits (%) by area, age and sex.

Smoking habits	Bavi			Hanoi			Different by						
	21–45 y		46–70 y		All	21–45 y		46–70 y		All	Area	Age	Sex
	M	W	M	W		M	W	M	W				
Non-smoker	26.6	98.6	20.3	99.1	62.4	49.9	96.4	44.0	94.8	71.3			
Ex-smoker	4.7	0	13.5	0	3.8	2.0	0	4.6	0.2	1.7	<0.001	0.197	<0.001
Smoker	68.7	1.4	66.2	0.9	33.7	48.1	3.6	51.4	4.9	27.0			

multivariate model. In the results section, associations between smoking and symptoms are also given based on stratified uni-variate analysis.

## Results

### Participation and smoking habits

The questionnaire was completed by 5782 (82.5%) subjects. The response rate in the rural Bavi was 91.7%, while it was 70.3% in Hanoi. The response rate in Bavi, respectively Hanoi, was similar in men and women, and there were no major difference by age (Table 1). Among men 61.1% were current smokers (Bavi 67.8%; Hanoi 49.7%;  $p < 0.001$ ) (Table 2). The corresponding figure among women was 2.3% (Bavi 1.2%; Hanoi 4.2%;  $p < 0.001$ ).

### Prevalence of airway diseases

*Ever asthma* was reported by 5.6% in Hanoi versus 3.9% in Bavi (Table 3). In Bavi, a lower prevalence was found in subjects aged 21–45 years compared with the elderly ( $p = 0.02$ ) while an opposite trend was found in Hanoi. The highest prevalence, 7.1%, was reported by men in Hanoi aged 21–45 years, and the lowest among women in Bavi aged 21–45 years, 2.5%. All together, the prevalence among men was higher than in women ( $p = 0.01$ ), while use of asthma medicines was 2.1% in both areas and similar in men and women.

The prevalence of *ever chronic bronchitis* was significantly greater in Hanoi than in Bavi ( $p = 0.005$ ) with no significant gender difference, and it was considerably greater among the elderly in both areas (Table 3). *Physician-diagnosed chronic bronchitis* was significantly more common among men than women ( $p = 0.005$ ).

Allergic rhinitis, or *hay fever*, was considerably more common in Hanoi, 29.6%, than in Bavi, 10.0% ( $p < 0.001$ ). It was equally common in men and women and tended to be more common among subjects aged 46–70 years compared to those aged 21–45 years in both areas (Table 3).

### Prevalence of respiratory symptoms

The most common symptom was *longstanding cough* followed by *sputum production* (Table 4). *Longstanding cough* was reported by 18.1% in Bavi versus 12.0% in Hanoi ( $p < 0.001$ ) without significant age or gender difference in both areas. The prevalence of *sputum production* was 16.0% in Bavi versus 11.0% in Hanoi ( $p < 0.001$ ) and was more common in elderly ( $p = 0.022$ ). *Sputum production* was equally common in men and women in Hanoi, while in Bavi it was more common in men, 17.5%, versus 14.5% in women ( $p = 0.014$ ). The prevalence of wheeze, attacks of shortness of breath and dyspnea were all low.

Bronchitis symptoms, i.e. *sputum production*, *longstanding cough* and *chronic productive cough* were more common among smokers (Fig. 1). Respiratory symptoms were equally common and equally distributed among subjects reporting physician-diagnosed asthma and physician-diagnosed chronic bronchitis, respectively (Fig. 2).

### Multivariate relationships

Family history appeared as the dominating risk factor for both asthma and chronic bronchitis (Table 5). Physician-diagnosed asthma was further associated to both ex-smoking, OR 3.04 (1.51–6.13) and current smoking, OR 1.61 (1.07–2.42), but not with age, sex and area. Physician-diagnosed chronic bronchitis was significantly

**Table 3** Prevalence (%) of respiratory diseases and use of asthma medicines by area, age and sex (M = men, W = women). Difference ( $p$ -value) by area, age and sex.

Respiratory and allergic diseases and medicine use	Bavi			Hanoi			Different by						
	21–45 y		46–70 y		All	21–45 y		46–70 y		All	Area	Age	Sex
	M	W	M	W		M	W	M	W				
Ever asthma	4.3	2.5	5.1	4.7	3.9	7.1	4.4	5.4	5.4	5.6	0.003	0.084	0.011
Ph-diagnosed asthma	4.5	2.3	5.0	4.5	3.8	5.0	3.4	3.4	3.9	3.9	0.880	0.216	0.017
Using asthma medicines	2.2	1.1	3.1	2.9	2.1	2.5	1.2	2.0	3.0	2.1	0.943	0.005	0.108
Hay fever	9.1	10.0	10.5	11.0	10.0	29.0	28.8	29.4	31.8	29.6	<0.001	0.001	0.546
Ever chronic bronchitis	3.7	2.4	8.5	6.2	4.6	4.8	4.1	7.8	9.0	6.2	0.005	<0.001	0.067
Ph-diagnosed chronic bronchitis	3.0	1.2	5.4	3.3	2.9	3.4	2.4	5.2	5.8	4.1	0.016	<0.001	0.005

**Table 4** Prevalence (%) of respiratory symptoms by area, age and sex (M = men, W = women). Difference (*p*-value) by area, age and sex.

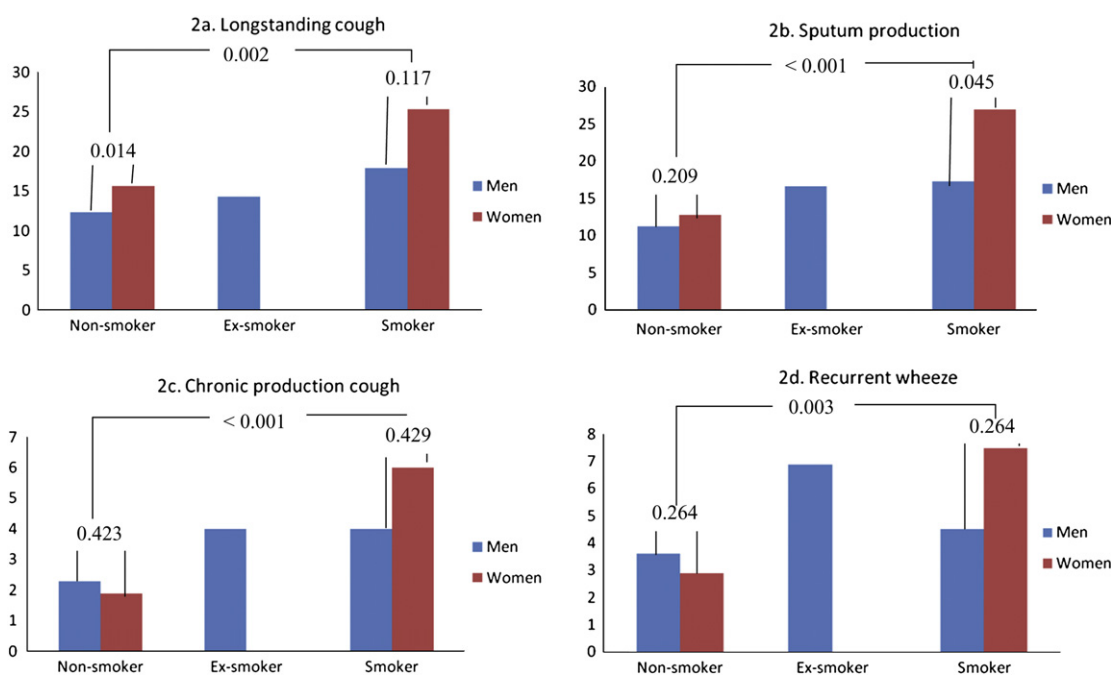
Respiratory symptoms	Bavi					Hanoi					Different by		
	21–45 y		46–70 y		All	21–45 y		46–70 y		All	Area	Age	Sex
	M	W	M	W		M	W	M	W				
Any wheeze	4.6	3.4	7.6	6.5	5.1	5.0	2.6	3.2	4.5	4.3	0.216	<0.001	0.021
Wheeze apart from cold	3.2	2.2	5.4	4.5	3.5	2.8	1.4	3.4	2.8	2.6	0.044	<0.001	0.027
Recurrent wheeze	3.5	2.1	5.7	5.0	3.7	3.7	2.4	5.4	3.4	3.7	0.990	<0.001	0.006
Attacks of SOB	3.4	2.5	5.9	4.5	3.7	2.7	1.7	4.2	3.4	2.9	0.106	<0.001	0.033
Woken by chest tightness	4.5	4.1	10.2	8.7	6.2	3.4	2.7	5.4	5.4	4.1	0.001	<0.001	0.269
Longstanding cough	16.6	17.7	20.3	19.3	18.1	11.4	10.6	13.4	12.9	12.0	<0.001	0.063	0.964
Sputum production	15.8	13.9	20.6	15.7	16.0	10.3	10.1	12.8	10.9	11.0	<0.001	0.022	0.017
Chronic productive cough	3.1	1.4	4.0	2.4	2.6	2.8	2.2	4.2	2.8	3.0	0.383	0.022	0.001
Dyspnea	2.3	3.9	6.8	8.0	4.6	5.0	5.8	6.8	7.3	6.1	0.013	<0.001	0.057

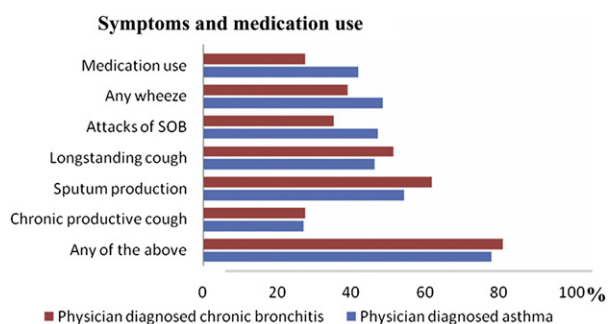
associated with high age, OR 1.99 (1.46–2.71), while current and ex-smoking did not yield an increased risk. Most symptoms were associated with high age and current smoking.

When the multivariate analyses were performed separately in Hanoi and Bavi, current smoking was a risk factor in Hanoi for chronic productive cough (OR 3.86; 95% CI 1.97–7.57), longstanding cough (OR 1.60; 1.13–2.27), physician-diagnosed chronic bronchitis (OR 1.95; 1.08–3.57) and physician-diagnosed asthma (OR 1.80; 1.02–3.19), while in Bavi current smoking reached statistical significance only for longstanding cough (OR 1.40; 1.05–1.87). When performing the analyses separately in men and women, similar patterns appeared despite a gender difference in smoking habits (data not shown).

## Discussion

This survey was the first general population study of asthma, chronic bronchitis and rhinitis among adults performed in both rural and urban Vietnam. The main findings verify that the prevalence of asthma and of symptoms common in asthma was lower than in westernized countries.<sup>2,11,14</sup> Both physician-diagnosed asthma and ever having had asthma was reported on average by 4% in the rural Bavi. In the capital Hanoi physician-diagnosed asthma was on the same level, while the prevalence of ever asthma was 7% in men aged 21–45 years. The prevalence of both longstanding cough and sputum production was high and possibly contributed by the heavy smoking burden in the society. These symptoms of bronchitis were reported similar or greater than in several westernized

**Figure 1** Prevalence (%) of longstanding cough, sputum production, chronic productive cough and recurrent wheeze by smoking habits in men and women. Difference (*p*-value) by sex, and between non-smokers and current smokers.



**Figure 2** Proportion (%) of respiratory symptoms and users of asthma medicines among subjects with physician-diagnosed asthma and physician-diagnosed chronic bronchitis, respectively.

countries.<sup>11,12,17</sup> Despite the large gender difference in smoking habits, the prevalence of symptoms was similar in men and women. A large majority of men were smokers versus a very low percentage of women.

The prevalence of asthma and respiratory symptoms in Vietnam is poorly known particularly in adults due to few performed studies, and most studies have not been published elsewhere than locally. One such study was performed in 1961, and the prevalence of asthma was assumed to be 2% [professor Nguyen Nang An, Hanoi Medical University report]. A study in Dalat, a highland city 400 km northeast from Ho Chi Minh City in the southern part of Vietnam yielded a prevalence of asthma or asthma-like symptoms of 2.3% in ages >15 years.<sup>5</sup> The survey was an interview study based on the European Community Respiratory Health Survey (ECRHS) questionnaire among 9984 subjects. In contrast to these low estimates of prevalence, in Hanoi in 2001 following the ISAAC protocol,<sup>18</sup> the prevalence of 'doctor-diagnosed asthma' among children aged 6–11 years was 14% and similar to westernized countries.<sup>6</sup>

In contrast to studies of adults, studies among children and teenagers following the ISAAC protocol have been performed in countries in South-east Asia.<sup>4,19–22</sup> The prevalence is fairly in line with the results of the referred study in Hanoi.<sup>5</sup> In schoolchildren in Singapore the prevalence of recurrent wheeze was 12%,<sup>21</sup> while in Malaysian primary and secondary schoolchildren current wheeze was 4–7% without any major changes from 1995 to 2001.<sup>22</sup> In early 1990s among secondary schoolchildren in the province of Guangdong, Southern China, considerably lower prevalence was found, wheeze or asthma ever and wheeze in the past 12 months were 2% and 1%, respectively.<sup>23</sup> A recent study of schoolchildren found the prevalence of asthma to be 6% in urban Beijing versus 1% in a rural area outside Beijing.<sup>24</sup> Major cities and heavily urbanised areas, such as Hong Kong<sup>25</sup> with a westernized life style have a higher prevalence of asthma and wheezing conditions than we found. Australia, New Zealand and Japan have all a higher prevalence of asthma and symptoms common in asthma than Vietnam.<sup>26–28</sup>

Due to the very few population based studies in adults of asthma and respiratory symptoms in the neighbouring countries, and the use of different methods as well, makes comparisons difficult. Nevertheless, one study in Thailand

**Table 5** Risk factors, Odds ratio (OR/95%CI), for physician diagnosed asthma, physician-diagnosed chronic bronchitis, and respiratory symptoms by multiple logistic regression analyses.

Independent variables	Dependent variables											
	Physician diagnosed asthma		Physician diagnosed chronic bronchitis		Recurrent wheeze		Longstanding cough		Chronic productive cough			
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI		
Age, 46–70 y	1.16	0.87–1.64	1.99	1.46–2.71	1.75	1.31–2.32	1.20	1.03–1.39	1.38	1.00–1.92		
Sex, male	0.97	0.65–1.45	1.45	0.97–2.17	1.21	0.82–1.79	0.79	0.64–0.98	1.16	0.73–1.85		
Area, Hanoi	1.02	0.75–1.37	1.34	0.98–1.83	0.91	0.67–1.22	0.58	0.50–0.68	1.11	0.79–1.55		
F. H of asthma <sup>a</sup>	16.10	12.09–21.43	–	–	–	–	–	–	–	–		
F. H of ch. br. <sup>a</sup>	–	–	12.84	9.45–17.43	–	–	–	–	–	–		
F. H. OLD <sup>a</sup>	–	–	–	–	7.21	5.43–9.56	3.42	2.79–3.95	6.37	4.61–8.82		
Smoking habits	1	–	1	–	1	–	1	–	1	–		
Non-Smoker	3.04	1.51–6.13	1.57	0.75–3.28	1.78	0.87–3.62	0.97	0.60–1.56	1.73	0.72–4.20		
Ex-smoker	1.61	1.07–2.42	1.07	0.71–1.61	1.34	0.90–2.00	1.45	1.16–1.80	1.89	1.20–2.99		
Smoker	–	–	–	–	–	–	–	–	–	–		

<sup>a</sup> Family history of asthma, chronic bronchitis and obstructive lung disease, respectively.

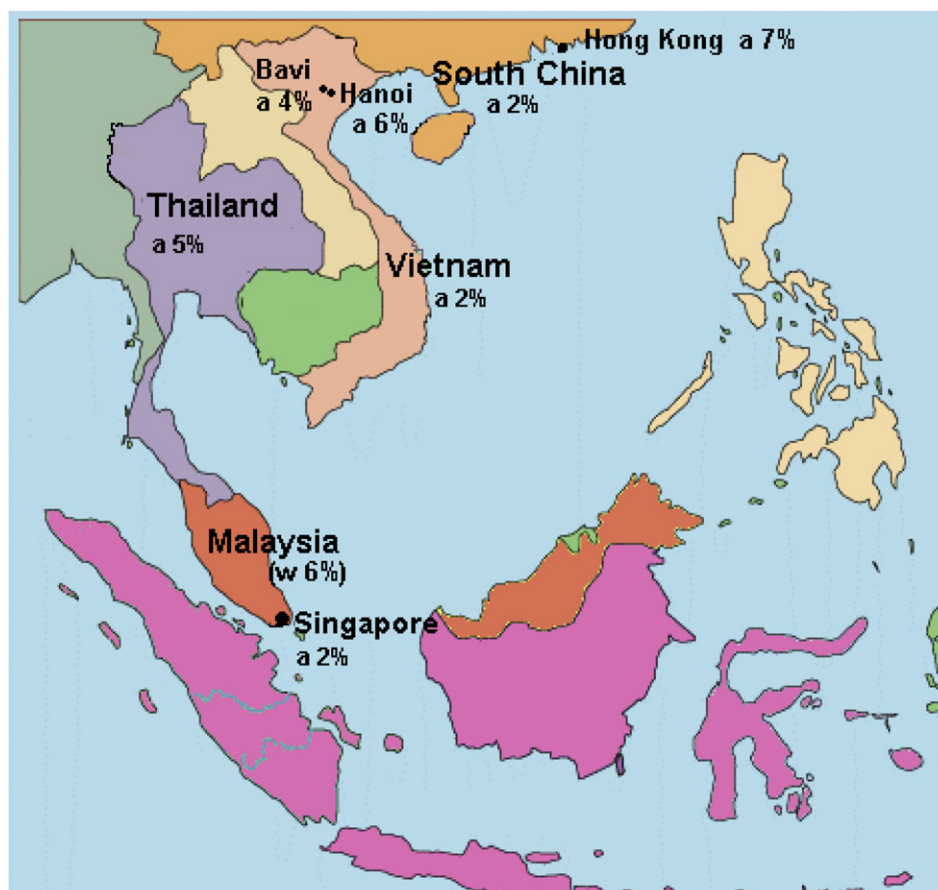
among 3631 randomly selected students from six universities in Bangkok found the prevalence of wheeze to be 10% and of diagnosed asthma somewhat lower.<sup>29</sup> Studies of adult asthma in Singapore have estimated the prevalence to be 2% in both men and women.<sup>30</sup> According to a cross-sectional study using a self-administrated questionnaire in Guangzhou, China, the prevalence of diagnosed asthma was also found to be 2%.<sup>31</sup> These studies were performed 10–20 years ago, which may explain the somewhat higher asthma prevalence of 4–5% found in our study.

In a recent study in Thailand using methacholine tests and tests of reversibility, the prevalence of asthma was similar to ours. In our study the prevalence of both recurrent wheeze and any wheeze in the last 12 months was only about 5%, while wheezing was reported by 16% in the study from Thailand.<sup>32</sup> The prevalence of symptoms common in asthma was surprisingly low in our study. The wording of wheeze and breathlessness symptoms may have contributed to the low prevalence. Asthma control in adults in East

Asia is far from optimal,<sup>33</sup> and in eight countries hospitalisation among asthmatics was most common in Vietnam and the Philippines, a not surprising result, as our data show that only a half the asthmatics were using asthma medicines. The referred south-east Asian studies of asthma prevalence among adolescents and adults are summarised in Fig. 3.

The prevalence of current smokers among men in our study, 61%, was higher than that in a study of Singapore and Vietnam by Morrow et al,<sup>8</sup> but lower than found in Vietnam by Jenkin et al.<sup>34</sup> When compared to other countries in South-East Asia, the prevalence of smoking in men in Vietnam was the highest.<sup>8,9</sup> In contrast, the prevalence of smoking women was the lowest, and still only 2% of women reported they were smokers in our study.

Also in countries in Eastern Europe,<sup>15,35–37</sup> the proportion of smoking men is considerably greater than that of smoking women. For instance in Estonia, as in Vietnam, symptoms of bronchitis are almost equally common in men



Foot-note:

South China - references 31 and 23: Zhong et al, 1990; Leung et al, 1994

Hong Kong - reference 25: Leung et al, 1994

Singapore - reference 30: Ng 1999

Malaysia - reference 22: Quah et al, 2005

Thailand - reference 32: Dejsomritrutai et al, 2006

Vietnam - reference 5: Sy et al, 2007

(Hanoi and Bavi in Vietnam: this study)

**Figure 3** Map of South-East Asia with population studies of prevalence of adult or adolescent asthma (a) referred to in the discussion. For Malaysia the prevalence refers to wheeze (w). The reference numbers are given in a footnote below the figure.

as in women although large differences in smoking habits.<sup>15</sup> In Estonia, passive smoking with exposure from family members, at restaurants, work places etc. was found to be a major cause of respiratory symptoms.<sup>36</sup> This dose-response association between passive smoking and respiratory symptoms was also found in the ECRHS.<sup>37</sup> In Vietnam cooking by using open fire particularly in rural areas and a very heavy air pollution in cities mainly from traffic are other causes that may contribute to respiratory symptoms and bronchitis. A study of non-smoking women in Singapore confirmed both passive smoking and gas cooking to be associated with chronic cough and sputum production.<sup>38</sup>

Among risk factors for both asthma and chronic bronchitis, family history of the diseases yielded the highest odd ratios in line with results from western countries.<sup>11,13,14</sup> A similar association regarding family history and asthma was also found in the study from Dalat in southern Vietnam.<sup>5</sup> As found by other cross-sectional studies,<sup>11,12</sup> ex-smoking was significantly associated with asthma, further, so was current smoking, which is in line with results from some prospective studies.<sup>13</sup> Chronic bronchitis was mainly associated with increasing age.

The proportion of symptoms and medicine users among subjects with asthma and chronic bronchitis, respectively, was close to identical. This together with the poor association between smoking and bronchitis indicate that the two diagnoses may have been used inconsequently by physicians. There is also a possibility for misunderstanding by the patients with obstructive airway diseases about their diagnosis.

The prevalence of hay fever was considerably higher in Hanoi compared to Bavi reflecting a previously recognised urban effect on allergic sensitisation.<sup>39,40</sup> It could be explained by heavy air pollution from vehicle exhausts in the city, the high traffic density on narrow roads all the time with stuck traffic jams happening every day. Car exhausts may pollute allergens, such as pollen from grass and trees, so the sensitising effects become stronger.<sup>41</sup>

As a result of the active field work, the response rate of 83% in our study must be regarded as high, and it was similar with results of postal questionnaire surveys in European countries with often high response rates, such as Finland and Sweden.<sup>11–14</sup> The participation rate in Bavi was notably high, 92%. The well-trained surveyors and already previously well defined field laboratory in Bavi<sup>10</sup> with experience from several surveys have probably contributed to the success. Also in Hanoi, the participation was similar or higher than in capitals for instance in European studies.<sup>11,15</sup>

There are several strengths with our study. First, the populations in the studied areas were clearly defined, and the study samples were randomly selected within each area. Also the size of the sample and the participation was large enough to allow comparisons with reasonable power between the areas. A weakness is that there may have been misunderstanding of questions, particularly in the rural area, and the low prevalence of wheezing may partly be result of misunderstanding. Also the method of using field workers instead of a postal survey may have influenced the results. Regarding external validity, although not validated in Vietnam, an internationally well validated questionnaire was used. A clinical validation of the questionnaire study's result is needed in order to define the internal validity and

to yield valid estimates of the prevalence of asthma and COPD.

In conclusion, the prevalence of asthma among adults of 4–5%, in contrast to previous results of 2%, strongly indicates an increase in asthma among adults in Vietnam. The prevalence was higher than expected also in rural Vietnam. The smoking burden in Vietnam with a majority of men smoking results in a high exposure of environmental tobacco smoke in the whole society. The prevalence of symptoms of bronchitis was high in both men and women.

## Conflict of interest

None.

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