

# Worldwide severity and control of asthma in children and adults: The global Asthma Insights and Reality surveys

Klaus F. Rabe, MD,<sup>a</sup> Mitsuru Adachi, MD,<sup>b</sup> Christopher K.W. Lai, MD,<sup>c</sup> Joan B. Soriano, MD,<sup>d,e</sup> Paul A. Vermeire, MD,<sup>f</sup> Kevin B. Weiss, MD,<sup>g</sup> and Scott T. Weiss, MD<sup>h</sup> *Leiden, The Netherlands, Tokyo, Japan, Hong Kong, China, Upper Providence, Pa, London, United Kingdom, Antwerp, Belgium, Chicago, Ill, and Boston, Mass*

**Background:** In 1995, the Global Initiative for Asthma (GINA) guidelines recommended goals for the management of asthma, which were updated in 2002. However, there are no recent international surveys on the real management of asthma.

**Objective:** The Asthma Insights and Reality surveys are the first large-scale surveys aimed at determining international variations in the severity, control, and management of asthma in children and adults.

**Methods:** A cross-section of households in 29 countries in North America, Europe, and Asia were surveyed to identify from the general population asthmatic patients with symptoms within the last year or who were taking current asthma medication. A standard questionnaire was administered to 7786 adults, and, through a proxy, to 3153 children with asthma. Objective and subjective patient perception of asthma control and severity were assessed, including access to medical care, health care use, missed work-school, and medication use.

**Results:** Despite variations at a country level, a substantial effect of asthma on patients' lives was observed, with considerable loss of schooldays and workdays. The current level of asthma control worldwide falls far short of the goals for long-term management in international guidelines. A significant proportion of patients continue to have symptoms and lifestyle restrictions and to require emergency care. The proportion of adult asthmatic patients who were current smokers was also high. However, the use of anti-inflammatory preventative medication, even in patients with severe persistent asthma, was low, ranging from 26% in Western Europe to 9% in Japan, as was the use of objective lung function testing. The

correlation between self-perceived severity of asthma and objective assessment of severity on the basis of GINA criteria was consistently poor in all areas.

**Conclusion:** We conclude that there is direct evidence for suboptimal asthma control in many patients worldwide, despite the availability of effective therapies, with long-term management falling far short of the goals set in the GINA guidelines. (*J Allergy Clin Immunol* 2004;114:40-7.)

**Key words:** Asthma, Global Initiative for Asthma, international, control, severity

The Global Initiative for Asthma (GINA),<sup>1</sup> updated in 2002,<sup>2</sup> and other asthma management guidelines have been introduced to improve patient care and to provide optimal long-term control of the disease. It has been shown that the correct use of asthma guidelines leads to improved care of patients.<sup>3</sup> During the early 1990s, 2 large epidemiologic surveys, the International Study of Asthma and Allergies in Childhood in children<sup>4</sup> and the European Community Respiratory Health Survey in adults,<sup>5,6</sup> greatly expanded the understanding of the distribution and burden of asthma worldwide. However, data are scarce on the effects of asthma, the current level of asthma control, and the international variations in the management of asthma according to objective severity of asthma symptoms. International surveys can help to identify management areas that perform better (or worse) than the average or than *a priori* determined goals.

The GINA guidelines specify 8 goals for the long-term management of asthma: minimal chronic symptoms, minimal exacerbations, no emergency visits, minimum need for as-required  $\beta_2$ -agonists, no limitations to daily activities, near-normal peak expiratory flow, peak expiratory flow circadian variation of less than 20%, and minimal adverse effects from asthma medication. The guidelines also recommend smoking cessation and the avoidance of exposure to tobacco smoke because this exposure has been strongly linked to an increased susceptibility to the development or exacerbation of asthma.<sup>1,2</sup>

Although there have been some efforts to validate the GINA classifications of asthma severity and control,<sup>7,8</sup> it has to be acknowledged that the GINA staging system has not been formally validated, and the proposed level of control might not be achievable in many asthmatic patients.

From <sup>a</sup>the Department of Pulmonology, Leiden University Medical Center, Leiden; <sup>b</sup>the First Department of Internal Medicine, Showa University School of Medicine, Tokyo; <sup>c</sup>The Chinese University of Hong Kong, Hong Kong; <sup>d</sup>Worldwide Epidemiology, GlaxoSmithKline Research and Development, Upper Providence; <sup>e</sup>the Health Promotion Research Unit, London School of Hygiene and Tropical Medicine, London; <sup>f</sup>the Department of Respiratory Medicine, University of Antwerp; <sup>g</sup>Midwest Center for Health Services and Policy Research, Hines VA Hospital, and The Center for Health Care Studies, Northwestern University Feinberg School of Medicine, Chicago; and <sup>h</sup>Channing Laboratory, Department of Medicine, Brigham & Women's Hospital and Harvard Medical School, Boston.

Supported by GlaxoSmithKline R&D.

Received for publication October 23, 2003; revised April 1, 2004; accepted for publication April 5, 2004.

Reprint requests: Klaus F. Rabe, MD, Department of Pulmonology C3-P, Leiden University Medical Center, NL-2300 RC Leiden, The Netherlands. E-mail: k.f.rabe@lumc.nl.

0091-6749/\$30.00

© 2004 American Academy of Allergy, Asthma and Immunology  
doi:10.1016/j.jaci.2004.04.042

**TABLE I.** Classification of asthma severity according to type and frequency of asthma symptoms on the basis of GINA guidelines

Frequency of asthma symptoms	Severe persistent	Moderate persistent	Mild persistent	Intermittent
Daytime	3 times/d	Every day ( $\leq 2$ times/d)	$\geq 2$ times/wk	$< 2$ times/wk
Nighttime	Every night/most nights	$\geq 2$ times/wk	$\geq 2$ times/mo	$< 2$ times/mo
Severe episodes in the past 12 mo	Every day	Every day	$\geq 2$ times/wk	$\leq 1$ time/wk
Exercise-induced symptoms in the past 12 mo	Every day	Every day	$\geq 2$ times/wk	$\leq 1$ time/wk
Symptom frequency during a typical week	8-21 times/wk	7-20 times/wk	3-6 times/wk	$\leq 2$ times/wk

*Abbreviations used*

AIR surveys: The Asthma Insights and Reality surveys  
GINA: The Global Initiative for Asthma

The Asthma Insights and Reality (AIR) surveys aimed to assess actual variations in symptom severity and control of asthma and the current state of asthma management with respect to the GINA guidelines. The AIR surveys were the Asthma in America survey,<sup>9,10</sup> which was conducted in the United States in 1998, followed in 1999 by the Asthma Insights and Reality in Europe,<sup>11-13</sup> Asia-Pacific,<sup>14</sup> and Japan<sup>15</sup> surveys in 2000 and in Central and Eastern Europe in 2001.

**METHODS**

All surveys used the same standard protocol. The surveys were conducted in 29 countries in Western Europe (France, Germany, Italy, the Netherlands, Spain, Sweden, and the United Kingdom), Central and Eastern Europe (Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, and Ukraine), Asia-Pacific (China, Hong Kong, Korea, Malaysia, Philippines, Singapore, Taiwan, and Vietnam), the United States, and Japan.

**Case definition of asthma**

Patients with current asthma were identified as those with asthma diagnosed by a physician and who were currently taking asthma medication or had asthma attacks and symptoms during the past year. If a household had more than one current asthmatic patient, one designated respondent was randomly selected for interview. If the respondent was younger than 16 years, the interview was conducted with a proxy, who was the parent or guardian most knowledgeable about the child's condition. The designated respondents were assured of the voluntary nature of the survey and the confidentiality of all survey responses.

**Recruitment**

All areas used random-digit telephone sampling only, except in Asia-Pacific, where most participants were selected by means of door-to-door recruitment. The range of door-to-door recruitment in the 8 Asia-Pacific areas surveyed was from 100% in mainland China, Korea, and the Philippines to 8.8% in Taiwan.<sup>16</sup> These methods of recruitment were used to ensure that the required number of asthmatic patients was achieved in each area over the same time period. Where

more than one eligible interviewee was identified in a household, the interviewer selected one designated respondent according to the standard Kish selection grid methodology.<sup>17</sup>

**Questionnaire**

All participants were interviewed after consenting to participate in the survey. The symptom questionnaire was based on the American Thoracic Society questionnaire.<sup>18</sup> It also collected demographic characteristics and information on access to medical care, health care use, missed work-school, asthma management practices, medication use, and patient perception of asthma control and severity. The questionnaire was developed in English and translated into the national language of each country. The surveys were either reviewed by a bilingual representative or back-translated into English by an independent translator to ensure consistency.

A combined symptom severity index on the basis of the severity classification in the GINA guidelines<sup>1</sup> was derived from the reported frequency of daytime symptoms, nighttime symptoms, exercise-induced symptoms, severe episodes, and total symptom frequency in the past 4 weeks (Table I). *Severe persistent asthma* was indicated by the presence of daytime symptoms more than 3 times a day or nighttime sleep disruption on at least most nights. *Moderate persistent asthma* was defined as daytime symptoms more than 2 times per day or nighttime sleep disruption at least twice a week. *Mild persistent asthma* was defined as daytime symptoms at least twice a week or nighttime sleep disruption at least twice per month. *Intermittent asthma* was defined as fewer symptoms than those for mild persistent asthma.

**RESULTS**

A total of 10,939 asthmatic patients (3153 children and 7786 adults) participated in the 29 countries surveyed. Basic demographic characteristics are presented in Table II. In all countries but Hong Kong, the majority of adult participants were women. In all countries other than Singapore and Latvia, most participating children were boys. The prevalence of smokers among adult asthmatic patients ranged from 5.6% in Latvia to 28.9% in Japan. Across all regions, the prevalence of adult asthmatic patients who were current smokers approached 20%.

**Severity**

The distribution of asthma symptom severity varied by region. There was a trend for Japanese and Asian-Pacific asthmatic patients to have less severe disease, whereas

**TABLE II.** Demographics of asthmatic patients in the 5 regions

Country	Total no.	No. of adults (% female)	No. of children < 16 y of age (% female)	Smokers (% of adults)
United States	2509	1786 (69.5)	723 (41.2)	18.1
Western Europe	2803	2050 (60.9)	753 (44.0)	17.5
France	402	257 (58.0)	145 (44.8)	23.7
Germany	400	320 (59.7)	80 (28.8)	19.4
Italy	400	294 (61.6)	106 (38.7)	14.6
The Netherlands	400	283 (61.1)	117 (41)	18.0
Spain	401	315 (65.4)	86 (36)	16.5
Sweden	400	307 (60.3)	93 (40.9)	19.9
United Kingdom	400	274 (61.3)	126 (47.6)	15.7
Asia-Pacific	3207	2309 (55.2)	898 (42.3)	19.1
China	400	360 (52)	40 (47)	20.7
Hong Kong	402	342 (39)	60 (27)	21.3
Korea	401	241 (70)	160 (42)	19.6
Malaysia	404	323 (56)	81 (39)	19.1
The Philippines	400	204 (59)	196 (48)	21.8
Singapore	400	244 (54)	156 (56)	16.3
Taiwan	400	256 (57)	144 (30)	23.1
Vietnam	400	348 (61)	52 (36)	12.1
Japan	803	401 (66.6)	402 (38)	28.9
Central and Eastern Europe	1617	1316 (65.5)	301 (30.3)	13.4
Bulgaria	100	81 (75.3)	19 (47.4)	12.3
Croatia	101	83 (61.4)	18 (16.7)	26.5
Czech Republic	207	163 (68.1)	44 (31.8)	11.7
Hungary	204	153 (64.1)	51 (27.5)	21.6
Latvia	100	72 (69.4)	28 (53.6)	5.6
Lithuania	100	84 (61.9)	16 (31.3)	9.5
Poland	300	239 (62.8)	61 (31.1)	9.6
Romania	103	85 (72.9)	18 (38.9)	15.3
Russia	100	78 (79.5)	22 (27.3)	16.7
Slovakia	100	89 (75.3)	11 (45.5)	6.7
Slovenia	102	70 (60.0)	32 (46.9)	5.7
Ukraine	100	85 (58.8)	15 (20.0)	14.1

**TABLE III.** Asthma symptom severity among asthma patients in 5 regions worldwide

Country-region, % patients (range)	Persistent			
	Severe	Moderate	Mild	Intermittent
United States	19	22	16	43
Western Europe	18 (14-26)	19 (18-25)	19 (14-22)	44 (33-49)
Asia-Pacific	11 (4-17)	16 (9-29)	20 (14-25)	53 (30-66)
Japan	15	19	12	54
Central and Eastern Europe	32 (12-50)	27 (19-35)	19 (9-29)	22 (15-44)

Central and Eastern Europeans reported more severe asthma symptoms (Table III).

### Social effect

The social effect of asthma is presented as the burden of absences from school in children and work loss in adults caused by asthma in the previous 12 months. The percentages of children with lost schooldays because of asthma were as follows: 49% in the United States; 43% in Western Europe (range, Sweden at 34% to Spain at 54%); 37% in Asia-Pacific (Korea at 16% to China at 61%); 53% in Japan; and 54% in Central and Eastern Europe

(Slovakia at 36% to Russia and Latvia, both at 68%). The percentages of adults with lost workdays caused by asthma were as follows: 25% in the United States; 17% in Western Europe (Sweden at 13% to The Netherlands at 28%); 27% in Asia-Pacific (Korea at 8% to The Philippines at 47%); 30% in Japan; and 23% in Central and Eastern Europe (Bulgaria at 11% to the Czech Republic at 32%). Overall, school-aged asthmatic patients lost schooldays less frequently in Asia than in other regions. The range was from a low of 16% in Asia-Pacific (South Korea) to the highest of 68% in Central and Eastern Europe (Latvia and Russia). Work loss was more uniform

**TABLE IV.** Findings of the surveys compared with GINA goals for asthma management

GINA guideline goal	AIR result, % (range)	United States (n = 2509)	Western Europe (n = 2803)	Asia-Pacific (n = 3207)	Japan (n = 803)	Central and Eastern Europe (n = 1617)
Minimal chronic symptoms, including nocturnal symptoms	Symptoms in past 4 weeks					
	During the day	61.0	56.0 (47.0-71.0)	51.0 (45.0-64.0)	51.0	74.0 (51.0-84.0)
	Night waking	41.0	36.0 (28.0-43.0)	44.0 (33.0-65.0)	41.0	59.0 (37.0-70.0)
	Exercise induced	53.0	48.0 (41.0-61.0)	33.0 (22.0-47.0)	33.0	59.0 (46.0-67.0)
Minimal exacerbations/ no emergency visits for asthma	Sleep disruptions $\geq 1/wk$	30.0	30.0 (20.0-35.0)	28.0 (22.0-44.0)	20.0	51.0 (30.0-60.0)
	Need for emergency health care in he past 12 mo					
	Hospital admission	9.0	7.0 (5.5-10.0)	15.0 (9.3-26.0)	10.0	19.1 (9.0-31.0)
	Hospital emergency department visit	23.0	10.0 (5.5-25.9)	19.0 (6.5-32.3)	13.0	20.7 (15.0-28.0)
Minimal need for SABA	Unscheduled emergency visit to other health care facility	29.0	25.0 (13.3-37.4)	30.0 (6.0-83.3)	47.0	40.0 (12.0-55.0)
	Current use of bronchodilator	61.0	63.0 (45.1-70.8)	56.3 (23.7-93.8)	39.0	54.3 (38.8-70.0)
No limitation on physical activity	Asthma restricts normal physical activity	36.0	32.0 (26.0-43.0)	45.0 (25.0-73.0)	17.0	68.2 (43.0-76.3)
Normal or near-normal lung function	Lung function test never performed	53.2	53.7 (20.0-69.0)	60.0 (42.0-87.0)	68.0	36.2 (14.0-66.0)
	Lung function test performed in past year	35.0	33.0 (22.0-67.0)	33.0 (13.0-48.0)	29.0	52.2 (30.0-79.7)
	Peak flowmeter owner	28.0	28.0 (7.0-42.0)	7.0 (2.0-22.0)	9.0	5.6 (0.0-24.0)
	Regular user of peak flowmeter	8.4	8.0 (3.0-12.0)	3.0 (0.3-10.8)	4.0	2.8 (0.0-10.0)

SABA, Short-acting bronchodilating agents.

in adults, although there were some notable exceptions, possibly because of social-cultural differences. For example, the percentage of adults with work loss caused by asthma in the Asia-Pacific region ranged from 8% in South Korea to 47% in The Philippines.

### How well are the GINA goals being met?

In all participating regions asthmatic patients performed equally poorly against the different GINA goals, with a consistently high proportion of subjects reporting daytime, nighttime, and exercise-induced symptoms (Table IV). The frequency of sleep disruption caused by asthma tended to be highest in Central and Eastern Europe. The frequency of hospital admissions, hospital emergency department visits, and emergency visits were similarly high in all regions, although variations caused by cultural-social factors or differences in health care systems cannot be ruled out.

Use of short-acting bronchodilators appears to be much lower in Japan and a number of the other Asian countries surveyed, namely China, Korea, and Taiwan (data not

shown). Across the other regions, the high use of quick-relief medication was a similar finding.

The proportion of patients reporting a restriction in normal activities caused by asthma varied by region. The surveys show that asthma limits the normal activities of a considerable proportion of patients, ranging from 17% in Japan to 68% across Central and Eastern Europe.

Overall, the use of lung function testing was low. With the exception of Central and Eastern Europe, more than 50% of asthmatic patients reported never having performed a lung function test, and only one in 3 had a lung function test during the last year. Ownership of a peak flowmeter was highest in the United Kingdom (40%), but regular use was extremely low in all regions.

### Management of asthma

We postulated that there would be an association between medication use and asthma severity; the more severe the symptoms, the higher the use of quick relief and preventative medication. The former association was observed in all regions (Fig 1), although there were a low number of patients reporting severe persistent asthma

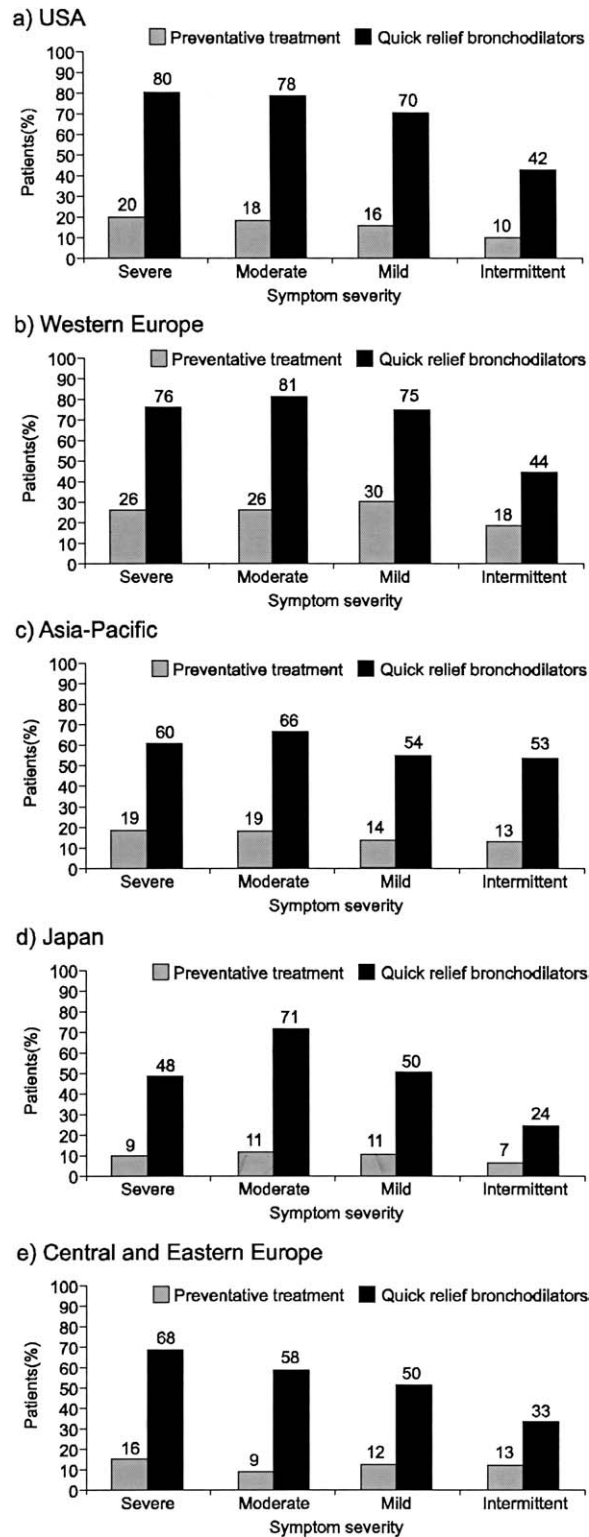


FIG 1. Use of medication by asthma symptom severity among regions.

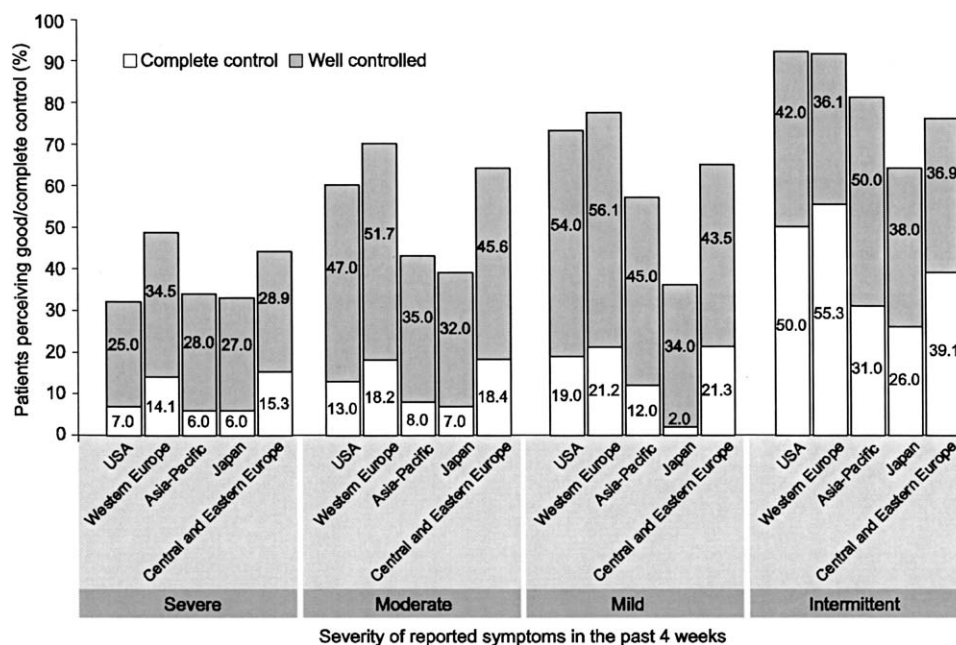


FIG 2. Patients' perception of asthma control against actual symptom severity among regions.

symptoms in some areas. However, the expected association of more severe asthma symptoms with more frequent use of preventive medication, such as inhaled corticosteroids, was not observed in any of the 5 regions. All patients with persistent asthma, from mild to severe, had low use of preventative medication and high use of quick-relief medication, which is suggestive of poor asthma control. This was even observed in Japan and other Asian areas, all with overall low use of inhaled corticosteroids. Sweden had the highest use of preventative medication (data not shown).

### Patient perception of asthma control

A similar finding across all regions was the discrepancy between the level of reported symptoms and patients' perception of their asthma control. The surveys indicate that 32% to 49% of patients experiencing severe symptoms and 39% to 70% of patients with moderate symptoms believed their current level of asthma control to be "well" or "complete" (Fig 2).

## DISCUSSION

The global AIR surveys provide direct evidence for suboptimal asthma control in many patients worldwide, despite the availability of effective therapies, with long-term management falling far short of the goals in the GINA guidelines.<sup>1</sup>

### Differences between regions

Cultural differences between areas might have caused some of the observed differences. The degree of urbanization might influence the use of hospital–health

care facilities. Different health care systems might also explain the differences seen; that is, whether there is good primary care and universal free coverage, as in Western Europe; whether patients are charged for accident and emergency attendance, as in the United States; or whether there is reluctance to prescribe inhaled medications by some Asian doctors might be explanatory.<sup>19</sup> As briefly reported, in Asia up to very recently oral antiasthmatic agents (particularly  $\beta$ -agonists) were more commonly used than inhaled drugs, and inhaled therapy mainly consisted of nonselective  $\beta$ -agonists, with steroids being very rare. Cultural and religious ideas might play a major role, and therefore further education is required to improve inhaled antiasthmatic drug use patterns in the Asia-Pacific region.

The effect of methodologic differences in recruitment or whether drugs were identified on the spot or on the basis of recall cannot be ruled out but cannot wholly explain the differences.

### Similarities between regions

The general similarity in the poor performance in all GINA goals in every area studied is perhaps the most striking finding of these global surveys.<sup>9-15</sup> Sweden seems the country that performs best in achieving the GINA goals of asthma management.<sup>12</sup> This might be related to the fact that Sweden is the country with the highest use of preventative asthma therapy. Despite the variation in the distribution of peak flowmeter ownership, the proportion of patients who regularly use them appears to be similarly low across all surveys. The high use of quick-relief bronchodilators was similar between regions but appears to be lower in Japan and the Asia-Pacific region than in

Western countries. Urban and rural populations within the same country often differ in environment and exposures, and their asthma epidemiology can be largely different.<sup>20</sup> Because we basically selected urban areas for this survey, major discrepancies in asthma control and management cannot be ruled out in rural areas within the countries surveyed.

The social effect of asthma worldwide is of concern. Although there was variation between countries, which might reflect differing cultural attitudes and economic circumstances, the overall level of workdays and school-days lost was high. Although the AIR surveys were not designed to quantify the cost of poor asthma management in terms of lost productivity, our findings suggest this should not be underestimated.

There was remarkable similarity in the population distribution of asthma symptom severity in each participating country. As recently highlighted, the GINA severity classification used here is a first-step, population-screening tool based on symptoms and use of health services.<sup>21</sup> In individuals already under medical care, the GINA 2002 severity classification is based on both drug treatment and symptom severity.<sup>2</sup> Therefore the symptom severity classification used here (Table I) might underestimate the true level of asthma disease severity. Furthermore, as demonstrated by Fuhlbrigge et al<sup>10</sup> in the United States, the proportion of patients with moderate or severe persistent disease increases markedly (to 77.3%) if the functional effect of asthma, as well as short-term and long-term symptoms, are considered in the assessment of severity. However, because patients and often their physicians fail to properly discriminate well between intermittent and persistent asthma, as well as between different degrees of severity in persistent asthma, these findings support the recent discussions on redefining GINA severity classifications, especially for patients with milder asthma.<sup>22</sup>

Given the importance of smoking cessation in the management of asthma, it is a notable finding that 29% of adult Japanese asthmatic patients were current smokers. Sadly, this is not an isolated result because approximately one in 5 of adult asthmatic patients surveyed elsewhere were current smokers. This is of concern because for most countries and geographic areas the prevalence of smoking in asthmatic patients mirrors the national prevalence of smoking.<sup>23</sup> Asthmatic patients should be reminded at every medical visit of the deleterious effects of smoking in all body systems and particularly in respiratory disease and actively encouraged to quit smoking.

### Perceived control versus symptom severity

A remarkably consistent finding was the difference between patients' perceived level of asthma control and reported symptom severity. Worldwide, there was a tendency for patients to overestimate control and underestimate severity, suggesting a willingness to accept symptoms and lifestyle limitations as unavoidable consequences of their disease. This might, in part, be responsible for the poor outcomes seen elsewhere in these

surveys because patients who consider their symptoms controlled are unlikely to seek further medical advice. Raising patients' and physicians' expectations of what can be achieved in terms of asthma control might ultimately lead to improved care.

### CONCLUSION

The AIR surveys constitute the first large-scale international assessment of asthma effect and management in children and adults, with data from 10,939 patients in 29 countries. They allow us to conclude that the overall results observed in North America, Europe, Japan, and the Asia-Pacific region are comparable and equally poor when assessed against the goals specified in the GINA guidelines. Every effort should be made to encourage the widespread availability of peak flowmeters and written action plans as a cheap and effective method for patients to monitor and manage their asthma, and the importance of smoking cessation should be reinforced at every opportunity. The regular use of appropriate anti-inflammatory controller therapy in all children and adults with persistent asthma should also be implemented. With the availability of effective treatments, physicians and patients should raise their expectations of the level of asthma control that can be achieved.

We thank Dr John Boyle for his invaluable consultation, Dr Onno van Schayck for helpful comments on the manuscript, and Michael Ho for editorial assistance. The following investigators have also participated in local surveys: Teresita S. de Guia, MD, Philippine Heart Centre, Quezon City, Philippines; Kyohsuke Ishihara, MD, Department of Internal Medicine, Kobe West City Hospital; You-Young Kim, MD, PhD, Seoul National University Hospital, Seoul, Korea; Sow-Hsong Kuo, MD, National Taiwan University Hospital, Taiwan; Akihiro Morikawa, MD, Department of Pediatrics, Gunma University School of Medicine; Amartya Mukhopadhyay, MD, MRCP, National University Hospital, Singapore; Pham Long Trung, MD, University of Medicine and Pharmacy, Ho Chi Minh City, Vietnam; Nan Shan Zhong, MD, Guangzhou Institute of Respiratory Diseases, Guangzhou, China; Norzila Zainudin, MD, MMed, Paediatric Institute Hospital, Kuala Lumpur, Malaysia; and BMZ Zainudin, MD, FRCP, Damansara Specialist Hospital, Petaling Jaya, Malaysia.

### REFERENCES

1. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. NHLBI/WHO workshop report. National Institutes of Health, National Heart, Lung and Blood Institute; 1995. National Institutes of Health publication no. 95-3659.
2. Global Initiative for Asthma. Global Strategy for asthma management and prevention. National Institutes of Health; 2002. NIH publication no. 02-3659.
3. Feder G, Griffiths C, Highton C, Eldridge S, Spence M, Southgate L. Do clinical guidelines introduced with practice based education improve care of asthmatic and diabetic patients? A randomised controlled trial in general practice in east London. *BMJ* 1995;311:1473-8.
4. The International Study of Asthma and Allergies in Childhood Steering Committee. Worldwide variations in the prevalence of asthma symptoms: the International Study of Asthma and Allergies in Childhood (ISAAC). *Eur Respir J* 1998;12:315-35.
5. European Community Respiratory Health Survey. Variations in the prevalence of respiratory symptoms, self-reported asthma attacks, and

- use of asthma medications in the European Community Respiratory Health Survey (ECRHS). *Eur Respir J* 1996;9:687-95.
6. Janson C, Chinn S, Jarvis D, Burney P. Physician-diagnosed asthma and drug utilization in the European Community Respiratory Health Survey. *Eur Respir J* 1997;10:1795-802.
  7. Liard R, Leynaert B, Zureik M, Beguin FX, Neukirch F. Using Global Initiative for Asthma guidelines to assess asthma severity in populations. *Eur Respir J* 2000;16:615-20.
  8. Salmeron S, Liard R, Elkharrat D, Muir J, Neukirch F, Ellrodt A. Asthma severity and adequacy of management in accident and emergency departments in France: a prospective study. *Lancet* 2001;358:629-35.
  9. Adams RJ, Fuhlbrigge A, Guilbert T, Lozano P, Martinez F. Inadequate use of asthma medication in the United States: results of the asthma in America national population survey. *J Allergy Clin Immunol* 2002;110:58-64.
  10. Fuhlbrigge AL, Adams RJ, Guilbert TW, Grant E, Lozano P, Janson SL, et al. The burden of asthma in the United States: level and distribution are dependent on interpretation of the national asthma education and prevention program guidelines. *Am J Respir Crit Care Med* 2002;166:1044-9.
  11. Rabe KF, Vermeire PA, Soriano JB, Maier WC. Clinical management of asthma in 1999: the Asthma Insights and Reality in Europe (AIRE) study. *Eur Respir J* 2000;16:802-7.
  12. Vermeire PA, Rabe KF, Soriano JB, Maier WC. Clinical management of asthma in seven European countries in 1999. *Respir Med* 2002;96:142-9.
  13. Soriano JB, Rabe KF, Vermeire PA. Predictors of poor asthma control in European adults. *J Asthma* 2003;40:803-13.
  14. Lai CKW, de Guia TS, Kim Y-Y, Kuo S-H, Mukhopadhyay A, Soriano JB, et al. Asthma control in Asia-Pacific: the Asthma Insights and Reality In Asia-Pacific Study. *J Allergy Clin Immunol* 2003;111:263-8.
  15. Adachi M, Morikawa A, Ishihara K. Asthma insights and reality in Japan (AIRJ). *Arerugi* 2002;51:411-20.
  16. Pothoff RF. Telephone sampling in epidemiologic research: to reap the benefits, avoid the pitfalls. *Am J Epidemiol* 1994;139:967-78.
  17. Kish L. Survey sampling. New York: John Wiley & Sons, Inc; 1965.
  18. Ferris BG. Epidemiology standardization project. *Am Rev Respir Dis* 1978;118(suppl 1):1-120.
  19. Kumana CR, So SY, Li KY, Kou M, Chan SC. Pattern of anti-asthmatic drug utilization in Hong Kong compared to other parts of the world. *Respir Med* 1989;83:343-8.
  20. Massicot JG, Cohen SG. Epidemiologic and socioeconomic aspects of allergic diseases. *J Allergy Clin Immunol* 1986;78(suppl):954-8.
  21. Romagnoli M, Fabbri LM. Mild asthma. *N Engl J Med* 2002;346:1335-6.
  22. Stempel DA. The myth of mild asthma. *Ann Allergy Asthma Immunol* 2002;89:340-3.
  23. World Health Organization. The demographics of tobacco: the tobacco atlas. Available at: <http://www.who.int/tobacco/en/atlas40.pdf>. Accessed June 3, 2004.

### Availability of Journal back issues

As a service to our subscribers, copies of back issues of *The Journal of Allergy and Clinical Immunology* for the preceding 5 years are maintained and are available for purchase until inventory is depleted. Please write to Elsevier Inc, Subscription Customer Service, 6277 Sea Harbor Dr, Orlando, FL 32887, or call (800) 654-2452 or (407) 345-4000 for information on availability of particular issues and prices.