

# Asthma control and differences in management practices across seven European countries

P. A. VERMEIRE\*, K. F. RABE<sup>†</sup>, J. B. SORIANO<sup>‡</sup> AND W. C. MAIER<sup>‡</sup>

\*Department of Respiratory Medicine, University of Antwerp (U.I.A.), Antwerp, Belgium, <sup>†</sup> Department of Pulmonology C3-P, Leiden University Medical Centre, Leiden, The Netherlands and <sup>‡</sup>Worldwide Epidemiology, GlaxoSmithKline Research and Development, Greenford, U.K.

**Abstract** Failure to follow asthma management guidelines may result in poor asthma control for many patients. The Asthma Insights and Reality in Europe (AIRE) survey, a multi-national survey assessing the level of asthma control from the patients perspective in seven Western European countries, previously demonstrated that the Global Initiative for Asthma (GINA) guideline goals were not achieved in Western Europe and that both adults and children with asthma were poorly controlled. Using additional data on asthma management practices from each of the seven countries in the AIRE survey, we compared variations in asthma morbidity and asthma management practices across countries to provide insight into the reasons for poor asthma control. Asthma management practices and asthma control among adults and children with current asthma were suboptimal in each of seven countries surveyed. Among patients with symptoms of severe persistent asthma, over 40% reported their asthma was well or completely controlled. School absence due to asthma was reported by up to 52.7% of children and up to 27.6% of adult reported work absence due to asthma. Lung function testing in the past year was uncommon: ranging from 13.5% of children in the U.K. to 68.8% of adults in Germany. Written asthma management plans were used by less than 50% of adults and less than 61% of children in all seven countries. Most adults (49.5–73.0%) and a large proportion of children (38.4–70.6%) had follow-up visits for their asthma only when problems developed. The ratio of recent inhaled corticosteroid use to recent short-acting  $\beta$ -agonist use was inappropriate ( $<1$ ) among patients with symptoms of severe asthma in all countries. This disparity was greatest among adults in Italy and France, where recent inhaled corticosteroid use was reported by less than one in nine patients reporting recent use of short-acting bronchodilators (IS:SAB  $<0.11$ ). Management practices differ between countries and additional public health interventions and resources may be necessary to reduce patient suffering. Further efforts to fully implement asthma management guidelines are required to improve asthma control in Europe. © 2002 Elsevier Science Ltd.

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## INTRODUCTION

Asthma is a severe chronic disease which remains poorly controlled in Western Europe (1). Clinical practice guidelines have been developed to help physicians better manage patients by presenting them with optimal management practices based on a systematic review of current evidence about treatment options for a given disease (2). In recent years, several national and international guidelines, including the Global Initiative for Asthma (GINA) (3) have been developed to improve the quality of care for patients with

asthma and reduce the public health burden associated with this disease (4). The GINA guidelines specify that effective long-term control of asthma may be achieved by selecting appropriate medications, treating asthma attacks, identifying and avoiding asthma triggers, educating patients to manage their condition, and by regular monitoring and modifying of asthma care (3).

In a previous publication using data from the Asthma Insights and Reality in Europe (AIRE) study, we demonstrated that the GINA guideline goals are not currently being achieved in Western Europe and that in both adults and children asthma is poorly controlled (1). The present paper uses additional information on asthma management practices from each of the seven countries surveyed and compares the variations in morbidity and clinical management practices across countries to provide insight about the potential causes of poor asthma control currently observed in Western Europe.

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Correspondence should be addressed to: Prof. Paul A. Vermeire, Department of Respiratory Medicine, University of Antwerp (U.I.A.), Antwerp, Belgium. Fax: 32 3 820 2590; E-mail: paul.vermeire@ua.ac.be  
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## METHODS

The methods of the AIRE study have been described previously (1). Briefly, the objective of the survey was to interview patients (adults and parents of children younger than 16 years) with physician-diagnosed asthma, and with current symptoms or asthma medication, about their asthma-related knowledge, attitudes, behaviour and health outcomes. Patients were identified by systematic telephone screening of a national random digit dialling sample of households with telephones in seven European countries: France, Germany, Italy, The Netherlands, Spain, Sweden and the U.K. The study design required 400 completed interviews with current asthma patients in each of the seven countries to ensure equal sample precision (for 80% power, 5% error).

All participants were interviewed after consenting to participate in the survey. The questionnaire was derived from the American Thoracic Society (ATS) questionnaire (5). It was developed in English, translated into the national language of each country and back-translated in English by an independent translator to ensure consistency. The questionnaire collected demographic characteristics and information on access to medical care, healthcare utilization, asthma symptoms, missed work/school, asthma management practices, medication use, and patient perception of asthma control and severity.

### Data analysis

A combined symptom severity index, based upon the severity classification in the GINA guidelines (3), was derived from the reported frequency of daytime symptoms, night-time symptoms, exertion-induced symptoms, severe episodes and total symptom frequency in the past 4 weeks and it has been outlined in a previous report (1). Severe persistent asthma was indicated by the presence of daytime symptoms more than three times a day or night-time sleep disruption on at least most nights. Moderate persistent asthma was defined as daytime symptoms  $\leq$  twice per day or night-time sleep disruption at least twice a week. Mild persistent

asthma was defined as daytime symptoms at least twice a week or night-time sleep disruption at least twice per month. Mild intermittent asthma was defined as fewer symptoms than those for mild persistent asthma.

Recent asthma management was determined by patient-reported information on lung function testing, peak flow meter use, specialist visits, use of written asthma management plans, reasons for visiting the physician and use of both inhaled corticosteroids and quick-relief bronchodilator medications. Asthma morbidity was determined by patient reported frequency of work/school absence, urgent care, emergency room visits, physician visits and hospitalizations.

Asthma management practices and morbidity were compared across each of the seven countries surveyed relative to the rest of the AIRE population. All analyses were presented separately for adults and children to allow for the potentially modifying effects of different treatment guidelines used for these patient groups and information by proxy in children. Pearson's chi-square test and Student's *t*-test (not pooled) were used to compare proportions and means, respectively. All tests were performed on unweighted data, two-tailed and considered significantly different at the 0.05 level.

## RESULTS

### Sample population

Table I describes characteristics of the sample population in each country. One or more current asthma patients were identified in 3488 households and full interviews were completed with 2803 current asthma patients or their parents (80.4%). Age and sex distributions were similar across all countries. Over 65% of all participants lived in either urban or suburban residences.

### Characteristics of current asthmatics across countries

The samples of children and adults of the countries involved were similar with respect to age, sex, age at

**TABLE I.** Sampling strategy and demographic characteristics by country

	France	Germany	Italy	The Netherlands	Spain	Sweden	U.K.
Total screened (n)	8537	21 823	11 688	9429	12 329	6628	3446
Total qualified (n)	498	525	467	478	490	520	510
Eligible response rate (%)	83.7	76.2	85.6	83.7	81.6	76.9	87.2
Total survey population (n)	402	400	400	400	401	400	400
Mean age (sd) (yr)	28.6 (20.6)	37.6 (21.4)	34.5 (22.6)	32.1 (20.9)	35.4 (22.9)	35.0 (22.0)	32.1 (22.2)
Female (%)	53.2	53.5	55.5	55.3	59.1	55.7	57.0
Urban or suburban residence (%)	86.4	76.1	89.1	65.7	93.7	67.0	73.2

sd, standard deviation.

**TABLE 2.** Demographic and asthma-related variables by country, in children and adults

	France	Germany	Italy	The Netherlands	Spain	Sweden	U.K.
<b>Children (n)</b>	145	80	106	117	86	93	126
Female (%)	44.8	†28.8	38.7	41.0	36.0	40.9	47.6
Mean (SD) asthma diagnosis age	3.4 (3.0)	†4.6 (3.1)	†2.9 (3.4)	2.9 (3.1)	3.2 (3.4)	3.9 (3.5)	3.5 (3.2)
Mean (SD) duration of asthma	5.1 (3.4)	5.1 (3.5)	5.1 (4.0)	5.1 (4.0)	†5.9 (3.4)	†4.3 (3.5)	5.5 (3.6)
School absence in last year (%)	51.7	43.8	42.5	48.7	53.5	†34.4	38.1
Current symptom severity (%)							
Severe persistent	11.7	17.5	14.2	17.9	16.3	12.9	16.7
Moderate persistent	15.2	13.8	8.5	16.2	14.0	7.5	13.5
Mild persistent	17.2	18.8	17.0	27.4	8.1	19.4	15.9
Mild intermittent	55.9	50.0	60.4	38.5	61.6	60.2	54.0
<b>Adults (n)</b>	257	320	294	283	315	307	274
Mean age (SD) (yrs)	†39.9 (17.3)	44.6 (18.0)	44.0 (18.5)	42.1 (16.3)	42.5 (20.6)	43.1 (18.4)	42.8 (18.7)
Female (%)	58.0	59.7	61.6	61.1	65.4	60.3	61.3
Current smoker (%)	†23.7	19.4	14.6	18.0	16.5	19.9	15.7
Mean (SD) asthma diagnosis age	†20.9 (18.0)	†27.9 (19.0)	24.5 (18.7)	†20.7 (17.4)	24.1 (19.3)	†27.3 (20.5)	26.2 (21.5)
Mean (SD) duration of asthma	19.0 (14.1)	16.7 (14.3)	19.5 (15.3)	†21.5 (15.0)	18.5 (17.2)	†15.8 (14.0)	†16.6 (14.5)
Work absence in last year (%)	16.7	17.5	18.0	†27.6	16.8	†12.7	16.4
Current symptom severity (%)	†	†				†	
Severe persistent	14.8	27.8	21.4	25.4	19.4	15.3	18.6
Moderate persistent	20.2	24.4	23.5	25.4	27.6	20.5	20.1
Mild persistent	20.2	19.4	22.1	16.6	15.2	22.1	19.3
Mild intermittent	44.7	28.4	33.0	32.5	37.8	42.0	42.0

† $P < 0.05$  is significant for the comparison between samples and the rest of the AIRE population.

For categorical variables the † above the group represents statistical significance for the entire subgroup compared to the total population.

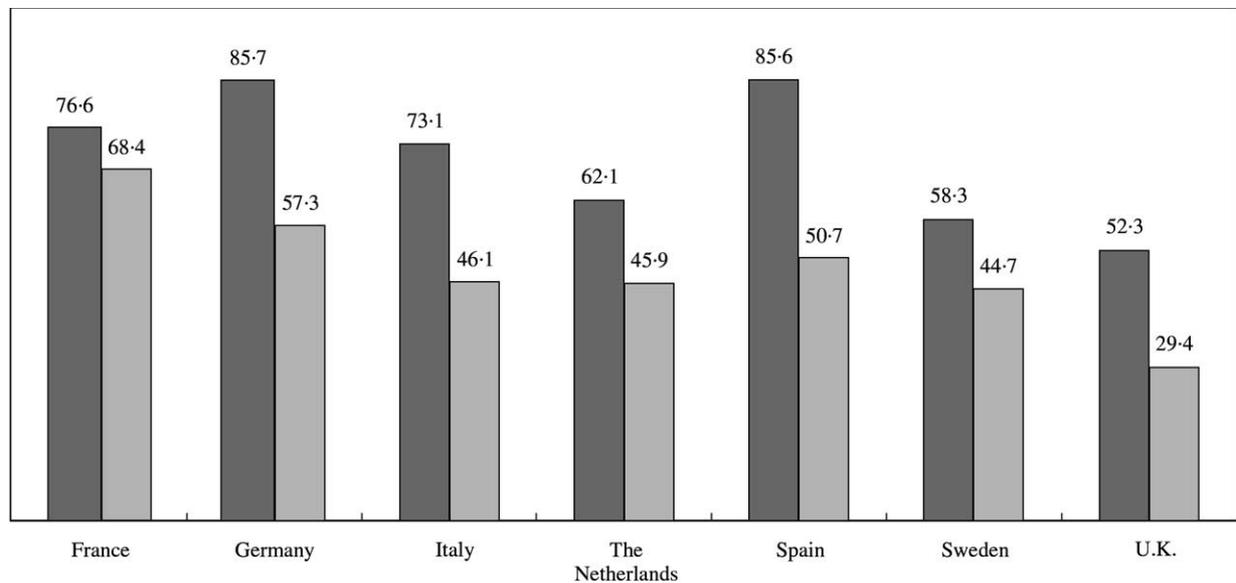
asthma diagnosis, duration of asthma and current symptom severity (Table 2). However, the children surveyed in Germany were significantly older and predominantly male relative to rest of the AIRE population. French adults surveyed were younger and more were current smokers than the rest of the AIRE population. Duration of asthma among adults was longer in the Netherlands and shorter in Germany, Sweden, and the U.K. relative to other countries. France and Sweden had fewer severe asthmatics compared with the rest of the adult AIRE population (Table 2).

Patients' perception of their overall asthma control did not match their reported symptom severity. Among patients with symptoms of severe persistent asthma (Fig. 1), over 50% of the children and over 40% of the adults in most countries felt their asthma was well or completely controlled. Germany, France and Spain reported the greatest disparities between actual and perceived control, with over 75% of children and 50% of adults with symptoms of severe persistent asthma reporting well or completely controlled asthma. Additionally, school absence due to asthma in the past year was reported by up to 53% of children (Spain) and up to 28% of adults (The Netherlands) reported work absence in the past year due to asthma (Table 2).

### Asthma management practices and use of healthcare services

Asthma management practice and use of health care varied widely between countries (Table 3). Unscheduled urgent care visits were most common in Spain and least common in Sweden among both children and adults. Compared with the rest of the AIRE population, emergency room visits in the past year were required by a higher percentage of children in Spain and Sweden and a lower percentage of children in the Netherlands, U.K. and Germany. Hospitalization rates of children in the Netherlands, Sweden, and the U.K. were 30–50% lower than the other countries surveyed. Similar to adults, there was a higher rate of emergency room visits among children in Spain and Sweden relative to the rest of AIRE population.

Lung function testing among children was least common in the U.K. and most common in Germany (Table 3). Few children in the U.K. had an asthma management plan (8.7%) or used a peak flow meter at least once a week (8.7%). In contrast, 60.5% of children in Spain had an asthma management plan but only 5.8% used a peak flow meter at least once a week. Similarly, a high proportion of Italian children had a written action plan (52.8%), but



**FIG. 1.** Proportion of well or complete control reported by severe persistent asthmatics among children (■) and adults (□) in each country.

**TABLE 3.** Asthma management practices and use of health services in past year by country, in children and adults

	Subjects (%)						
	France	Germany	Italy	The Netherlands	Spain	Sweden	U.K.
<b>Children (n)</b>	145	80	106	117	86	93	126
Unscheduled urgent care in past year	31.7	27.5	31.1	*40.2	*50.0	*14.0	27.8
ER visit in past year	15.2	*8.8	18.9	*6.8	*39.5	*33.3	*7.9
Hospitalisation in past year	11.0	10.0	12.3	*3.4	12.8	6.5	4.8
LF test in past year	*48.2	*60.0	*21.7	*39.3	*26.7	36.5	*13.5
Peak flow meter at least once a week	*3.4	*12.5	*1.9	*4.3	*5.8	*4.3	*8.7
Written plan for asthma	*44.1	23.8	*52.8	*19.7	*60.5	*23.7	*8.7
GP seen most often for asthma	*56.6	38.8	*21.7	*60.7	*17.4	*20.4	*81.7
Doctor visits for asthma 0–5 year <sup>-1</sup>	*48.3	55.0	63.2	*70.0	67.5	*86.1	*70.5
Specialist visit never or only if problems	*43.5	43.0	*48.2	*53.9	*40.7	*54.8	*79.4
Follow-up visits only when having trouble	46.9	41.3	57.5	*39.3	*38.4	*38.7	*70.6
<b>Adults (n)</b>	257	320	294	283	315	307	274
Unscheduled urgent care in past year	23.3	25.3	*18.7	*30.4	*34.0	*13.0	20.4
ER visit in past year	*4.7	*5.6	10.5	*4.9	*22.2	*16.9	8.0
Hospitalisation in past year	4.3	*9.7	7.5	6.4	9.2	4.6	5.8
LF test in past year	*46.3	*68.4	*23.5	*51.6	*36.8	*48.8	*25.9
Peak flow meter at least once a week	*3.1	*10.0	*4.8	*1.8	*1.6	*4.6	*13.1
Doctor written plan for asthma	*32.3	21.3	*34.7	*15.5	*49.2	*10.1	*9.5
GP seen most often for asthma	*72.0	65.9	*44.2	68.6	*49.8	65.5	*85.8
Doctor visits for asthma 0–5 year <sup>-1</sup>	*60.7	*59.4	*64.6	73.5	17.8	*90.8	*52.6
Specialist visit never or only if problems	*57.2	*45.4	*46.6	*62.2	*42.3	*82.8	*86.5
Follow-up visits only when having trouble	54.5	*53.4	*68.4	*52.7	*49.5	60.6	*73.0

\*P < 0.05 is significant for the comparison between samples and with the rest of the AIRE population.

ER, emergency room; LF, lung function; GP, general practitioner.

only 1.9% used a peak flow meter at least once a week. The variation in adult lung function testing, peak flow meter use and possession of an asthma action plan was generally similar to that seen among children. One exception was the low reported use of peak flow meters among adults in Spain (1.6%) and The Netherlands

(1.8%). In every country except the U.K., adults were less likely to have had a written asthma management plan than children.

General practitioners were the principal care giver for asthma among for the majority of adults in all countries, but provided treatment for the majority of children only

in the U.K., France and The Netherlands (Table 3). For over 80% of all adults and children, their primary care giver was also their primary source of advice about their asthma (not shown). Many children and adults had either never seen an asthma specialist or only when they developed problems with their asthma. Across the countries surveyed, a large proportion of children and the majority of adults only had follow-up visits when they were experiencing trouble with their asthma.

### Use of asthma medication

Inhaled corticosteroids use was highest in Sweden (Table 4) where it was significantly greater than in the rest of the AIRE population among both adults and children at most levels of asthma symptom severity. The proportion of Swedish children using ICS with symptoms suggestive of moderate (71.4%) or severe (83.3%) persistent asthma was approximately three and six times higher than similar rates in The Netherlands, respectively. Likewise, reported use of inhaled corticosteroids among adults with severe persistent symptoms was approximately six times higher in Sweden relative to France or Italy. In general, reported use of short-acting bronchodilator (SAB) medication in the past 4 weeks was high in all countries but tended to be higher with increasing symptom severity (not shown). The ratio of inhaled corticosteroid use to short-acting bronchodilator use was suboptimal (<1) in all countries for both children [Fig. 2(a)] and adults [Fig. 2(b)]. This disparity was greatest among adults with symptoms of severe persistent asthma in Italy and France where recent inhaled corticosteroids use was reported by less than one in nine patients reporting use of quick-relief medications (ICS:SAB <0.11).

## DISCUSSION

To our knowledge, the AIRE survey was the largest survey ever conducted in Europe to estimate asthma

control among children and adults. Suboptimal asthma control was found among children and adults in all countries and was reflected by a high level of work and school absence and a high rate of unscheduled doctor visits, hospitalization or emergency department visits. Furthermore, the level of care reported by patients in each country did not meet the recommendations required to achieve appropriate asthma control as described by the GINA guidelines. In particular, there was insufficient monitoring of asthma by doctors and patients themselves. Most disturbing was the evidence of considerable under-use of inhaled corticosteroids by patients with moderate or severe persistent symptoms. This implies that the asthma management guidelines were either not being adequately followed by physicians or patients were poorly compliant with this therapy.

Although the AIRE study was not an asthma prevalence study, we estimated prevalence among the screened population to describe how representative our sample was across each country. The household prevalence of asthma was highest in the U.K. (14.8%) and lowest in Germany (2.4%), and ranged from 3.6% to 5.8% in the other five countries surveyed. In agreement with the ECHRS study in adults (6) and the ISAAC study in children (7), we found the highest asthma prevalence rate in the U.K. and it was at least two-fold greater than that in any of the other six European countries surveyed. Our results on asthma drug usage rates also agreed with the ECHRS study, which found that asthma medication use among adult asthmatics was lower in Italy, France and Spain than in the Netherlands, Sweden and the U.K. (8). Moreover, they confirm earlier reports of heterogeneity in asthma management practices within Europe and in other parts of the world (8–10). The similarity of our study results to previous surveys indicated that the AIRE sample was representative of the current asthmatic population in these countries.

Moreover, this survey demonstrated insufficient monitoring of patient lung function using either clinic-based spirometry or home peak-flow monitoring. Regular

**TABLE 4.** Percentage children and adults reporting use of inhaled corticosteroids by current symptom severity and by country

	France	Germany	Italy	The Netherlands	Spain	Sweden	U.K.
<b>Children</b>							
Severe persistent	23.5	21.4	26.7	14.3	42.9	*83.3	23.8
Moderate persistent	18.2	27.3	66.7	26.3	33.3	71.4	35.3
Mild persistent	36.0	26.7	33.3	21.9	28.6	38.9	35.0
Mild intermittent	13.6	15.0	*4.7	17.8	9.4	*28.6	17.6
<b>Adults</b>							
Severe persistent	*7.9	30.3	*7.9	23.6	*9.8	*48.9	33.3
Moderate persistent	26.9	29.5	*14.5	30.6	18.4	*39.7	20.0
Mild persistent	*7.7	35.5	15.4	27.7	16.7	35.3	35.8
Mild intermittent	10.4	17.6	*9.3	20.7	11.8	*28.7	23.5

\* $P < 0.05$  is significant for the comparison between samples and the rest of the AIRE population.

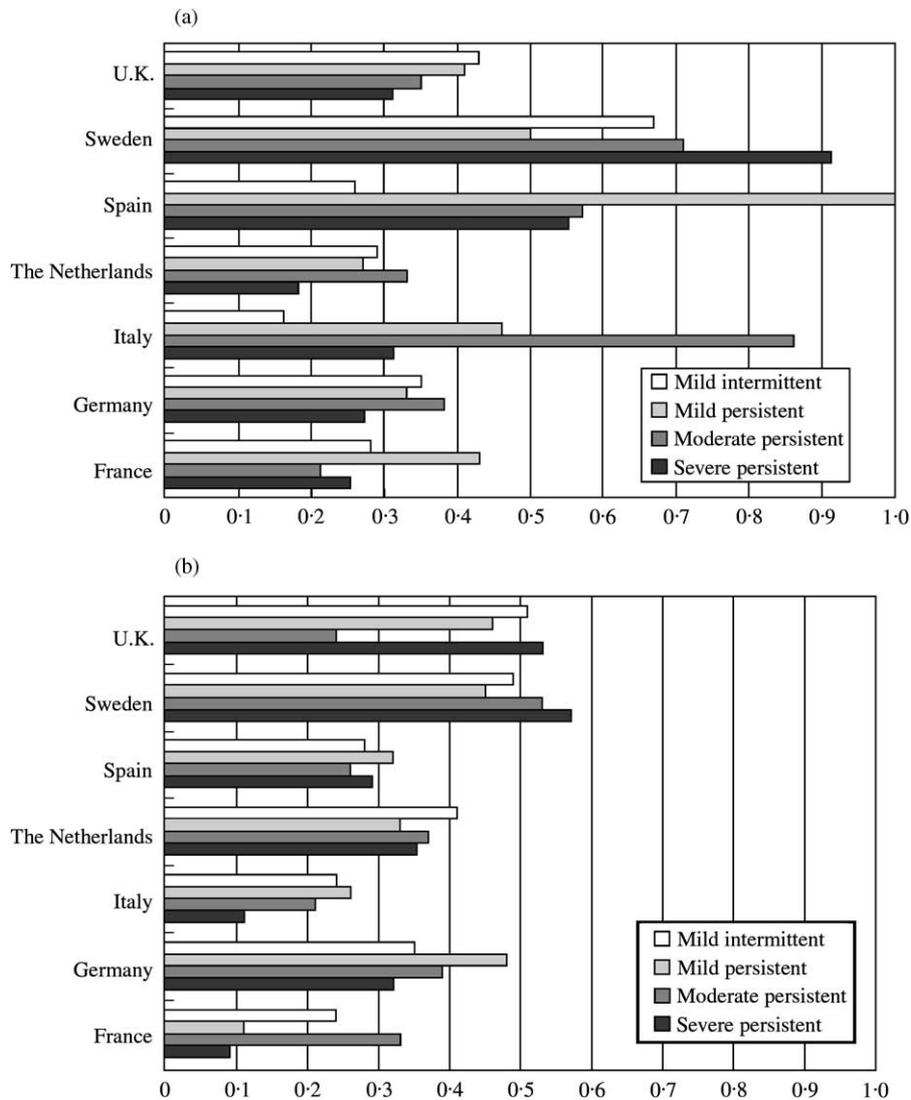


FIG. 2. Ratio of inhaled corticosteroid to quick-relief medication use in the past 4 weeks among (a) children and (b) adults.

objective measurement of lung function is advocated by the asthma management guidelines because both patients and physicians can have difficulties in recognizing asthma symptoms or their severity (11,12). We found that a high proportion of patients not only under-estimated the severity of their asthma symptoms but also substantially over-estimated their asthma control. In addition, written asthma management plans were generally uncommon, although they were used more frequently for children than adults in most countries.

In a recent, well-conducted case-control study (13), written asthma plans were associated with a 70% reduction in the risk of death, and regular use of a peak flow meter with a 35% reduction. Therefore, as concluded in a previous meta-analysis (14), the implementation of these simple interventions in the management of asthma lead to clinically relevant benefits for the patients, as advocated in the GINA guidelines.

Anti-inflammatory drugs play a central role in the long-term management of asthma, and asthma management guidelines recommend inhaled corticosteroids for all patients with persistent asthma (3). In the AIRE study, we found considerable under-use of inhaled corticosteroids among both adults and children experiencing symptoms consistent with persistent asthma. Additionally, the use of inhaled corticosteroids according to asthma symptom severity differed widely between the seven European countries surveyed. One of the most notable differences was the relatively high proportion of patients in Sweden taking inhaled corticosteroids. This may have been due to local recommendations which suggest the initiation of inhaled corticosteroids at a lower threshold of as-needed bronchodilator use than in other countries (15). The increased use of inhaled corticosteroids in Sweden in recent years has been associated with a significant decline in hospitalization rates and asthma-related morbidity (16). The large cross-country differences in

the reported use of inhaled corticosteroids suggests that the prescribing of inhaled corticosteroids may differ between countries and are additional evidence that asthma management guidelines may not be applied uniformly across Europe.

A striking finding of our survey was that, except for asthmatic children in Sweden, less than half of the patients (adults and children) with symptoms suggestive of severe persistent asthma in each country reported using inhaled corticosteroids in the past 4 weeks. This may be because physicians had not prescribed corticosteroids or patients were not compliant with therapy. Previous research has shown that non-compliance to asthma medication is common in the seven countries included in the AIRE survey, being highest in The Netherlands (approximately 75%) and lowest in Sweden (approximately 50%) (17). It is well recognized that patient compliance with prescribed asthma medication is poor and that this may be due to a variety of factors including poor patient understanding of the role of therapy (18). Nevertheless, poor patient compliance with medication is a major factor contributing to poor asthma control regardless of asthma severity (19).

Another important finding of our survey was that use of quick relief bronchodilation therapy was inappropriately high relative to the use of inhaled corticosteroids and the severity of asthma symptoms. There was an over-reliance on quick-relief medication in all countries surveyed. These results suggested that overall asthma medication use was better among children than adults. Previous studies in the U.K. have suggested that the inhaled corticosteroid to bronchodilator ratio can be taken as a measure of the quality of asthma care, and an increase in the ratio has been associated with a reduction in hospitalization for asthma (20,21). The substantial differences in asthma drug use ratios across European countries may reflect differences in knowledge of asthma medications between these countries, and indicates the need for improved patient education about the role of inhaled corticosteroids in maintaining asthma control.

The AIRE survey revealed that few patients see an asthma specialist. It is generally accepted that most asthma care should be provided at the primary care level, but patients who may benefit from consultation with an asthma specialist should be identified and referred accordingly (22). Patients treated by specialists are more likely to receive and use inhaled corticosteroids (23). Access to medical care in general and asthma-related care in particular varied between countries, and this may have contributed to the differences in asthma control and morbidity found across countries in the present study. Regular follow-up visits are an important factor in the process of asthma care, and lack of regular medical follow-up has been associated with under-use of inhaled anti-inflammatory treatment by patients (4).

Although the GINA guidelines have been disseminated in all countries surveyed in the AIRE survey, our results suggest that the level of adherence to asthma management guidelines is low. Similar conclusions were reached in earlier studies of asthmatics (23) and the general population (9). Although doctors may agree with asthma treatment guidelines, this is not always reflected in their prescribing behaviour or management practices (24). Moreover, a recent study demonstrated that physicians were poor at estimating asthma severity and their use of lung function tests and anti-inflammatory agents was inadequate; this may have contributed to their poor adherence to the guidelines (25). Further efforts must be made to improve asthma management in general practice, to adhere more closely to international guidelines, to improve asthma control among patients and to reduce the need for acute healthcare services.

The limitations of the AIRE study methodology have been previously described (1). Briefly, the sample consisted of currently treated or recently symptomatic asthmatic patients with telephone access in predominantly urban and suburban households. Current asthmatics or their parents were surveyed to reduce the risk of recall bias because of poor disease awareness. The method of telephone sampling by random digit dialling is well accepted and has already been used in several population studies of the burden of asthma (26–28). There is increasing evidence that patients of lower socio-economic status have reduced access to medical care (29) and increased asthma hospitalization (30). Therefore, the problem of poor control and management of asthma may be even worse than found in our study, as families without a home telephone may be of lower socio-economic status. Other potential factors contributing to the differences seen between countries include different dissemination and use of guidelines, cultural variations in symptom perception and seeking medical care, environmental differences (31), and differences in physician understanding of asthma and its treatment (32). Seasonal differences are unlikely to have contributed to the differences observed between countries, as the survey was conducted over a short period during the same season in all countries.

In summary, the AIRE study demonstrated that asthma management practices in the countries surveyed are highly variable and do not appear to achieve the standards expected by the GINA treatment guidelines. This is reflected in the poor level of asthma control demonstrated by adults and children participating in the survey. One of the real challenges over the next few years will be the effective implementation of asthma management guidelines. In particular, physicians need to improve the use of inhaled corticosteroids by patients and to make more use of written asthma action plans for patients to self-manage their asthma. This should be coupled with regular medical review and monitoring of lung function. Education and public health resources should be targeted

to increase awareness about the severity of asthma and to ensure proper treatment of this condition to avoid potentially severe consequences.

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