



Cost of scheduled and unscheduled asthma management in seven European Union countries

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ABSTRACT: Frequent need for emergency healthcare indicates poor asthma control and consumes resources that might be better spent on improved management. This study estimated the cost of scheduled and unscheduled healthcare for asthma in seven European Union (EU) countries.

The occurrence of asthma-related healthcare resource use and asthma symptom severity were identified from a telephone sample of people with asthma in France, Germany, Italy, the Netherlands, Spain, Sweden and the UK. Healthcare resource use was multiplied by country-specific unit costs to estimate per patient annual expenditure. Patients were divided into four groups according to asthma symptom severity: mild intermittent symptoms, mild persistent symptoms, moderate persistent symptoms and severe persistent symptoms. Cost was divided between scheduled and unscheduled care. Drug cost was not evaluable.

The study included 2,803 patients, of whom 1,695 (60%) reported mild symptoms and 2,050 (73%) were aged ≥ 16 yrs. The average annual per patient cost was €789 for patients aged 0–4 yrs, €463 for patients aged 5–15 yrs and €566 for adults. Unscheduled care accounted for 47% of total cost in infants, 45% in children and 56% in adults.

Around half of expenditure on asthma management was found to be due to unscheduled care regardless of the severity of patient symptoms.

KEYWORDS: Asthma, Europe, healthcare costs

Asthma continues to be one of the most common chronic diseases in the developed world in both adults and children, and is a major cause of morbidity and healthcare costs [1–4]. Within Europe, the prevalence of physician-diagnosed asthma has been reported to be 10.9% in the UK and 3.9% in Germany, with France and Italy having rates of 6.2 and 4.7%, respectively [5].

The goal of asthma management is to achieve and maintain control of the disease [6]. However, asthma has been shown to be poorly controlled within Europe, indicating that this goal is not being achieved [7]. The impact of asthma on a patient's quality of life decreases as guideline-based asthma control is achieved [8], with the quality of life of many patients with well-controlled asthma being minimally affected.

The management of asthma can be divided into scheduled and unscheduled activities. Scheduled activities include planned consultations with healthcare professionals to manage and monitor the disease and scheduled medication use.

Emergency physician contacts, rescue medication use, emergency room (ER) visits and hospitalisation are unscheduled activities, undertaken in response to a troublesome increase in symptoms or to exacerbation of the disease.

The largest contributors to healthcare costs are prescription medications (28–68% of costs) and hospitalisations (8–48%) [3, 9, 10]. The cost of treating asthma increases if the disease is poorly controlled [11, 12]. The cost of unscheduled healthcare resource use in adults with poorly controlled asthma has been found to be more than twice as high as in those with well-controlled asthma in France (€1,451 *versus* €550; 1997 values) [12].

This study aimed to evaluate scheduled and unscheduled healthcare resource use and associated cost for the management of asthma in Europe.

METHODS

The Asthma Insights and Reality in Europe (AIRE) study was a cross-sectional survey undertaken in 1999 in France, Germany, Italy,

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SUPPORT STATEMENT

This analysis was supported by a grant from GlaxoSmithKline.

TABLE 1 Patient distribution by age group, symptom severity and country

	France	Germany	Italy	The Netherlands	Spain	Sweden	UK	All
Aged 0–4 yrs	25	4	23	34	12	23	20	141
Symptom severity								
Severe persistent	6	2	5	9	4	7	7	40
Moderate persistent	5	1	1	7	2	2	7	25
Mild persistent	4	1	5	8	1	9	0	28
Mild intermittent	10	0	12	10	5	5	6	48
Aged 5–15 yrs	120	76	83	83	74	70	106	612
Symptom severity								
Severe persistent	11	12	10	12	10	5	14	74
Moderate persistent	17	10	8	12	10	5	10	72
Mild persistent	21	14	13	24	6	9	20	107
Mild intermittent	71	40	52	35	48	51	62	359
Aged >16 yrs	257	320	294	283	315	307	274	2050
Symptom severity								
Severe persistent	38	89	63	72	61	47	51	421
Moderate persistent	52	78	69	72	87	63	55	476
Mild persistent	52	62	65	47	48	68	53	395
Mild intermittent	115	91	97	92	119	129	115	758
All	402	400	400	400	401	400	400	2803
Symptom severity								
Severe persistent	55	103	78	93	75	59	72	535
Moderate persistent	74	89	78	91	99	70	72	573
Mild persistent	77	77	83	79	55	86	73	530
Mild intermittent	196	131	161	137	172	185	183	1165

Data are presented as n.

the Netherlands, Spain, Sweden and the UK. A representative sample of 2,803 patients with asthma was recruited using a systematic screening process. Patients were accepted as having asthma if they had been diagnosed with asthma by a physician, were currently taking asthma medication or reported asthma attacks and symptoms during the past year. Patients were interviewed by telephone and data were collected on their symptoms and disease history, knowledge and beliefs about their disease and management received. Patients also reported the frequency of asthma-related contacts with the healthcare system, creating an opportunity for analysis to estimate asthma-related healthcare resource use and cost. Parents or carers were interviewed on behalf of children aged <16 yrs. Previous reports have described in more detail the methods used in the AIRE study [7, 10].

The full set of patient level data from the AIRE study was then further analysed. Patients were divided into three age groups for analysis: infants (aged 0–4 yrs), children (aged 5–15 yrs) and adults (aged \geq 16 yrs). A symptom severity index has been derived for use with these data, which allocates patients to four categories: severe persistent if they reported symptoms three times or more per day and/or every night; moderate persistent if they reported symptoms every day or at least two nights per week; mild persistent if they reported symptoms at least twice a week and/or two or more nights per month; and mild intermittent otherwise. The calculation used has been described in detail elsewhere [7].

Patients reported unscheduled resource use including the number of asthma-related hospitalisations and days in hospital in the previous year, the number of ER visits, and the frequency of emergency contacts with a physician. Patients also reported the frequency of planned contact with their usual physician and with specialists. Patients were asked to report their utilisation of controller and rescue medication, but on inspection these data were not sufficient to estimate cost, and drug costs were not considered further in this analysis.

Per patient cost was estimated by multiplying the frequency with which each resource item was reported by the unit cost of that item in the patient's country of residence. A number of resource items were collected using tick box categories that covered a range of responses, such as reporting visiting a physician "3–5 times per yr". In these cases the mid point of the range was used. Unit costs were estimated from the perspective of public sector healthcare systems, which provide the majority of asthma care in all seven countries. For patients in France, Italy, Germany and the Netherlands, unit costs were taken from the official list of payments made by the public sector in these countries [13–18]. In the UK, estimated average costs published by the government were used [19, 20]. The government has not published national price lists in Sweden or Spain. Unit costs for Sweden were taken from the price and reimbursement list for the Southern Swedish Health Region (Sodra Regionvardsnamnden) [21]. Unit costs for Spain were taken from a database of healthcare costs generated by a local

TABLE 2 Scheduled resource use

	Symptoms				All
	Mild intermittent	Mild persistent	Moderate persistent	Severe persistent	
Aged 0–4 yrs n	48	28	25	40	141
Patients with at least one scheduled doctor visit %	100	100	92	98	98
Mean number of visits	6.1	13	14.9	29.8	15.7
Patients with at least one scheduled specialist physician visit %	40	36	28	40	37%
Mean number of visits	0.9	2.5	0.8	3.3	1.9
Aged 5–15 yrs n	359	107	72	74	612
Patients with at least one scheduled doctor visit %	99	97	100	97	99
Mean number of visits	5.8	6.5	11	18	8
Patients with at least one scheduled specialist physician visit %	23	31	38	32	27
Mean number of visits	0.7	0.9	2.7	1.6	1.1
Aged ≥ 16 yrs n	758	395	476	421	2050
Patients with at least one scheduled doctor visit %	99	98	99	98	99
Mean number of visits	3.9	5.6	8.7	15.8	7.8
Patients with at least one scheduled specialist physician visit %	19	22	22	28	22
Mean number of visits	0.6	1.0	1.1	1.2	0.9

health economics organisation (the Centre for Studies in Health, Economics and Social Policy (SOIKOS)). All costs were inflated to 2003 prices using the appropriate Consumer Price Index and converted into 2003 Euro values at market exchange rates.

The cost of unscheduled healthcare use included the cost of inpatient admission, ER visits and unscheduled physician contacts. Scheduled care included planned visits to the family physician and to specialists. Total cost was the sum of scheduled and unscheduled costs. The average per patient cost of unscheduled and scheduled care and the ratio of unscheduled to scheduled costs were calculated. Costs were calculated separately for age groups, by country and by symptom severity.

RESULTS

All 2,803 patients who participated in the AIRE survey were included in this analysis. Patient distribution according to age and symptom severity in each country is shown in table 1. Of the patients included, 141 (5%) were aged 0–4 yrs; the majority were adults. A total of 1,165 patients (42%) were categorised as having mild intermittent symptoms, with the remainder of the patients divided approximately equally between the three categories of persistent symptoms. The sample was in general balanced across countries, although children aged 0–4 yrs accounted for 1% of the German sample (four of 400) and for 5% of the pooled sample (141 of 2,803). The percentage of patients with severe persistent symptoms was 14% in France, 15% in Sweden, 26% in Germany and 23% in the Netherlands.

The proportion of patients reporting scheduled resource use and the mean annual number of visits per patient in each age bracket are shown in table 2. Almost all patients reported at least one scheduled general physician visit, irrespective of age and symptom severity. The annual mean number of general physician visits reported by patients with severe persistent symptoms was 29.8 among infants, 18.0 in children and 15.8 in adults. Infants reported an average of 1.9 scheduled specialist physician visits per year, children 1.1 visits per year and adults 0.9 visits per year.

Table 3 shows the percentage of patients reporting each category of unscheduled resource use and the mean number of events that were reported. Among children, 7% reported at least one hospitalisation, ranging from 3% in those with mild intermittent symptoms to 18% in those with severe persistent symptoms; among adults, 7% reported at least one hospitalisation (range 2–18%). At least one hospital admission was reported by 21% of infants with mild intermittent or mild persistent symptoms, 12% of infants with moderate persistent symptoms and 13% of infants with severe persistent symptoms. Unscheduled physician visits were reported by 45% of infants, 29% of children and 24% of adults.

The unit costs used in the analysis are shown in table 4, and figure 1 shows the costs of both scheduled and unscheduled healthcare by symptom severity across in the three age groups. The average annual per patient cost was €789 for infants, €463 for children and €566 for adults. Unscheduled care accounted for 47% of total cost in infants, 45% in children and 56% in adults.

TABLE 3 Unscheduled resource use

	Symptoms				All
	Mild intermittent	Mild persistent	Moderate persistent	Severe persistent	
Aged 0–4 yrs n	48	28	25	40	141
Patients with at least one hospital admission %	21	21	12	13	17
Mean number of nights hospitalised	1.69	1.5	0.88	0.1	1.06
Patients with at least one ER attendance %	29	43	16	28	29
Mean number of attendances	0.52	0.89	0.36	0.98	0.7
Patients with at least one unscheduled physician visit %	42	46	44	50	45
Mean number of visits	2.06	1.18	1.8	1.65	1.72
Aged 5–15 yrs n	359	107	72	74	612
Patients with at least one hospital admission %	3	7	11	18	7
Mean number of nights hospitalised	0.5	0.16	0.78	1.18	0.56
Patients with at least one ER attendance %	11	14	26	26	15
Mean number of attendances	0.19	0.2	0.58	0.85	0.32
Patients with at least one unscheduled physician visit %	22	35	40	41	29
Mean number of visits	0.6	1.13	1.39	2.58	1.02
Aged ≥16 yrs n	758	395	476	421	2050
Patients with at least one hospital admission %	2	4	8	16	7
Mean number of nights hospitalised	0.17	0.4	0.97	2.47	0.91
Patients with at least one ER attendance %	6	10	13	17	11
Mean number of attendances	0.07	0.15	0.31	0.64	0.26
Patients with at least one unscheduled physician visit %	15	19	29	38	24
Mean number of visits	0.36	0.58	0.96	2.02	0.88

ER: emergency room.

In infants with mild symptoms, children with severe persistent symptoms and adults with moderate and severe persistent symptoms, the cost of unscheduled healthcare was larger than the cost of scheduled healthcare (fig. 1). The cost of unscheduled care was three times higher than the scheduled costs in infants with mild intermittent symptoms (€531 *versus* €177 per patient).

The average per patient cost of unscheduled care was larger than scheduled care in France, Germany, Italy and the Netherlands. Unscheduled care was, however, less expensive than scheduled care in Spain, Sweden and the UK (fig. 2).

DISCUSSION

This analysis found that among asthma patients of all ages and symptom severities, the cost of unscheduled resource use was high. Around half of the healthcare cost of asthma management was consumed by unscheduled events.

This analysis estimated costs using resource use data collected from patients or parents in a telephone survey in seven countries and the pattern of resource use reported reflects patient recall of events occurring over the previous year. Patients are likely to be able to accurately report major health events, such as emergency hospitalisation, over such a period, but the accuracy of reporting of less significant events, such as physician visits, may be less precise.

The medication use reported was not sufficiently complete to allow drug costs to be included in the analysis, and the costs reported relate to physician contacts and hospitalisation only. A survey conducted in primary care in the UK reported the cost of asthma drugs to vary between €32 and €777 per yr according to the intensity of treatment [22]. The annual cost of the most intensive drug therapy described was therefore approximately equal to the cost of 2–4 days of hospital stay.

TABLE 4 Unit costs		Per day stay in hospital	Emergency room visit	Primary care visit	Specialist care visit	Source [ref.]
France		460.50	23.00	20.00	23.00	PSMI [13], AMELI [14]
Germany		340.73	157.16	29.34	44.47	EBM [16], ARNOLD <i>et al.</i> [17]
Italy		197.77	61.97	12.91	20.66	OFFICIAL GOVERNMENT [15]
The Netherlands		255.80	44.63	18.06	49.30	OOSTENBRINK [18]
Spain		267.60	103.60	17.86	108.90	2002 SOIKOS database of sanitary costs (unpublished)
Sweden		329.69	126.23	76.19	76.19	Prices and Reimbursements for the Southern Health Care region 2001 [21]
UK		222.93	109.42	29.18	131.30	DEPARTMENT OF HEALTH [19] NETTEN and CURTIS [20]

Data are presented as number of Euros per event. PSMI: Le programme de médicalisation des systèmes d'information; AMELI: L'Assurance maladie en ligne; EBM: Einheitlicher Bewertungsmaßstab; SOIKOS: Centre for Studies in Health, Economics and Social Policy.

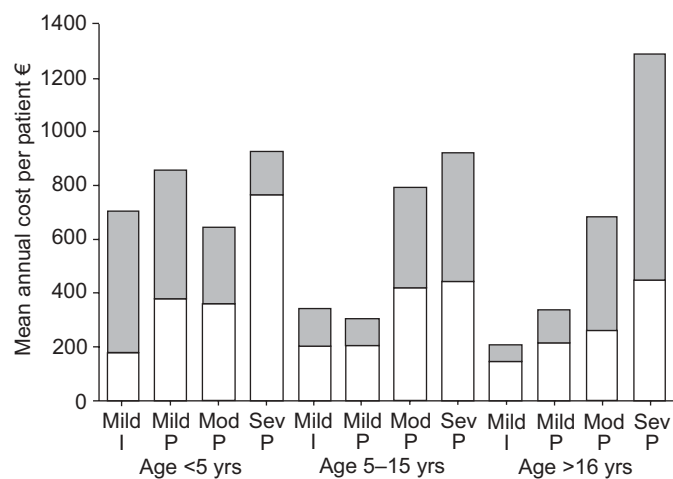


FIGURE 1. Cost of scheduled and unscheduled resource use by symptom severity and age group. I: intermittent; P: persistent; Mod: moderate; Sev: severe. ■: unscheduled resource use; □: scheduled resource use.

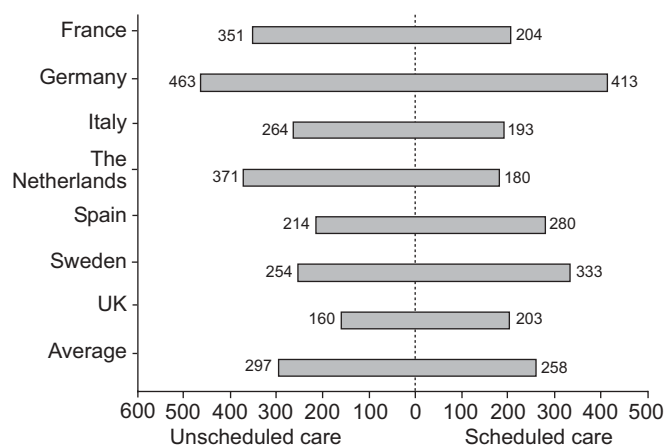


FIGURE 2. Per patient costs by country, shown in Euros per patient.

Other limitations of the study include potential heterogeneity introduced by pooling responses from different countries, and the adaptation of epidemiology data to estimate economic costs.

Within these limitations, the AIRE study remains a useful research resource. Extensive effort was made to generate a representative sample, and the dataset consistently records information for patients with asthma across seven countries. These data provide a unique insight into the pattern of asthma morbidity and management, and the sample size is the largest available to estimate healthcare cost at the European level. The AIRE data remains the most comprehensive dataset of its kind in Europe.

This study found that 7–17% of patients in different age groups had been hospitalised, 11–29% had visited an ER and almost all patients had consulted with a physician in the previous year due to their asthma. A study in the USA reported similar findings, with 3.6–13.9% of patients hospitalised and 16.1–33.6% requiring urgent care visits in the past year depending to short-term symptom burden [23]. Part of the European Community Respiratory Health Survey, however, reported lower rates of physician contacts, finding that only 60% of patients with asthma had consulted a physician in the past year because of their asthma [24].

In France, a survey reported healthcare costs to be €263 per patient per yr for mild intermittent asthma, €686 for mild persistent, €1,196 for moderate persistent, and €2,782 for severe persistent asthma [25]. A Dutch study found that the mean total direct costs per patient per yr for “low” severity asthma were €559, *versus* €984 and €772 for “moderate” and “high” categories [12], although severity in this study was based on inhaled steroid dose [12]. The current work found mean costs that were intermittent between the two earlier studies, and provides the first comprehensive assessment across countries.

As might be expected, the intensity of scheduled management appeared to be higher for patients reporting more severe symptoms. With the exception of the youngest patients, unscheduled cost also appeared to increase with symptom severity. The more intensive scheduled management offered to

adult patients with moderate and severe persistent symptoms did not offset the increased frequency and cost of emergency care in these patients.

Surprisingly, among infants the annual cost of unscheduled care per person was €478 and €531 in the groups of patients with mild symptoms. These patients also had a high rate of hospitalisation. Patient-reported symptom severity was not found to be a good predictor of hospitalisation risk in younger children.

In this large and comprehensive survey in seven European countries, almost half the expenditure on asthma management was found to be due to unscheduled care, with particularly high costs in adults with more severe symptoms and in infants with mild intermittent symptoms.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the contribution of P. Reeves who conducted data analysis. We are grateful to the AIRE investigators, interviewers and patients who provided the source data.

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