



Original Article

Economic Cost of Treating the Patient With Asthma in Spain: The AsmaCost Study

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ABSTRACT

Objective: This analysis of the cost of asthma in Spain includes both direct health care costs and indirect costs arising from illness.

Patients and Methods: Prospective, 12-month observational cohort study of adult patients with asthma diagnosed according to the guidelines of the Global Initiative for Asthma (GINA) and the adapted Spanish criteria (GEMA). We recorded information on health care resources utilized (medications, medical visits, emergency care, hospital admissions, and tests) and indirect costs (patient travel or transfer costs and workdays lost).

Results: A total of 627 patients throughout Spain were studied. Of these, 21.2% had intermittent asthma, 24.6% mild asthma, 27.6% moderate asthma, and 26.6% severe asthma. The total societal cost of asthma (including indirect costs) was €1726 (95% confidence interval [CI], €1314-€2154) per patient annually. Indirect costs accounted for 11.2% of the total. The cost to the National Health Service was €1533 (95% CI, €1133-€1946) per patient annually. The cost of asthma was higher for patients older than 65 years (€2079) and for those with more severe disease (€959 for intermittent asthma; €1598, mild asthma; €1553, moderate asthma; and €2635 severe asthma). Based on these findings, the total annual cost of asthma in Spain is estimated to be €1480 million (95% CI, €382-€2565 million) for patients with demonstrated bronchial hyperreactivity and €3022 million (95% CI, €2472-€3535 million) for patients diagnosed based on symptoms alone.

Conclusions: The average annual cost of asthma in adults in Spain comes to €1726 per patient, considering both direct and indirect costs from a societal perspective. The average annual cost per patient to the National Health Service is €1533.

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Coste económico del paciente asmático en España (estudio AsmaCost)

RESUMEN

Introducción: Se ha realizado un estudio del consumo de recursos y de los costes derivados, tanto sanitarios como no sanitarios, en el paciente asmático en España.

Pacientes y métodos: Se trata de un estudio prospectivo y observacional de cohortes, en pacientes asmáticos adultos, diagnosticados según los criterios de GINA/GEMA y seguidos durante 12 meses. Se recogieron datos sobre recursos sanitarios (consumo de medicamentos, consultas médicas, visitas a urgencias, ingresos hospitalarios y pruebas) y no sanitarios (desplazamientos de los pacientes y pérdidas de jornadas laborales).

Palabras clave:

Asma

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Resultados: Participaron 627 pacientes de toda España, con asma intermitente (21,2%), leve (24,6%), moderada (27,6%) y grave (26,6%). Desde la perspectiva de la sociedad (incluyendo los recursos no sanitarios), el coste anual de un paciente con asma asciende a 1.726 € (intervalo de confianza [IC] del 95%, 1.314–2.154). El 11,2% del gasto corresponde a recursos no sanitarios. Para el Sistema Nacional de Salud el gasto por paciente es de 1.533 € (IC del 95%, 1.133–1.946). El coste es superior en los pacientes mayores de 65 años (2.079 €) y en aquellos con asma de mayor gravedad (959; 1.598; 1.553, y 2.635 € para asma intermitente, leve, moderada y grave, respectivamente). De acuerdo con estos resultados, se estima que el coste anual del asma en España es de 1.480 millones de euros (IC del 95%, 382–2.565 millones) y de 3.022 millones de euros (IC del 95%, 2.472–3.535 millones) considerando el diagnóstico por hiperreactividad bronquial y sólo sintomático, respectivamente.

Conclusiones: El coste anual medio del paciente asmático adulto en España asciende a 1.726 y a 1.533 € desde la perspectiva de la sociedad y del Sistema Nacional de Salud, respectivamente.

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Introduction

Asthma is a chronic airway disease that currently causes significant public health problems, consistent with high prevalence rates and the accompanying burden of morbidity and mortality.¹ When diagnosis is based only on characteristic symptoms, the prevalence of asthma in Spain is estimated to be 4.9%, although higher rates (up to 14.6%) have been described; when bronchial hyperreactivity is added as a diagnostic criterion, the reported prevalence rates have been as low as 2.4% or as high as 4.7%.²⁻⁵ A total of 27 899 hospital admissions due to asthma were registered in Spain in 2005, accounting for 180 699 days of hospitalization.⁶ The standardized mortality rate for asthma was estimated at 10.1 and 13.2 per million population for men and women, respectively, in the country in 1996.¹

Because of these high prevalence, morbidity and mortality rates, asthma consumes large quantities of health care resources and represents a considerable burden for our National Health Service as well as for patients, their families and society as a whole.^{1,7} In developed countries from 1% to 2% of health care expenditure is required to cover asthma-related costs.⁸

Various studies of the economic impact of asthma in Spain have been carried out. One study conducted in the metropolitan area of Barcelona between 1994 and 1995 found that the total annual cost per patient with asthma, expressed in the currency of 2008, was €1964.⁹ According to the COAX study, the mean primary care cost of an asthma attack was estimated to be €166.70 (95% confidence interval [CI], €146.50–€192.30),¹⁰ while hospital costs were calculated at €1555.70 (95% CI, €1237.60–€1907.00).¹¹

The overall cost of asthma in Spain has been assessed at between €900 million and €1200 million.¹² In the Canary Islands specifically, the cost of this disease was €36 million in 2002.¹³

Consistent with prevalence data and the per-patient costs found in the aforementioned study of Serra-Batlles et al,⁹ it seems reasonable to hypothesize that currently available assessments of the overall burden of asthma in Spain may underestimate the real cost of illness.

The AsmaCost study was therefore designed to calculate the economic cost per asthma patient in the context of routine clinical practice in Spain, seen from a societal perspective, which is to say, quantifying both the direct and indirect costs of the disease. Secondary objectives of the AsmaCost study, whose results are presented in this paper, were as follows: *a*) to estimate costs generated by an adult asthma patient from the perspective of the payers—the health care administration (National Health Service) on the one hand and the patient and family (society) on the other; *b*) to calculate the overall cost of asthma based on the results obtained in the present study and on available population and prevalence data for Spain; and *c*) to quantify and compare costs associated with different types of patients.

Patients and Methods

This prospective, observational study of a cohort formed by nonprobabilistic sampling was designed to analyze the use of health care and other resources related to asthma in Spain.

The cohort was representative of the population of Spanish asthmatics. Included were male and female adults (aged ≥ 18 years) with a diagnosis of asthma based on the criteria of the Global Initiative for Asthma (GINA)⁸ and the adapted Spanish guidelines (GEMA).¹ Patients had a medical history indicative of the disease, variable and/or reversible airflow obstruction demonstrated in lung function tests, and bronchial hyperreactivity. At the start of the study, all patients were stable, as demonstrated by an absence of exacerbations requiring a change in medication other than inhaled β_2 -agonists on demand in the last 4 weeks. All signed written statements confirming their informed consent before enrollment. Exclusion criteria were mental illness; drug addiction; active alcoholism; disabling comorbidity that might interfere with cooperation or that might affect morbidity data, use of health resources, or quality of life; or any other characteristic the researcher considered would make enrollment of the patient inadvisable. Nor were patients enrolled if they declined to give their written informed consent. The study was duly approved by the ethics committee of one of the participating centers. All guidelines applying to confidentiality of patient information were followed.

The sample was stratified according to the following prospectively determined variables: *a*) asthma severity according to GINA/GEMA classes (intermittent, mild persistent, moderate persistent, and severe persistent asthma)^{1,8}; *b*) age, recorded as 18–65 years or >65 years; and *c*) location of residence, classified by Spanish geographic area as northern (Asturias, Cantabria, Galicia, Basque Country), eastern (Catalonia, Community of Valencia, Balearic Islands), central (Aragon, Castile and Leon, Castile-La Mancha, Madrid, Navarre, La Rioja), or southern (Andalusia, Canary Islands, Ceuta, Extremadura, Melilla, and Murcia).

Patients were recruited from hospital outpatient clinics and centers with respiratory medicine specialists, with help from primary care physicians in finding patients with mild asthma. Each researcher received a list of types of patients to be included in each stratum and accordingly selected a maximum of 3 consecutive patients as they attended appointments on successive days during the recruitment period.

Enrolled patients were followed for 1 year, in 3 visits at baseline, 6 months and 12 months.

Included among the sociodemographic variables recorded were type of residence (urban or rural), work status, and smoking habit. A patient was classified as an ex-smoker if he or she had not smoked for over a year. The main clinical variables recorded were those related to the aforementioned strata, plus time since asthma diagnosis and the presence of concomitant diseases related to asthma

(seasonal or chronic rhinitis, conjunctivitis, eczema or atopic dermatitis, nasal polyps, and gastroesophageal reflux).

The cost of illness was analyzed from 2 perspectives: *a*) the societal burden, in which both direct health care costs (pharmacologic treatments, medical visits, emergency visits, hospitalizations, and diagnostic tests), direct non-health care costs (patient transfers or travel to appointments, to the emergency room, or to the hospital) and indirect costs (an individual's loss of income or work time), and *b*) the burden for the National Health Service, in which only direct health care costs were included.

Direct health care costs were quantified for each patient by establishing the natural number of units or items of health system resources used (number of primary care or specialist appointments, number of times care was received from a hospital or primary care emergency service, number of hospital admissions and length of stay, number and type of diagnostic tests) and multiplying by the unit cost of each item. To calculate the cost of medications, the researchers recorded dosage, route of administration, and duration of asthma treatment and concomitant treatments.

All costs were expressed in terms of the 2007 value of the euro. Unit costs for health care resources were based on the prices published for Spanish autonomous communities¹⁴⁻²³ and a database of Spanish health care costs.²⁴

The unit costs of patient transfers or travel to attend a medical appointment, to obtain emergency care, or to go to the hospital were based on various criteria. The cost for use of an ambulance without an attending physician or for use of a mobile intensive care unit was based on prices published by the autonomous communities.^{14,17,18,22} The price of a metropolitan transport system ticket (for an underground train or bus) was calculated as the average of such fares in 30 Spanish cities.²⁵ The price of a taxi ride was calculated by taking the average of the minimum fares in 42 Spanish cities and adding the cost of traveling an additional kilometer.²⁶ Finally, the cost of traveling in a private vehicle was based on the price of gasoline for 1 km in a mid-sized car.²⁷ The cost of an 8-hour shift for a health care staff member in 2007 was based on a database of Spanish health costs.²⁴

The economic burden attributable to a patient with asthma was calculated by quantifying the resources used (as determined by prospective study) and applying the corresponding unit prices.

Two prevalence rates were used as the basis for calculating the overall cost of asthma in Spain. First, we calculated the expenditure given a prevalence of 4.9% (95% CI, 4.2%-5.5%) estimated when diagnosis is based only on clinical criteria (symptoms suggesting asthma). Second, we calculated costs assuming a prevalence of 2.4% (95% CI, 0.6%-4.2%) based on including the presence of bronchial hyperreactivity as a diagnostic criterion.²⁻⁴

The total population in 2007 was 35 729 733 inhabitants according to the figures of the Spanish National Institute of Statistics.²⁸

Monte Carlo modeling was used to calculate mean costs and the 95% CIs.

Results

In total, we followed 627 patients with intermittent (21.2%), mild persistent (24.6%), moderate persistent (27.6%), and severe persistent (26.6%) asthma for 12 months. The sociodemographic characteristics of the sample are summarized in Table 1.

Resource utilization is summarized in Table 2. The most frequently used medications were β_2 -adrenergic receptor agonists (salmeterol, salbutamol, formoterol, and terbutaline), corticosteroids (fluticasone, prednisone, budesonide), and montelukast (a leukotriene receptor antagonist).

In the first and second halves of the 12-month study period, 0.87 and 0.74 scheduled visits per patient took place. In addition, 0.49 and 0.20 unscheduled primary care visits were attended per patient in

the 2 halves of the year, respectively. The numbers of scheduled and unscheduled visits to a specialist were 0.91 and 0.87 per patient, respectively, in the first half of the study period. In the second half, the number of such visits, respectively, were 0.08 and 0.35 per patient.

The number of visits made to primary care and hospital emergency services were, respectively, 0.08 and 0.09 per patient in the first 6 months and 0.04 and 0.05 in the second 6 months. The most frequently administered drugs in these settings were salbutamol, ipratropium, and methylprednisolone.

The numbers of hospital admissions were 0.08 and 0.01 per patient in the first and second 6-month periods, respectively; the mean duration of hospital stay was 11.87 days in the first half of the study period and 7.00 days in the second half. Although information on resource utilization was recorded separately for both halves of the study period, all analyses cover the entire 12 months of the study. Possible differences between the first and second 6-month periods, therefore, were not considered given that the aim of the study was to estimate the annual economic burden of asthma.

The unit costs applied in the analyses are shown in Table 3.

Table 1
Sociodemographic and Clinical Characteristics of Patients in the AsmaCost Study^a

Item	Value
<i>Sociodemographic characteristics</i>	
Total No. of patients	627
Age, mean (SD), y	53.94 (18.14)
>65 y	36.84%
Sex, female	63.90%
Weight, kg	71.47 (13.38)
Height, cm	161.06 (9.63)
Residence, urban	73.50%
Central Spain, n (%) (Aragon, Castile-La Mancha, Castile and Leon, Madrid, La Rioja)	173 (27.59%)
Eastern Spain (Catalonia, Community of Valencia, Balearic Islands)	239 (38.12%)
Northern Spain (Asturias, Cantabria, Galicia, Navarre, Basque Country)	106 (16.91%)
Southern Spain (Andalusia, Canary Islands, Ceuta, Extremadura, Melilla, Murcia)	109 (17.38%)
<i>Work status</i>	
Active	37.80%
Retired, pensioner, or disabled	31.74%
Unemployed	1.75%
Student	3.83%
Homemaker	24.40%
Other	0.48%
<i>Smoking habit</i>	
Nonsmoker	64.74%
Ex-smoker	27.25%
Smoker	8.01%
<i>Clinical characteristics</i>	
<i>Asthma severity (GINA/GEMA class)</i>	
Intermittent	21.21%
Mild persistent	24.56%
Moderate persistent	27.59%
Severe persistent	26.63%
Years since diagnosis	15.68 (14.00)
<i>No. of concomitant diseases</i>	
None	43.93%
1	34.35%
2	16.45%
3	5.27%
Seasonal rhinitis	15.65%
Chronic rhinitis	26.36%
Conjunctivitis	10.06%
Eczema, atopic dermatitis	5.43%
Nasal polyps	10.70%
Gastroesophageal reflux	9.74%

Abbreviations: GEMA, Spanish Guidelines for the Management of Asthma; GINA, Global Initiative for Asthma.

^a Values are expressed as mean (SD), number of patients (%), or percentage of patients.

Table 2
Resource Utilization by Patients With Asthma During the Year of Follow-up^a

Resources	Annual Statistics
Direct costs	
<i>1. Health care</i>	
Medications prescribed for asthma ^b	
Salmeterol	68.2%
Salbutamol	25.7%
Formoterol	45.9%
Terbutaline	8.7%
Fluticasone	48.9%
Prednisone	5.4%
Budesonide	38.0%
Montelukast	29.1%
Additional medications ^c	
Fluticasone	4.4%
Mometasone	4.8%
Budesonide	7.1%
Omeprazole	4.5%
No. of medical visits per patient	
Primary care, scheduled visits	1.61 (3.27)
Primary care, unscheduled visits	0.69 (1.57)
Specialist care, scheduled visits	1.78 (1.26)
Specialist care, unscheduled visits	0.43 (0.55)
No. of visits to emergency health services per patient	
Primary care emergency service	0.12 (0.70)
Hospital emergency department	0.14 (0.66)
Medications administered during emergency health service care	
Salbutamol	7.6%
Ipratropium	6.1%
Methylprednisolone	6.3%
Hospital admissions	
No. of admissions per patient	0.09 (0.73)
Average length of hospital stay, d	18.87
Diagnostic and complementary tests	
No. of spirometric tests per patient	3.5
No. of radiographs per patient	1.3
<i>2. Non-health care costs</i>	
Travel to receive medical care	
Bus, train (metropolitan transport)	14.64%
Taxi	2.29%
Private vehicle	47.26%
Transport for emergency care	
Ambulance	11.73%
Mobile ICU	4.37%
Bus, train (metropolitan transport)	4.28%
Taxi	15.97%
Private vehicle	66.64%
Indirect costs	
Average work time lost per patient, h	6.72
For clinic visits	12.87
For emergency care	7.86
For hospitalization	

^aValues are mean (SD) of the unit stated or percentage of patients.

Abbreviation: ICU, intensive care unit.

^bOnly medications administered to more than 10% of the patients are shown for this category.

^cOnly medications administered to more than 3% of the patients are shown for this category.

From a societal perspective (including use of non-health care resources), the annual cost per patient was €1726 (95% CI, €1314–€2154). Accounting for the largest portions of spending were medications (32.1%), tests of all types (27.3%), and hospitalization (15.2%). The cost of non-health care resources accounted for 11.2% of the total disbursement (Table 4).

The National Health Service spent €1533 (95% CI, €1133–€1946) per patient in the course of the year. More was spent on patients over the age of 65 years (€2078) than on younger asthmatics (€1477). More was also spent on those with more severe disease, with the amounts rising from €959 per patient with intermittent asthma to €1598, €1553 and €2635 for those with mild, moderate and severe persistent asthma, respectively. Based on the minimum and

Table 3
Unit Costs Used in the Cost-of-Illness Analysis (2007 Euro)¹⁴⁻²⁷

Direct Resources	Mean Cost	Minimum-Maximum Amounts
<i>Health care costs</i>		
Clinic visits		
Primary care, scheduled visits	33.39	25.88–46.17
Primary care, unscheduled visits	53.73	51.74–56.04
Specialist care, scheduled visits	61.95	25.36–98.26
Specialist care, unscheduled visits	93.54	38.45–141.70
Emergency health services		
Primary care emergency service	53.73	51.74–56.04
Hospital emergency department	130.56	–
Hospitalization		
Days of hospitalization	347.46	246.94–564.53
Tests		
Complete blood count	2.90	1.33–4.47
Biochemistry	36.79	5.06–71.32
Coagulation profile	1.56	1.20–1.92
Chest radiograph	12.78	6.77–19.10
Chest CT scan	101.77	90.71–109.43
Arterial blood gas analysis	4.80	3.52–6.07
Forced spirometry	27.03	14.05–34.77
Lung volumes	14.05	–
DLCO	46.72	–
ECG	33.48	6.77–74.70
<i>Non-health care costs</i>		
Travel and transport		
Bus, train (metropolitan transport)	0.94	–
Taxi	3.14	–
Private vehicle	0.56	–
Ambulance	34.33	26.38–58.74
Mobile ICU	409.51	199.47–572.55
Indirect resources		
Mean		Minimum–Maximum
Value of 1 h of work time h	6.40	5.44–7.36

Abbreviations: CT, computed tomography; DLCO, carbon monoxide diffusing capacity; ECG, electrocardiogram; ICU, intensive care unit.

Table 4
Basic Annual Disbursement per Patient With Asthma in Spain, According to Disease Severity (2007 Euro)

Asthma Severity ^a	Direct Costs	Indirect Costs	Total
Intermittent asthma	819 (705–934)	140 (136–144)	959 (841–1,078)
Mild asthma	1,419 (950–1,915)	180 (168–201)	1,598 (1,118–2,115)
Moderate asthma	1,355 (1,167–1,562)	198 (185–211)	1,553 (1,351–1,773)
Severe asthma	2,392 (1,611–3,180)	243 (223–264)	2,635 (1,834–3,444)

^aValues are mean cost per patient, followed by the 95% confidence interval, for each severity classification according to the Global Initiative for Asthma and the Spanish Guidelines for the Management of Asthma.

maximum unit prices, the annual cost per patient was estimated to range from €1226 to €2572. Annual costs per patient calculated for each geographic area ranged from €1417 in the center of Spain to €2148 in northern Spain (Table 5).

Based on these figures, the total annual disbursement for asthma in Spain, assuming the prevalence found when both bronchial hyperreactivity and symptoms are considered in the diagnosis, was €1480 million (95% CI, €382 million–€2565 million). The total expenditure on asthma, assuming the prevalence calculated when the diagnosis is based only on symptoms, came to €3022 million (95% CI, €2472 million–€3535 million).

Discussion

The AsmaCost study found that the annual cost of illness for asthmatic patients in Spain comes to €1726 per patient from a societal perspective and to €1533 from the perspective of the National Health Service.

Our findings must be compared with those of other studies in terms of 4 aspects: a) the average cost per asthmatic patient, b) the

Table 5
Annual Cost per Patient With Asthma in Spain, According to Disease Severity (2007 Euro); Sensitivity Analysis

Asthma Severity ^a	Age, y		Costs ^b	
	<65	>65	Minimum	Maximum
Intermittent asthma	853	1,119	775	1,298
Mild asthma	1,180	2,197	1,031	3,242
Moderate asthma	1,455	1,757	1,261	2,054
Severe asthma	2,270	3,068	1,731	4,181
Asthma Severity ^a	Area of Spain			
	Central	Eastern	Northern	Southern
Intermittent asthma	865	969	1,304	881
Mild asthma	1,244	1,740	2,034	1808
Moderate asthma	1,411	1,560	1,978	1,397
Severe asthma	2,022	2,101	3,102	346

^aAccording to the classifications of the Global Initiative for Asthma and the Spanish Guidelines for the Management of Asthma.

^bCalculations are based on minimum and maximum unit costs and the 95% confidence interval.

influence of age and severity of disease on costs generated, c) the burden of non-health care costs, and d) the total cost of asthma in Spain.

- In 1998 the results of a cross-sectional study performed in Spain between April 1994 and May 1995 were published by Serra-Batlles et al.⁹ The study population consisted of 333 patients with asthma treated at 9 primary care clinics and 1 regional hospital. That study found that the mean annual cost per patient, in terms of the value of the euro in 2008, was €1964. The cost was higher for patients aged over 65 years (€2079) than for younger asthmatics (€1477) and higher in patients with more severe disease (€959, €1598, €1553, and €2635 for intermittent, mild persistent, moderate persistent, and severe persistent asthma, respectively). The AsmaCost study findings are very similar to the results reported by that group. In another study, performed in Italy in 1999, the mean annual cost per asthmatic patient was found to be €1260.²⁹
- Regarding the second aspect to be compared, the AsmaCost study has demonstrated higher costs for treating more severe disease, with the amount per patient rising from €959 for intermittent asthma to €1598, €1553 and €2635 for mild, moderate, and severe persistent asthma, respectively. This pattern was also evident in the Spanish study of 1998,⁹ in the previously cited Italian study,²⁹ and in a study carried out in France.³⁰ Higher costs for patients over the age of 65 years were observed for all asthma severity classes.
- The categories of health care resource utilization that most account for the economic burden of asthma, according to the AsmaCost study, are specific medications (32.1%), diagnostic and other tests (27.3%), and hospital admissions (15.2%). Spending on non-health care resources accounted for only 11.2% of the total cost, with amounts ranging from €43 million to €287 million annually. However, different studies have found considerably different amounts for indirect or non-health care costs. The study in Barcelona found such costs to account for 62.9% of the total⁹ and the Italian study reported 52% of the total for this category.²⁹ This discrepancy might have arisen from the fact that patients in the AsmaCost study were older (mean age, 53.9 years) and the number of subjects still working would have been lower than in the aforementioned studies, in which the mean ages of subjects were 42 and 36.6 years, respectively. We note that no one in the AsmaCost study reported disability due to asthma. What seems evident based on our findings is that in Spain the investment ratio between direct and indirect costs has been reversed, such that direct costs currently predominate at all levels of asthma severity.

A recent study showed that the use of medications for asthma in Spain has grown considerably in recent years.³⁰

- Assuming an asthma prevalence that takes the diagnostic criterion of bronchial hyperreactivity into consideration (2.4%; 95% CI, 0.6%–4.2%) and an adult (18 years of age) population of 35 729 733 inhabitants, there would be an estimated 857 514 (95% CI, 221 524–1 486 357) asthmatics in Spain. This would mean that the estimated annual cost of this disease in this country is €1480 million (95% CI, €382 million–€2565 millions). This figure is higher than the estimate of Nieto et al,¹² who calculated the cost to fall between €900 million and €1200 million.

An important finding of cost-of-illness analyses for asthma is poor control of the disease, which some authors have blamed for 70% of the total cost (including non-health care and some direct health care costs such as for hospitalization, emergency care and death).^{1,31} In accordance with the GEMA guidelines,¹ a policy aiming to save resources should take into account improvements in the utilization of preventive medication (mainly inhaled corticosteroids²¹), improved patient education,³³⁻³⁵ and the implementation of good practice guidelines.³⁶⁻³⁹

Based on our findings, and in accordance with recent statements by the European Parliament in Brussels,⁴⁰ we believe there is a need for a clear, effective health policy that assigns high priority to the management of asthma in the various health services in Spain.

Conflict of Interest

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List of researchers participating in the AsmaCost study.

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