ORIGINAL ARTICLE

Costs Associated With Workdays Lost and Utilization of Health Care Resources Because of Asthma in Daily Clinical Practice in Spain

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Abstract

Background: Asthma is associated with high indirect costs due to lower work productivity and higher absenteeism and presenteeism.
Objectives: To study loss of productivity measured using the lost workday equivalent (LWDE) index and health care utilization in asthmatics depending on age, geographical location, time period, severity, and level of asthma control.
Patients and Methods: In this cross-sectional, observational, epidemiological multicenter study, 120 allergists nationwide were asked to select asthmatic patients aged 18 to 65 years who were evenly distributed according to the 4 levels of asthma severity (Global Initiative on Asthma) during 3 different seasons. The participants collected sociodemographic data, spirometry values, Asthma Control Test (ACT) score, health care utilization data, perceived stress according to the Impact on Work Productivity Index (IMPALA, Índice del Impacto de la Enfermedad en la Productividad Laboral), and score on the Sheehan disability scale. The LWDE index was used to measure the number of workdays lost and the number of workdays with asthma symptoms combined with the percentage for average performance at work.
Results: The study sample comprised 1098 patients (58.7% females; 48.5% aged 18-40 and 51.5% aged 41-65). According to the ACT score, disease was uncontrolled in 57.6% of patients, well controlled in 32.8%, and totally controlled in 9.6%. The mean cost due to workdays lost was €285.81/patient/mo (95%CI, €252.71-318.92). Indirect costs were significantly higher in older patients (41-65 years, €405.08; 95%CI, 348.97-461.19), patients with more severe disease (€698.95; 95%CI, €588.63-809.27), and patients with more poorly controlled asthma (€466.86; 95%CI, €414.39-519.33).
The average cost of health care units per patient for each 3-month period was €1317.30 (95%CI, €1151.34-€1483.26). Indirect costs were significantly higher in older patients (€2104.00 in patients aged 18-40 vs €3301.55 in patients aged 41-65), in northern and central regions, in severe disease (€2921.63), and in more poorly controlled asthma (€1799.42).
Conclusion: Our findings could prove useful for physicians and health care providers.

Key words: Asthma costs. Health care utilization. LWDE. Absenteeism. Presenteeism. ACT (Asthma Control Test). IMPALA (Impact on Work Productivity).

Resumen

Introducción: El asma está asociada a elevados costes indirectos debido a baja productividad y alto grado de presentismo y absentismo.
Objetivos: Estudiar la pérdida de productividad mediante días de trabajo equivalente (LWDE) y utilización de recursos sanitarios (HCU) en pacientes asmáticos según edad, localización geográfica, tiempo, gravedad y nivel de control del asma.
Pacientes y Métodos: Estudio observacional, transversal, epidemiológico y multicéntrico.120 alergólogos a nivel nacional seleccionaron a pacientes asmáticos de edad comprendida entre 18 y 65 años, distribuidos en los 4 niveles de gravedad del asma según la GINA en 3 diferentes estaciones del año. Los datos recogidos fueron: socio-demográficos, espirometría, ACT, HCU, índice IMPALA, estrés percibido, cuestionario Sheehan de discapacidad. El LWDE consideraba el número de días laborables perdidos y el número de días trabajados con sintomatología asmática combinado con el porcentaje de rendimiento laboral promedio.
Resultados: 1.098 pacientes entraron en el estudio (58,7% mujeres; 48,5% con18 40 años de edad y 51,5% con 4165 años).
Según la puntuación del ACT el 57,6% tenía asma no controlada, 32,8% bien controlada y 9,6% totalmente controlada. El coste medio debido al LWDE fue de 285,81€/paciente/mes (IC 95%: 252,71-318,92€).Los costes indirectos fueron significativamente mayores en pacientes mayores (41-65 años: 405,08€; IC95%:348,97-461,219€) mayor gravedad (698,95€; IC95%: 588,63-809,7€) y peor control de asma (466,86€; IC95%: 414,39-519,33€).

El coste promedio de HCU/paciente/3 meses fue de 1.317,30€ (IC 95%: 1.151,34-1.483,26€. Los costes indirectos fueron significativamente mayores en pacientes mayores 18-40 años: 2.104,00€ vs 41-65 años: 3.301,55€, en el centro y norte del país, en enfermedad grave (2.921,63€) y en asmáticos peor controlados (1.799,42€).
Conclusión: Estos datos pueden ser de interés para profesionales y proveedores de la salud.

Palabras clave: Coste del asma. Utilización de recursos sanitarios. LWDE absentismo. Presentismo. ACT (test de control del asma). IMPALA (Impacto sobre la productividad laboral).

Introduction

Asthma is a chronic inflammatory disease of the airways associated with airway hyperresponsiveness that leads to recurrent symptoms and exacerbations and reversible airflow obstruction. Around 300 million people worldwide suffer from asthma, which causes 250 000 deaths per year [1]. Based on the results of the Community Respiratory Health Survey, asthma prevalence in Spain varies widely according to geographical area, from 5% in the north to 14.4% in the south [2]. The Global Initiative for Asthma guidelines (GINA) [1] have redefined the primary goal of asthma treatment as achieving optimum control, since this approach proved to be more relevant and useful in daily practice than classifying asthma by severity [1,3]. The Asthma Control Test (ACT) is a validated tool for patient-based and objective assessment of asthma control [4].

Asthma can be a significant cause of impaired health. Economic assessments of asthma from various sources indicate that, besides the direct costs, decreased productivity at work and school account for a high proportion of the disease burden and can add to indirect health costs. In order to accurately assess health-related reduced work productivity, it is important to consider both absenteeism, or the time lost from work, and presenteeism, or the loss of productivity while at work. These same principles apply when assessing impairment in school-related activities. The concept of presenteeism could be relevant to asthma patients who continue to work or attend classes in spite of ongoing symptoms that may impair their ability to perform effectively [5-9].

Several studies, some of which were performed in Spain, have shown that asthma is associated with high direct costs due to increased consumption of health care resources; however, few studies have focused on indirect costs, especially loss of productivity [10,11].

Objectives

The objectives of this study were to assess loss in productivity measured using the lost workday equivalent (LWDE) index [12] in a population of Spanish adult asthmatics and to assess the likely variability depending on age, geographical location, time period, asthma severity, and level of asthma control. The secondary outcomes evaluated in this study were the use of health care resources, the degree of disability caused by the disease, and sleep disturbances caused by asthma symptoms.

Patients and Methods

Spanish allergists were invited to participate in a nationwide cross-sectional, observational, epidemiological multicenter study. A stratified multistage probability sample without replacements was selected. The sampling frame was the health regions of the 17 Autonomous Communities of Spain. The first stage consisted of the selection of allergy outpatient clinics within each health region. The number of clinics to be selected in each region was proportional to the population. In the second stage, 1 allergist per clinic was randomly selected from among those with previous experience in clinical and epidemiological research in asthma and invited to participate. In the third stage, patients were selected based on a systematic sampling strategy using the daily list of all patients attending an appointment with each of the participating allergists and meeting the inclusion and exclusion criteria described below.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: *(1)* age 18-65 years; *(2)* a confirmed diagnosis of asthma based on the criteria set out in the GINA [1] or 2009 Spanish Guide to Management of Asthma guidelines (GEMA, Guía Española de Manejo del Asma) [2] and the results of pulmonary function tests; *(3)* signed informed consent. The exclusion criteria were as follows: *(1)* no previous diagnosis of asthma in the clinical history; *(2)* chronic obstructive pulmonary disease (COPD); *(3)* any other condition precluding participation or understanding of the study instructions; and *(4)* refusal to give informed consent.

Patient Selection

The investigators were asked to select 4 patients evenly distributed among the 4 GINA levels of asthma severity (4 patients per investigator) in 3 different seasons (winter, spring, and summer) and from 4 geographical regions: North (Asturias, Cantabria, Galicia, Basque Country, Navarra, and La Rioja); Center (Aragon, Madrid, Castile and León, and Castile-La Mancha); East (Catalonia, Valencia, Balearic Islands, and Murcia); and South (Andalusia, Canary Islands, Ceuta, Melilla, and Extremadura).

As the data were collected at a single visit to the physician's office, patients may have been symptom-free during the visit. No follow-up visits were programmed. Patients were informed about the anonymity of data collection.

All the data collected were provided by the participants at the study visit, with no additional information sought from

other sources. All the participants continued to receive their usual asthma treatment as indicated by their physician.

The study was approved by an institutional review board and the Spanish Ministry of Health.

Participants underwent evaluations that included self-completed questionnaires: the Asthma Control Test (ACT), the Impact on Work Productivity (IMPALA, Impacto sobre la Productividad Laboral), a productivity questionnaire, Sheehan Disability Scale, and perceived stress. The data collected were sociodemographic, clinical, and spirometric.

Asthma control was measured using the ACT [4], and the level of asthma control was defined by the GINA/GEMA guidelines as controlled, partially controlled, and uncontrolled [1,2].

Participants were asked to score the impact of asthma on their ability to work, attend classes, and perform regular daily activities during the past month.

The LWDE index considers the number of lost workdays and the number of workdays with asthma symptoms combined with the percentage for average performance at work, according to the following calculation: LWDE = W1 + W2 [1-P], where W1 is the number of days a patient is unable to work or conduct his/her daily activities owing to asthma during the previous 12 weeks, W2 the number of days working with asthma in the same period, and [1-P] the percentage of labor disability at work, since is P the percentage of effectiveness at work [13].

Estimation of Costs

The total cost per patient including healthcare costs and indirect costs derived from LWDE was calculated. The cost of use of healthcare resources (medical visits, emergency department visits, and hospitalizations) was obtained from the Oblikue healthcare costs database 2011 [14]. Finally, the cost for each LWDE was determined by applying the human capital method to data from the Spanish National Institute of Statistics (www.ine.es/ accessed November 2011) for the first quarter of 2011. To obtain an estimate of daily costs, the full monthly salary was divided by 30 days.

Patients were also asked to indicate the number of visits made to their primary care physician, visits to the asthma clinic, nonscheduled visits, visits to the emergency department, and hospital admissions and days of hospital admission due to asthma during the 3 months preceding the study visit.

The Sheehan Disability Scale is a self-completed questionnaire including 5 questions divided into 3 subscales: degree of disability caused by asthma symptoms, disability in life due to stressful events, and support from relatives and friends. The score ranges from 0 (no disability) to 100 (total disability).

Statistical Analysis

The *t* test or the 1-factor analysis of variance were used to assess statistical differences in quantitative measures meeting the assumptions necessary for the use of parametric tests; the Mann-Whitney test or the Kruskal-Wallis test was used for differences not meeting these assumptions.

The Pearson χ^2 and Fisher exact test were used for 2×2 tables and the likelihood ratio test with m×n tables.

Tests were carried out to determine compliance with the assumptions necessary for the use of parametric contrasts.

Information relative to the number of days patients did not work owing to asthma, days working with asthma, and average self-perceived labor productivity on these occasions (on a scale of 0% to 100% or on a 10-mm visual analog scale) during the previous 15 days.

The estimates were carried out with a 95% CI using SPSS V17.0. A *P* value <.05 was considered significant.

Results

Adult asthmatic patients who were seen at least once between February and November 2010 were included by 102 allergists. The final study sample comprised 1186 of the original 2098 (58.7% were women; 48.5% were aged 18-40 years and 51.5% were aged 41-65 years). The patients were evenly distributed in terms of geographical location and seasonality. The ACT score showed that asthma was uncontrolled in 57.6% of patients, partially controlled in 32.8%, and totally controlled in 9.6%.

According to the GINA/GEMA guidelines [1,2], 25.1% (n=274) of the patients were classified as having intermittent asthma, 26.9% (n=294) as mild-persistent, 27.4% (n=299) as moderate persistent, and 20.7% (n=226) as severe persistent. No statistically significant differences were found in the distribution of the level of asthma control by season. Patients aged 18 to 40 years were more frequently classified as having intermittent asthma and less frequently as having severe asthma (Figure 1).

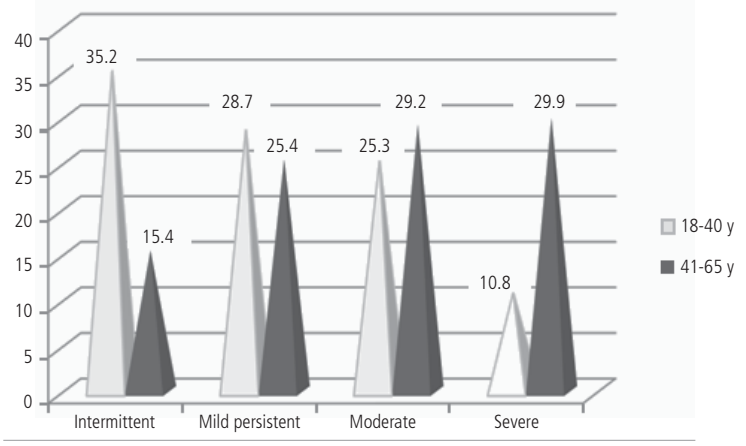

Figure 1. Classification of asthma according to the Global Initiative on Asthma and age
Intermittent (18-40 years vs 41-65 years): *P*<.01
Severe (18-40 years vs 41-65 years): *P*<.01

The mean number of days that the patients missed work or could not perform their daily activities owing to asthma within the 4 weeks before the clinical visit was 1.54 (95%CI, 1.32-1.76). The mean number of days that the patients attended work with asthma or clinical symptoms associated with asthma

during the same period was 4.91 days (95%CI, 4.49-5.32). Patients reported productivity to be ≤50% when working or performing their daily activities with asthma symptoms (Table 1).

As compared to younger patients (18-40 years), the average number of days of absenteeism and presenteeism was higher among patients aged 41-65 years, whereas productivity was lower (*P*<.05) (Figure 2 and Table 2). No statistically significant differences were observed in absenteeism or presenteeism between the different regions or seasons, except for presenteeism, which was significantly higher in southern Spain (5.77 days; 95%CI, 4.86-6.68) (Figure 3).

As expected, the higher the asthma severity and the poorer the level of asthma control, the higher the mean number of days of both absenteeism and presenteeism and the lower the productivity rates. Differences were statistically significant in all cases (*P*<.05) (Table 3).

The mean number of LWDEs due to asthma per patient per month was 3.58 (95%CI, 3.16-3.99). The number of LWDEs was significantly higher in older patients (1.86 [95%CI, 1.52-2.19] in patients aged 18-40 years vs 5.09 [95%CI, 4.39-5.79] in patients aged 41-65 years; *P*<.05). The results for disease were as follows: intermittent asthma, 0.63 (95%CI, 0.457-0.81); mild-persistent asthma, 1.37 (95%CI, 1.06-1.67) moderate asthma, 4.6 (95%CI, 3.77-5.42); and severe asthma, 8.66 (95%CI, 7.31-10.02) (*P*<.05). The level of disease control was lower in totally controlled asthma (0.56; 95%CI, –0.04 to 1.16) than in uncontrolled asthma, 5.84 (95%CI, 5.19-6.49) (*P*<.05). Furthermore, the number of LWDEs was higher in southern Spain (4.14; 95%CI, 3.22-5.06) owing to higher presenteeism (*P*<.05).

Table 1. Absenteeism and Presenteeism in the Study Population During the Previous Month

Days not working	No. Mean	1066 1.54
Days working with asthma	No. Mean	1064 4.91
Productivity	≤50% 60%-80% 90%-100%	26% 57.8% 16.10%

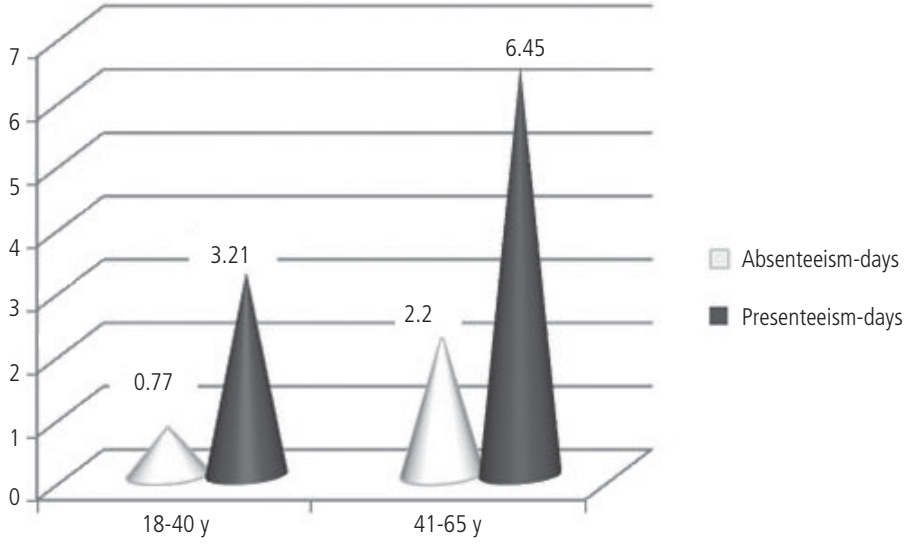

Figure 2. Days of absenteeism and presenteeism by age (*P*<.05)

Table 2. Absenteeism and Presenteeism by Age During the Previous Month[a]

	Age Range	18-40 y	41-65 y
Days not working, mean		0.77	2.20
Days working with asthma		3.21	6.45
Productivity	≤50% 60%-80% 90%-100%	16.70% 60.70% 22.70%	32.30% 56.00% 11.60%

[a] *P*<.05

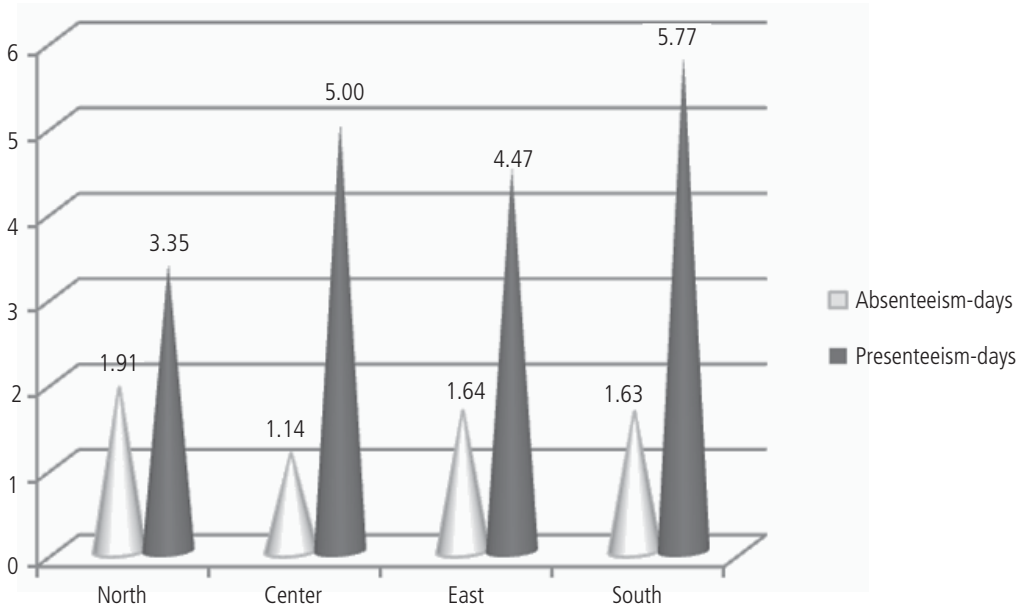

Figure 3. Days of absenteeism and presenteeism by geographical area: north vs south (*P*<.05)

Table 3. Absenteeism and Presenteeism by Asthma Severity During the Previous Month

Asthma Severity		Intermittent	Mild	Moderate	Severe
Days not working, mean		0.29[a,b]	0.55[a,b,c]	2.04[b,d,e]	3.67[a,d,e]
Days working with asthma		1.44[a,b]	3.03[a,b,c]	6.21[b,d,e]	9.85[a,d,e]
Patient productivity	≤50%	5.50%	5.70%	24.5%	56.70%
	60-80%	35.50%	71.30%	63.00%	41.00%
	90-100%	39.20%	23.00%	12.00%	2.4%

[a]*P*<.001 vs moderate
[b]*P*<.001 vs severe
[c]*P*<.05 vs intermittent
[d]*P*<.001 vs intermittent
[e]*P*<.001 vs mild

The results of the Sheehan Disability Scale showed that disability was significantly higher in older patients (35.09; 95%CI, 32.92-37.27), in patients with more severe asthma (50.48; 95%CI, 47.15-53.82), and in patients with poorly controlled asthma (40.88; 95%CI, 39.03-42.72) (P<.05). No statistically significant differences were detected for seasonality or geographical area, although patients from northern Spain received more support from their relatives and friends (Table 4).

The results of the IMPALA index showed that productivity was higher in patients aged 18-40 years (81.2%; 95%CI, 79.08-83.22) than in patients aged 41-65 years (71.7%; 95%CI, 69.33-74.01) (*P*<.05) and that it decreased progressively between intermittent asthma (88.19; 95%CI, 88.62-90.77) and severe asthma (58.77; 95%CI, 55.07-62.47). The impact on work productivity due to controlled asthma was significantly lower than that due to uncontrolled asthma (66.45 [95%CI, 64.43-68.47] vs controlled 93.10 [95%CI, 88.77-97.44]; *P*<.05) (Figure 4).

The average monthly cost per patient due to workdays lost was €285.81 (95%CI, €252.71-€318.92), which was significantly higher in older patients (€405.08 in patients aged 41-65 years vs €149.03 in patients aged 18-40 years; *P*<.05) and in southern Spain (4.14 days; 95%CI, 3.22-5.06 days; *P*<.05) compared with the other regions owing to higher presenteeism (€330.61 in the south vs €258.16 in the north). Indirect costs increased progressively with the level of asthma severity (Table 5) and the lack of disease control (Table 6).

Table 4. Sheehan Disability According to Degree of Asthma Control

	Uncontrolled	Partially Controlled	Controlled
Difficulty caused by symptoms at work	40.88	14.09[a]	6.41[a,b]
Difficulty caused by symptoms at a personal level	45.57	24.45[a]	14.95[a,b]
Friends and family support	66.09	71.21[c]	68.54

[a] *P*<.001 vs uncontrolled
[b] *P*<.01 partially vs controlled
[c] *P*<.05 vs uncontrolled

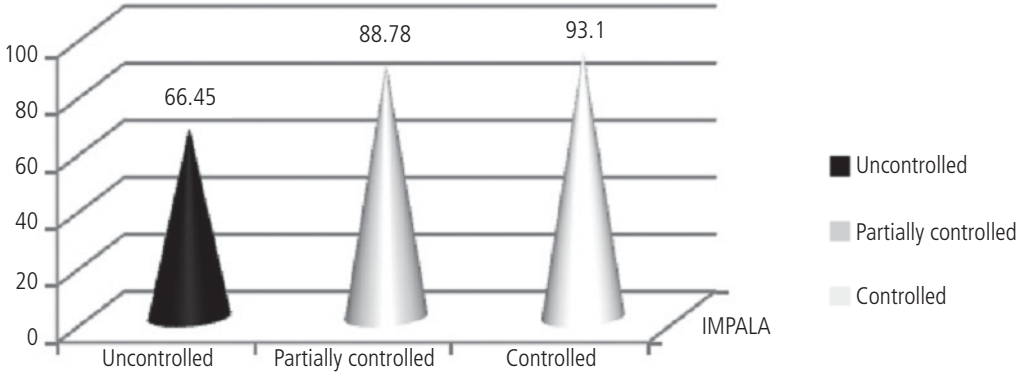

Figure 4. IMPALA: Impact on work productivity due to controlled asthma was significantly lower than in those patients with no asthma control vs patients with partial control and total control.
Uncontrolled vs partially controlled (*P*<.001)
Uncontrolled vs controlled (*P*<.001)

Table 5. Indirect and Direct Costs According to Disease Severity[a]

	Asthma Classification According to GINA Guidelines			
	MIA	MiPA	MoPA	SPA
Indirect costs[b]	51.03[e]	108.18	364.33[e,f]	698.95[e,f,g]
Direct costs[c]	519.65[e]	818.20	1303.20[e]	2921.63[e,f,g]
Total costs[d]	224.25[h]	380.91	798.73	1672.83

Abbreviations: GINA, Global Initiative on Asthma; MIA, mild intermittent asthma; MiPA, mild persistent asthma; MoPA, moderate persistent asthma; SPA, severe persistent asthma.
[a] In euros, for the year 2011, taking into account that the direct costs are partial, as pharmaceutical costs are excluded.
[b] Costs of workdays lost during the month before the study visit.
[c] Costs of health care utilization for the 3-month period before the study visit.
[d] The average total monthly cost per patient is calculated by dividing the direct costs by 3 and adding the indirect costs.
[e] *P*<.001 vs MiPA
f *P*<.001 vs MIA
[g] *P*<.001 vs MoPA
[h] *P*<.01 vs MoPA

Table 6. Indirect and Direct Costs According to Degree of Asthma Control[a]

	Asthma Control According to the Asthma Control Test		
	Totally Controlled	Partially Controlled	Uncontrolled
Indirect costs[b]	44.60[e]	39.12[e]	466.86
Direct costs[c]	594.17[e]	684.60[e]	1799.42
Total costs[d]	242.66	267.32	1066.67

[a]In Euros, for the year 2011. Direct costs are partial, as pharmaceutical costs are excluded.
[b]Costs of workdays lost during the month before the study visit. The differences were statistically significant.
[c]Costs of health care utilization for the 3-month period before the study visit. The differences were statistically significant.
[d]The average total monthly cost per patient is calculated by dividing the direct costs by 3 and adding the indirect costs.
[e]*P*<.001 vs uncontrolled asthma.

The average direct cost due to health care use was €1317.30 for a 3-month period (95%CI, €1148.26-€1483.26). The direct costs were significantly higher in patients aged 41-65 years (€3301.55; 95%CI, €1401.04-€1948.13) than in those aged 18-40 (€2104.00; 95%CI, €761.97-€1121.04) (*P*<.05) and in northern regions (€1816.67; 95%CI, 1034.07-2599.27) than in southern regions (€984.78; 95%CI, €796.76-€1172.80) (P<.05). Again, the direct costs increased progressively with the level of asthma severity (Table 5) and the lack of disease control (Table 6).

Discussion

Since asthma is highly prevalent in the general population, numerous studies have addressed the economic burden of the disease in different countries and using different methodologies. A systematic review by Bahadori et al [15] included 68 studies meeting the selection criteria and showed highly variable results depending on the methodology used and on the country, region, and setting. However, most of the studies reviewed found that both direct and indirect asthma-related costs increase as the degree of disease severity increases and disease control worsens.

In Spain, few studies have addressed the economic burden of asthma. In their 1-year cross-sectional study, Serra-Battles et al [10] calculated both the direct and indirect costs for the year 1995 for 333 asthmatic patients aged 14 to 82 years in a single province in northeast Spain. The direct costs represented about 30% of the total costs; the only indirect costs assessed were those arising from absenteeism and from work invalidity pensions, but not from presenteeism. The authors showed how both direct and indirect costs increased dramatically with disease severity, ranging from $1336 per year in patients with mild asthma to $6393 per year in those with severe asthma; the mean annual total cost per patient was $2879.

Martínez-Moragon et al [11] reassessed both the direct and indirect costs of asthma for the year 2007 in a 1-year longitudinal study [15]. The investigators included 627 adult asthmatics (aged >18 years) from different parts of Spain (north, south, and east) who were evenly distributed according to severity. The direct costs included costs of medications, costs of routine and emergency visits, costs of admissions to hospital, costs of diagnostic and additional tests, and transportation costs. However, the calculation of the indirect costs only included the workdays lost due to visits to health care facilities.

The main findings were higher costs associated with older age (patients aged >65 years compared with those aged 18-65 years), and increasing costs with more severe disease: from €959 (95%CI, €841-€1078) for intermittent asthma to €2635 (95%CI, €1834-€3444) for severe asthma.

As for asthma-associated direct costs, our study only assessed the use of health care resources (primary health care and specialized care visits, emergency room visits, and hospitalizations) but not costs of medications or other nonmedical associated direct costs. However, we made a detailed assessment of the costs associated with loss of productivity of asthma patients, considering the LWDE index as the primary study outcome. This variable includes 3 important aspects: *(1)* the number of days missed from work due to asthma symptoms (absenteeism); *(2)* the number of days the patients attended work with asthma symptoms (presenteeism); and *(3)* the patients' level of productivity while they were at work measured using the IMPALA questionnaire. For the 1-month period before the study visit, the average number of days missed from work for the whole sample was 1.5 days, while patients went to work with asthma symptoms for almost 5 days per month on average. This yields a mean LWDE value of 3.4 days, which represents an average monthly labor cost of €285.81 (95%CI, €252.71-€318.92) per patient. It is interesting to note that, as for direct costs, indirect costs increased with age, degree of asthma severity, and lack of asthma control. When the different regions were compared, only patients from southern Spain had higher indirect costs (€330.61 compared with €258.16 [north], €266.80 [center], and €277.06 [east]; *P*<.05), mainly owing to higher presenteeism in that region. The explanation for this higher presenteeism rate in southern Spain is unclear. Importantly, we did not find significant differences by seasonality: the average monthly indirect cost per patient was €279.38 for the

period January-May and €282.45 for the period June-October (P=.501).

Considering the data for health care utilization (direct costs) and the costs from workdays lost (indirect cost), the average total monthly cost per asthma patient in Spain for the year 2011 was about €725 (€724.91; 95%CI, €635.46-813.34).

Our study is subject to 2 important limitations. First, it does not consider all the direct costs involved in the management of an asthmatic patient, but separates costs of medications from other nonmedical items (eg, transportation), which are taken into consideration in other studies [15]. Therefore, although it provides more detailed information regarding indirect costs, it is incomplete in the estimation of total asthma cost. Second, the cross-sectional design does not enable us to calculate the costs per patient for 1 year, unlike the asthma costs study by Serra-Batlles et al [14]. However, to try to counteract this issue, patients were enrolled in different seasons to determine whether significant differences arose. None of the parameters studied (with the exception of infections and exercise as asthma triggers) showed statistically significant differences in their distribution by time of year.

In conclusion, we report the results of an observational, cross-sectional, multicenter study assessing the costs of asthma in a sample of almost 1100 asthmatic patients from throughout Spain for the year 2011. The study focused mainly on asthma-associated costs due to absenteeism and presenteeism measured using the LWDE index. Associated costs increased with age, disease severity, and lack of asthma control. These data are important both for physicians managing asthmatic patients and for health care policy makers, since they could facilitate allocation of resources in patient education and telemedicine-based disease management programs. Such an approach will in turn reduce the level of disability in more severely ill patients, who generate the highest costs.

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Previous Presentation

Two abstracts based on this study were presented at the European Academy of Allergy and Clinical Immunology (EAACI) Congress, June 2012 "Costs associated to health care utilization due to asthma in a Spanish population" and "Costs associated to absenteeism and presenteeism due to asthma in a Spanish population"

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