



ACTAS Derma-Sifiliográficas

Full English text available at
www.actasdermo.org



ORIGINAL

The Cost of Psoriasis and Psoriatic Arthritis in 5 European Countries: A Systematic Review[☆]



R. Burgos-Pol,^{a,*} J.M. Martínez-Sesmero,^b J.M. Ventura-Cerdá,^c I. Elías,^a
M.T. Caloto,^d M.Á. Casado^a

^a *Pharmacoeconomics & Outcomes Research Iberia (PORIB), Madrid, Spain*

^b *Servicio de Farmacia, Complejo Hospitalario de Toledo, Toledo, Spain*

^c *Servicio de Farmacia, Hospital Universitario Doctor Peset, Valencia, Spain*

^d *Celgene, S.L., Madrid, Spain*

Received 26 January 2016; accepted 29 April 2016

Available online 20 July 2016

KEYWORDS

Psoriasis;
Psoriatic arthritis;
Cost of disease;
Review;
Germany;
Spain;
France;
Italy;
United Kingdom

Abstract

Introduction: While the introduction of biologics has improved the quality of life of patients with psoriasis and psoriatic arthritis, it may have increased the economic burden of these diseases.

Objective: To perform a systematic review of studies on the costs associated with managing and treating psoriasis and psoriatic arthritis in 5 European countries: Germany, Spain, France, Italy, and the United Kingdom.

Methods: We undertook a systematic review of the literature (up to May 2015) using the MEDLINE and EMBASE databases. The methodological quality of the studies identified was evaluated using the Consolidated Health Economic Evaluation Reporting Standards checklist. We considered both direct costs (medical and nonmedical) and indirect costs, adjusted for country-specific inflation and converted to international dollars using purchasing power parity exchange rates for 2015 (\$US PPP).

Results: The search retrieved 775 studies; 68.3% analyzed psoriasis and 31.7% analyzed psoriatic arthritis. The total annual cost per patient ranged from US \$2,077 to US \$13,132 PPP for psoriasis and from US \$10,924 to US \$17,050 PPP for psoriatic arthritis. Direct costs were the largest component of total expenditure in both diseases. The severity of these diseases was associated with higher costs. The introduction of biologics led to a 3-fold to 5-fold increase in direct costs, and consequently to an increase in total costs.

Conclusions: We have analyzed the economic burden of psoriasis and psoriatic arthritis and shown that costs increase with the treatment and management of more severe disease and the use of biologics.

© 2016 Elsevier España, S.L.U. and AEDV. All rights reserved.

[☆] Please cite this article as: Burgos-Pol R, Martínez-Sesmero JM, Ventura-Cerdá JM, Elías I, Caloto MT, Casado MÁ. Coste de la psoriasis y artritis psoriásica en cinco países de Europa: una revisión sistemática. *Actas Dermosifiliogr.* 2016;107:577–590.

* Corresponding author.

E-mail address: rburgos@porib.com (R. Burgos-Pol).

PALABRAS CLAVE

Psoriasis;
Artritis psoriásica;
Coste de la enfermedad;
Revisión;
Alemania;
España;
Francia;
Italia;
Reino Unido

Coste de la psoriasis y artritis psoriásica en cinco países de Europa: una revisión sistemática**Resumen**

Introducción: La introducción de las terapias biológicas ha mejorado la calidad de vida de los pacientes con psoriasis y artritis psoriásica, aunque podría haber incrementado su carga económica.

Objetivo: Revisar los estudios de costes del manejo de la psoriasis y artritis psoriásica en cinco países de Europa (Alemania, España, Francia, Italia y Reino Unido).

Métodos: Revisión sistemática de la literatura en Medline y Embase hasta mayo 2015. La calidad metodológica de las publicaciones se evaluó mediante las recomendaciones de la Consolidated Health Economics Reporting Standard (CHEERS). Se consideraron costes directos (sanitarios y no sanitarios) e indirectos, actualizados por la inflación de cada país y ajustados a dólares internacionales 2015 mediante la Paridad de Capacidad Adquisitiva (USD-PPP).

Resultados: Se identificaron 775 publicaciones, 68,3% de psoriasis y 31,7% de artritis psoriásica. El coste total anual por paciente osciló entre 2.077-13.132 USD-PPP y 10.924-17.050 USD-PPP en psoriasis y artritis psoriásica, respectivamente. En ambas patologías, la partida con mayor contribución al coste total fue la relacionada con costes directos. Estadios más graves de la enfermedad se asociaron con un aumento de costes. La introducción de terapias biológicas conllevó un incremento de 3 a 5 veces de los costes directos, que repercutió en los costes totales.

Conclusiones: Esta revisión pone de manifiesto el impacto económico que supone el tratamiento y manejo de la psoriasis y artritis psoriásica, el cual aumenta en función de la gravedad del paciente y de la inclusión de terapias biológicas.

© 2016 Elsevier España, S.L.U. y AEDV. Todos los derechos reservados.

Introduction

Clinical skin and joint manifestations of the chronic autoimmune diseases psoriasis (psoriasis) and psoriatic arthritis (psoriatic arthritis) not only have a major impact on health-related quality of life of the patients,¹ but also represent a substantial economic burden on health systems.^{2,3} Psoriasis generally follows a chronic course, with relapses associated with different skin manifestations.⁴ Psoriatic arthritis is a chronic disease affecting the musculoskeletal system. It is usually seronegative and may be associated with psoriasis.⁵ Patients with psoriatic arthritis usually but not always present with skin manifestations before joint involvement is apparent,⁶ and in approximately 80% of patients, the presence of psoriasis occurs before the onset of psoriatic arthritis⁷ with a lag usually in excess of 10 years from diagnosis of psoriasis.⁶ In addition, although there is no clear correlation, there appears to be a greater risk of psoriatic arthritis in patients with more severe forms of psoriasis.⁷

The prevalence of these diseases is not well defined, given the heterogeneity of the clinical manifestations and differences in the diagnostic and classification criteria.⁹⁻¹¹ Estimates of the prevalence of psoriasis and psoriatic arthritis range from 1.3% to 2.2% and from 0.3% to 1% of the population, respectively.^{6,8} In Spain, although the number of studies is limited, according to estimates from recent data, the prevalence of psoriasis lies between 1.2% and 2.3%,^{12,13} and the prevalence of psoriatic arthritis is estimated to be 0.17%.¹² Furthermore, the prevalence of psoriatic arthritis in patients with psoriasis in Europe is significant, ranging

from 9.8% in the Spanish population¹² to 13.8% in the United Kingdom.¹⁴

The therapeutic approach to psoriasis and psoriatic arthritis is broad-ranging, and includes a first stage with conventional therapy (topical agents, phototherapy, glucocorticosteroids, nonsteroidal antiinflammatory agents, and nonbiologic disease modifying antirheumatic drugs) and a second stage with biologic therapies in patients refractory to conventional therapy.^{8,15,16}

Although a dose-dependent relationship between the use of biologic agents and the risk of infection has recently been observed,³ such agents are extremely effective and have considerably improved health-related quality of life.⁸ The counterpoint to this improvement is that the introduction of new biologic agents may increase the economic burden associated with these diseases.^{2,8} Thus, the objective of this study was to review the studies of costs of psoriasis and psoriatic arthritis management in the 5 biggest economies in Europe (Germany, Spain, France, Italy, and the United Kingdom).

Methods**Study Identification**

A systematic review of the literature was undertaken using the MEDLINE and EMBASE (via OVID) databases, with a cut-off of May 2015. The search strategy was based on use of search terms related to the type of patients and intervention (Medical Subject Headings, free text), syntactic operators,

and techniques used (simple and combined searches). The search was not limited by year of publication, type of study, or language, and included both full articles and conference abstracts. The Supplementary Material describes the strategy used for the 2 diseases.

Study Selection

Eligible studies were those published in English or Spanish in national or international journals that analyzed the cost of the disease. Studies had to include information on the estimation of direct health costs (for example, pharmacological and nonpharmacological treatment, visits to the physician, diagnostic tests, admission to hospital, rehabilitation, patient costs), nonmedical costs (transport, rehabilitation, out-of-pocket expenses), and/or indirect costs (lost productivity, sick leave, early retirement, unemployment, professional reorientation). There were no restrictions on the time horizon for the studies.

Publications that were not strictly studies of cost of the disease (for example, cost-effectiveness, cost-utility, cost-benefit analyses, and budget impact) were excluded. Likewise, studies conducted in European countries other than the 5 aforementioned ones were excluded.

Duplicate and rejected publications were represented along with those finally included with a flow diagram according to the criteria of the PRISMA statement.¹⁷

Data Extraction

Data extraction from the published studies occurred in 2 phases. In the first, one of the authors (RB) extracted the data and a second author (IE) reviewed these data. The discrepancies found were then resolved by discussion and consensus among the authors. A standard data collection sheet was used with different parameters (authors/year of publication, disease, country, study population, perspective used, cost estimation, results) for data collection.

The results of the costs were recorded in the original currency of each country (euros and pounds sterling) (original costs). Those studies with results in a currency other than euros (pounds sterling in the United Kingdom) were transformed to euros using the reference exchange rate as published by the Central European Bank for the year in which the costs of the article were estimated.¹⁸ The costs of the year of assessment in each study were adjusted to 2015 using the rate of inflation in the corresponding country, according to the data for the harmonized index of consumer prices provided by the OECD.STAT (updated costs).¹⁹ Then, to adjust for the different purchasing power of the different currencies and to eliminate differences between countries, a purchasing power parity [PPP] factor was applied, converting costs to international dollars updated to 2015 (US\$ PPP).²⁰

Assessment of Quality

The quality of the studies included was assessed according to the list of recommendations of the Consolidated Health Economics Reporting Standard (CHEERS).²¹ Of the 27 recommendations included in the 24 items that make

up the list, 11 were not applicable to the type of study selected for the review (studies of disease costs).

Results

We retrieved 775 publications, 529 (68.3%) about psoriasis and 246 (31.7%) about psoriatic arthritis. During the selection process, 761 publications were excluded because they were duplicates or did not meet the inclusion criteria (Fig. 1). Finally, 14 publications were included, 10 related to the cost of psoriasis (n = 5,537 patients) and 4 to psoriatic arthritis (n = 3,828 patients).

Study Characteristics

Germany is the country with most publications of studies of disease costs, both in psoriasis and psoriatic arthritis (n = 5), followed by Italy and Spain (n = 3), United Kingdom (n = 2), and France (n = 1).

All the studies of psoriasis reported direct health costs (pharmacological and nonpharmacological) and 2 also reported direct nonmedical costs.^{22,23} A societal perspective was used in all studies except for 2, which used the health system perspective.^{24,25} The human capital method was used to assess indirect costs in 3 publications,^{22,26,27} whereas one used the friction costs method.²⁸ The remaining publications that used the societal perspective did not specify the method used for calculating indirect costs. The time horizon ranged from 3^{24,27} to 12 months.^{22,23,25,27,29,30} In 6 of the 10 publications, patients with moderate to severe psoriasis were selected,^{23,25-28,31} and only 3 used tools such as the psoriasis area severity index and/or body surface area.²⁶⁻²⁸ Of the remaining 4 publications, 2 stratified the patients according to whether they had been hospitalized or not,^{22,29} and 2 assessed the costs associated with management before and after administration of biologic therapy (Table 1).^{23,25}

The 4 publications selected for psoriatic arthritis analyzed the pharmacological and nonpharmacological costs among the direct health costs, and 2 also included direct nonmedical costs.^{32,33} Three of the publications reported data from the societal perspective,³²⁻³⁴ with the human capital method alone used in one of these,³³ and both methods (human capital and friction costs) in the other.³⁴ One publication did not specify the method for calculating the indirect costs used,³² and another used the health system perspective.⁷ The time horizon ranged from 12³⁴ to 18 months.^{7,33} In one study, the time horizon was not specified, although annualized costs were presented.³² All analyses calculated the total cost of psoriatic arthritis after 1 year, except for one study that assessed resource usage 6 months before and after exposure to a biologic agent.³³ One of the studies assessed the cost of the disease in patients with psoriatic arthritis who had not received previous treatment with a biologic agent (Table 2).⁷

After assessing the reporting quality of 14 selected studies using the CHEERS statement, 8 of them (7 in psoriasis and 1 in psoriatic arthritis) did not explicitly specify the source of funding and 6 (5 in psoriasis and 1 in psoriatic arthritis) did not provide any information on conflicts of interest, population included, and methodology to obtain the preferences for each outcome measure. In 5 of the

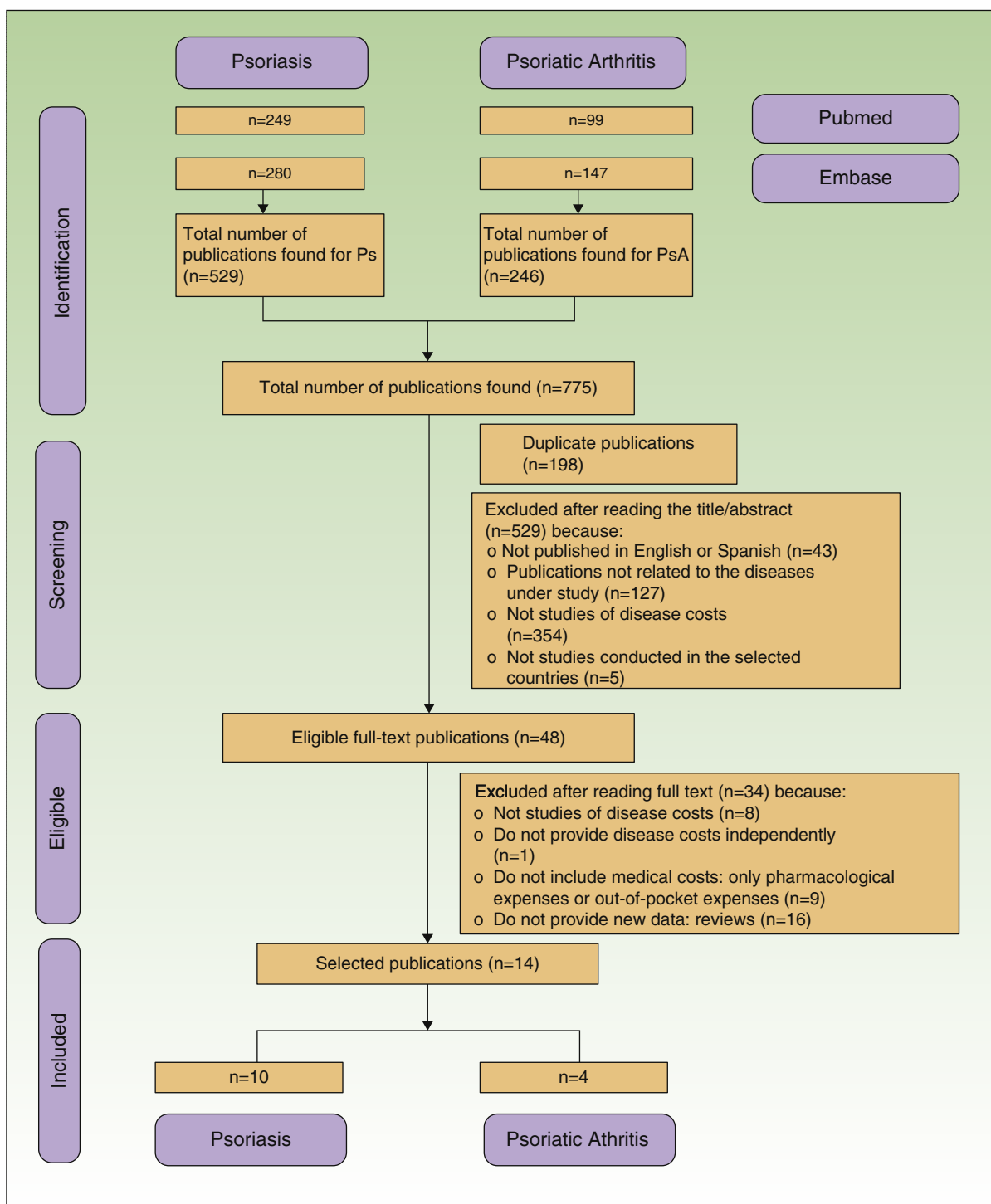


Figure 1 Flow diagram for the process of study selection based on PRISMA criteria. Ps indicates psoriasis; PsA, psoriatic arthritis.

studies (3 in psoriasis and 2 in psoriatic arthritis), the selected subgroup populations were not detailed (Table 3).

Cost of psoriasis

The annual cost of psoriasis, regardless of severity, lay between US \$2,077 and \$13,132 PPP patient-year,^{30,31} excluding studies of biologic agents,^{23,25} and a study that

assessed only hospitalized patients.²⁹ The direct and indirect costs ranged from US \$1,715 to \$8,925 and from US \$364 to \$4,207 PPP patient-year, respectively (Table 4). The direct costs were those that accounted for the greatest proportion of the total cost (between 50% and 93%), with the maximum proportion reported in a Spanish study (Fig. 2A).³¹

An increase in costs was seen in those studies that analyzed patients with severe disease (direct, indirect,

Table 1 Characteristics of the Studies Analyzing the Cost of Psoriasis.

Country	Author, Year of Publication	Study Characteristics (Patients, Design)	Perspective	Estimation of Costs
Germany	Berger et al., 2005 ²⁶	With moderate (BSA, 10%-20%) to severe (BSA > 20%) plaque Ps in patients aged 18 to 75 years (n = 156) Observational, national and multicenter study with retrospective (3 previous months) and retrospective (6 following months) data collection.	Societal	Direct: pharmacological treatment and nonpharmacological treatment, diagnostic tests, visits to the clinic, hospitalization, rehabilitation, and other additional costs Indirect ^a : lost productivity, absence from work, occupational disability, unemployment, and early retirement (HC)
Germany	Schöffski et al., 2007 ²⁸	With moderate to severe plaque Ps (PASI > 12 and/or BSA > 10%), > 18 years (n = 184) Retrospective observational (12 months), national and multicenter study.	Societal	Direct: pharmacological treatment and nonpharmacological treatment (phototherapy), visits to the clinic, hospitalization, rehabilitation, and minor expenses Indirect ^a : lost productivity due to absence from work, unemployment, retraining, occupational disability, and early retirement (FC)
Germany	Lang et al., 2009 ²⁹	With Ps of unspecified severity (n = 120). Stratification of patients by outpatients or hospitalized patients and according to treatment modality. Retrospective observational (12 months), national and single-center study.	Societal	Direct: medical, pharmacological and nonpharmacological (phototherapy). Other unspecified direct health costs covered by the health system Indirect: loss of work time (lost productivity). Includes direct nonmedical costs. Costs not specified
Germany	Steinke et al., 2013 ²²	With Ps (n = 120). Analysis of resource usage of outpatients (n = 71) and hospitalized patients (n = 49) Retrospective observational (12 months), national and single-center study.	Societal	Direct: pharmacological treatment and nonpharmacological treatment (radiotherapy), visits to the clinic, diagnostic tests. Direct nonmedical costs: transport Indirect ^a : lost productivity (HC)
Spain	Carrascosa et al., 2006 ³⁰	Ps with varying severity (n = 797) (<i>EPIDERMA project</i> : phase II) Prospective observational (12 months), national and multicenter study.	Societal	Direct: pharmacological treatment and nonpharmacological treatment, visits to the clinic, laboratory tests, hospitalization Indirect: lost productivity
Spain	Sanchez-Carazo et al., 2009 ³¹	With moderate to severe Ps, without specification of method for assessing severity (n = 1217). Prospective observational (4 months), national and multicenter study.	Societal	Direct: pharmacological and nonpharmacological (phototherapy), surgery, visits to the emergency room, visits to the clinic, and diagnostic and laboratory tests Indirect: lost productivity (full or part-time), social services, out-of-pocket expenses of the patient (transport, carers)
France	Le Moigne et al., 2014 ²³	Moderate to severe Ps ≥ 18 years (n = 1924) in treatment with biologic agents (n = 69) and with conventional therapy (n = 1.855) Retrospective observational (6 months prior to and 6 months after use of biologic agents), national, multicenter study.	Societal	Direct: pharmacological treatment and nonpharmacological treatment (phototherapy), visits to the physician or other healthcare professionals, laboratory and diagnostic tests, hospitalization, nursing. Direct nonmedical costs: transport Indirect: lost productivity: only daily sick pay for sick leave

Table 1 (Continued)

Country	Author, Year of Publication	Study Characteristics (Patients, Design)	Perspective	Estimation of Costs
Italy	Finzi et al., 2001 ²⁴	With Ps of unspecified severity (n = 793) Retrospective observational (3 months), national and multicenter study.	NHS	Direct: pharmacological treatment (biologic agents excluded) and nonpharmacological treatment, visits to the clinic, and hospitalization
Italy	Colombo et al., 2008 ²⁷	With moderate (PASI 12-20) to severe (PASI > 20) plaque Ps Prospective observational (3 months), national and multicenter study.	Societal	Direct: pharmacological treatment and nonpharmacological treatment (radiotherapy), visits to the clinic, diagnostic and laboratory tests, hospitalization Indirect ^a : lost productivity (HC)
United Kingdom	Fonia et al., 2010 ²⁵	Plaque Ps ≥ 18 years who had initiated treatment with biologic agents in the 6 months prior to data collection (n = 76) Retrospective observational (12 months), national and single-center study.	NHS	Direct: pharmacological treatment and nonpharmacological treatment (phototherapy), visits to the clinic, hospitalization

Abbreviations: BSA, body surface area; FC, friction costs; HC, human capital; PASI, psoriasis area severity index; Ps, psoriasis; NHS, national health system (National Health Service in the United Kingdom).

^a In the friction costs method, quantification of lost productivity due to illness depends on the time needed to replace the worker on sick leave. In the human capital method, indirect costs are quantified according to reduction in future gross earnings of the patients.

and total cost between US \$2,213 and \$12,051, \$1,145 and \$5,884, and \$4,175 and \$17,935 PPP patient-year, respectively). When the costs were assessed by grouping patients with moderate to severe psoriasis, the direct

and total costs were similar (US \$7,868-\$10,471 and \$9,778-\$11,223 PPP patient-year, respectively), with the highest costs corresponding to the study conducted in Spain.³¹

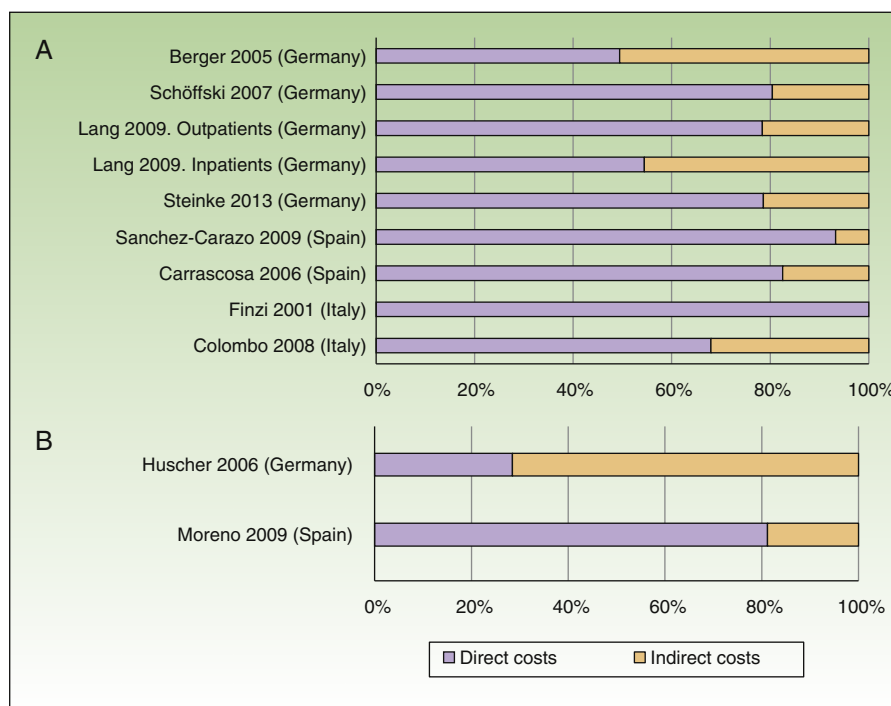


Figure 2 Percentage of direct and indirect costs by total cost per patient-year (according to current costs, US\$ PPP 2015). A, Psoriasis. B, Psoriatic arthritis.

Two studies of psoriasis conducted in France²³ and the United Kingdom²⁵ and 1 study of psoriatic arthritis conducted in Italy³³ were excluded because they only assessed exposure to biologic agents.

Table 2 Characteristics of the Studies Analyzing the Cost of Psoriatic Arthritis.

Country	Author, Year of Publication	Study Characteristics of (Patients, Design)	Perspective	Estimation of Costs
Germany	Huscher et al., 2006 ³⁴	Patients (< 65 years) diagnosed with PsA who need rheumatological care for at least one month (n = 908) Retrospective observational (12 months), national and multicenter	Societal	Direct: pharmacological and nonpharmacological treatment, surgery, visits to the clinic, hospitalization, diagnostic tests, additional expenses for the treatments prescribed for the disease borne by the patient Indirect ³ : lost productivity, absence from work, occupational disability, and early retirement (FC and HC)
Spain	Moreno et al., 2009 ³²	Patients with PsA of unspecified severity and of unspecified age (n = 287) Retrospective observational, national and multicenter	Societal	Direct: A, medical: drugs (purchase) whether paid for or not by the patient, hospitalization, surgery, visits to the physician and other healthcare professionals or alternative medicine practitioners, laboratory and diagnostic tests and phototherapy sessions. B, nonmedical: social care and other expenses paid for by the patient (carers and other disease-related expenses) Indirect: lost productivity (partial or complete)
Italy	Olivieri et al., 2008 ³³	Patients (> 18 years) diagnosed with PsA with failure or intolerance of conventional therapy (n = 107) Prospective observational (18 months), national and multicenter	Societal	Direct: pharmacological treatment, surgery, visits to the clinic, diagnostic and laboratory tests, hospitalization, rehabilitation process and other costs, transport Indirect ³ : costs borne by patients and carers and absence from work (HC)
United Kingdom	Poole et al., 2010 ⁶	Patients with PsA, either from BSRBR (n = 296 patients naïve to biologic agents and who began treatment with etanercept) or from THIN (n = 2526) with 6 months of follow-up before diagnosis of PsA and at 12 months Retrospective observational, national and multicenter	NHS	Direct: pharmacological treatment, visits to the physician or other healthcare professionals, diagnostic tests

Abbreviations: BSRBR: British Society of Rheumatology Biologics Register; FC, friction costs; HC, human capital; NHS, National Health Service; PsA, psoriatic arthritis; THIN: The Health Improvement Network.

^a In the human capital method, indirect costs are quantified according to reduction in future gross earnings of the patients. In the friction costs method, quantification of lost productivity due to illness depends on the time needed to replace the worker on sick leave.

The total cost of hospitalized patients was analyzed in 2 German studies, with the direct and total costs exceeding those of the other studies included in this review (US \$13,161-\$14,681 and \$19,014-\$24,161 PPP patient-year, respectively).^{22,29}

In addition, the direct costs for management of psoriasis increased by 3-fold to 5-fold after administration of a biologic agent (before the biologic agent: US \$1,967 to \$10,060 PPP patient-year; after the biologic agent: US \$7,097 to \$20,061 PPP patient-year), due to an increase in pharmacological costs (before the biologic agent: US \$412 to \$8,013 PPP patient-year; after the biologic agent: US \$2,111 to

\$18,064 PPP patient-year) with a similar impact on total costs (Fig. 3A).^{23,25}

Cost of Psoriatic Arthritis

The annual cost per patient of psoriatic arthritis lay between US \$10,924 and \$17,050 PPP patient-year,^{32,34} and exceeded US \$57,000 PPP patient-year when considering only patients with severe disease.³⁴ The direct costs varied between US \$3,693 and \$8,871 PPP patient-year, and the indirect costs between US \$2,053 and \$3,716 (friction costs method)

Table 3 Results of the Evaluation According to the CHEERS List of Recommendations^a

	Berger et al., 2005 ²⁶	Schöffski et al., 2007 ²⁸	Lang et al., 2009 ²⁹	Steinke et al., 2013 ²²	Carrascosa et al., 2006 ³⁰	Sanchez-Carazo et al., 2009 ³¹	Le Moigne et al., 2014 ²³	Finzi et al., 2001 ²⁴	Colombo et al., 2008 ²⁷	Fonia et al., 2010 ²⁵	Huscher et al., 2006 ³⁴	Moreno et al., 2009 ³²	Olivieri et al., 2008 ³³	Poole et al., 2010 ⁶	% (n) ^b
<i>Title, introduction, and methods</i>															
Title															0% (0)
Abstract		■		■	■			■							29% (4)
Background and objectives			■			■						■			21% (3)
Population, objective, and subgroups			■		■		■					■	■		36% (5)
Setting and place			■			■									14% (2)
Perspective			■									■			14% (2)
Time horizons												■			7% (1)
Discount rates, outcomes and choice of health outcomes			■		■	■	■	■				■			43% (6)
Estimate of resources and costs												■			0% (0)
Currency, price date, and conversion			■			■	■	■							29% (4)
Analytical methods			■			■		■				■			29% (4)
<i>Results</i>															
Study parameters	■		■			■						■			29% (4)
Characterization of heterogeneity						■		■				■	■		29% (4)
<i>Discussion</i>															
Findings, limitations, and current knowledge		■	■			■						■			21% (3)
<i>Others</i>															
Source of funding	■	■	■		■	■	■	■				■			57% (8)
Conflicts of interest			■		■	■		■	■	■		■			43% (6)
% (n)	13% (2)	13% (2)	69% (11)	6% (1)	25% (4)	63% (10)	19% (3)	44% (7)	6% (1)	0% (0)	0% (0)	75% (12)	13% (2)	0% (0)	

^a Items 7-11a and 11b, 13b, 15-16, 19-20a and 20b are not relevant given the type of study.

^b Results expressed as percentage noncompliant. Item in grey indicates criterion not met. Item in green indicates criterion is met
Source: Husereau et al.²¹

Table 4 Cost of Psoriasis.

Author, Year of Publication (Price Year)	Population	Original Costs (Patient-Year, € Year Costs)			Δ HICP Applied ¹⁹	Updated Costs (Patient-Year, euros in 2015)			Current Costs Adjusted for PPP ²⁰ (Patient-Year, PPP USD 2015)		
		Direct Costs	Indirect Costs	Total Cost		Direct Costs	Indirect costs	Total cost	Direct costs	Indirect costs	Total cost
<i>Germany</i>											
Berger et al., 2005 ^{26 a} (€ 2002)	Generalized Ps	1,426	1,440	2,866	21.9%	1,738	1,755	3,494	2,217	2,239	4,456
	Moderate Ps	1,393	1,266	2,658		1,698	1,543	3,240	2,166	1,968	4,133
	Severe Ps	1,423	1,429	2,852		1,735	1,742	3,477	2,213	2,222	4,434
Schöffski et al., 2007 ²⁸ (€ 2006)	Moderate to severe Ps	5,397	1,310	6,707	14.3%	6,169	1,497	7,666	7,868	1,910	9,778
Lang et al., 2009 ²⁹ (ND)(€ 2009)	Hospitalized Patients	9,510	2,973	17,458	8.5%	10,318	3,226	18,942	13,161	4,114	24,161
	Outpatients	1,850	509	7,657		2,005	552	8,297	2,560	704	10,597
Steinke et al., 2013 ²² (€ 2006)	Generalized	5,576	1,515	7,092	14.3%	6,373	1,732	8,106	8,129	2,209	10,339
	Hospitalized Patients	10,070	2,973	13,042		11,510	3,398	14,907	14,681	4,334	19,014
	Outpatients	2,476	509	2,985		2,830	582	3,412	3,610	742	4,352
<i>Spain</i>											
Carrascosa et al., 2006 ³⁰ (€ 2003)	Generalized	891	189	1,079	27.8%	1,139	242	1,379	1,715	364	2,077
	Mild	775	118	893		990	151	1,141	1,492	227	1,719
	Moderate	1,028	245	1,265		1,314	313	1,617	1,979	472	2,435
	Severe	1,574	595	2,169		2,012	760	2,772	3,029	1,145	4,175
Sanchez-Carazo et al., 2009 ³¹ (ND; € 2009)	Moderate to severe Ps	6,420	461	6,881	8.3%	6,953	499	7,452	10,471	752	11,223
<i>France</i>											
Le Moigne et al., 2014 ²³ (ND, € 2012)	Before BA	1,586	105	1,678	1.7%	1,613	107	1,707	1,967	130	2,081
	After BA	8,111	28	8,107		8,249	28	8,245	10,060	35	10,055
<i>Italy</i>											
Finzi et al., 2001 ²⁴ (€ 1994)	Generalized	905	No	905	59.3%	1,442	No	1,442	1,938	No	1,938
Colombo et al., 2008 ²⁷ (€ 2006)	Generalized	5,690	2,682	8,372	16.7%	6,640	3,130	9,770	8,925	4,207	13,132
	Moderate	3,643	1,583	5,226		4,251	1,847	6,099	5,714	2,483	8,197
	Severe	7,683	3,751	11,434		8,966	4,377	13,343	12,051	5,884	17,935
<i>United Kingdom</i>											
Fonia et al., 2010 ^{25 b} (£ 2008)	Before BA	4,207 £/5,283 €	No	4,207 £/5,283 €	18.1%	4,968 £/6,239 €	No	4,968 £/6,239 €	7,097	No	7,097
	After BA	11,891 £/15,046 €		11,891 £/15,046 €		14,043 £/17,769 €		14,043 £/17,769 €	20,061		20,061

Abbreviations: BA, biologic agents; HICP, harmonized index of consumer prices; ND, no data; PPP, purchasing power parity; Ps, psoriasis.

^a Includes a group of patients with arthritis (2358 € of total costs when patients with arthritis are excluded).

^b Price given in pounds Sterling in the original article. Cost estimate in euros with the reference exchange rate published by the Central European Bank in 2008 (according to publication) Available from: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=120.EXR.A.GBP.EUR.SP00.A&periodSortOrder=ASC

Table 5 Cost of Psoriatic Arthritis.

Author, Year of Publication (Price Year)	Population	Original Costs (Patient-Year, € Year, Costs)			Δ HICP Applied ¹⁹	Updated Costs (Patient-Year, euros in 2015)			Current Costs Adjusted for PPP ²⁰ (Patient-Year, USD 2015)		
		Direct Costs	Indirect Costs ^a	Total Cost		Direct costs	Indirect costs ^a	Total cost	Direct costs	Indirect costs ^a	Total cost
<i>Germany</i>											
Huscher et al., 2006 ³⁴ (€ 2003)	Generalized	3,156	FC: 2,414 HC: 7,919	FC: 5,570 HC: 11,075	20.7%	3,809	FC: 2,914 HC: 9,558	FC: 6,723 HC: 13,368	4,859	FC: 3,716 HC: 12,192	FC: 8,575 HC: 17,050
	Female vs Male	3,406	FC: 2,850 HC: 9,463	CF:6,256 HC: 12,870		4,111	FC: 3,440 HC: 11,422	FC: 7,551 FC: 15,534	5,244	FC: 4,338 FC: 14,569	FC: 9,631 FC: 19,814
		2,855	FC: 1,986 HC: 6,134	FC: 4,841 HC: 8,989		3,446	FC: 2,397 HC: 7,404	FC: 5,843 HC: 10,850	4,395	FC: 3,058 HC: 9,444	FC: 7,453 HC: 13,839
	Disease duration (< 5/5-10/ > 10 years)	3,254/2,602/ 3,455	FC: 2,529/ 1,578/2,548 HC: 4,654/ 6,365/11,173	FC: 5,783/ 4,180/6,003 HC: 7,908/ 8,968/14,628		3,928/3,141/ 4,170	FC: 3,053/ 1,905/3,075 HC: 5,617/ 7,683/13,486	FC: 6,980/ 5,045/7,246 CH:9,545/ 10,824/17,656	3,924/3,137/ 4,166	FC: 3,893/ 2,429/3,923 HC: 7,165/ 9,799/17,201	FC: 8,903/ 6,435/9,242 HC: 12,175/ 13,807/22,520
		Functional status (70/50-70/ < 50)	2,331/446/ 5,721	FC: 1,280/ 4,831 12,098 CH: 3,268/ 14,252/31,720		FC: 3,610/ 9,292/17,819 HC: 5,599/ 18,712/37,441	2,814/5,384/ 6,905	FC: 1,545/ 5,831/14,602 HC: 3,944/ 17,202/38,286	FC: 4,357/ 11,215/21,508 HC: 6,758/ 22,585/45,191	3,589/6,868/ 8,808	FC: 1,971/ 7,438/18,625 HC: 5,031/ 21,942/48,834
	<i>Spain</i>										
Moreno et al., 2009 ³² (euros in 2008)	Generalized	5,449	1,261	6,710	8.1%	5,890	1,363	7,254	8,871	2,053	10,924
<i>Italy</i>											
Olivieri et al., 2008 ³³ (euros in 2007)	Prior BA therapy (anti-TNF)	943	576	1,519	14.4%	1,079	659	1,738	1,450	886	2,336
	Increase/decrease in mean cost after BA (anti-TNF)	5,052	-413	4,639		5,779	-472	5,307	7,768	-635	7,133
<i>United Kingdom</i>											
Poole et al., 2010 ⁶ ^b (pounds sterling in 2007)	Generalized	1,446 £ (2,113)	No	1,446 £ (2,113)	22.4%	2,585	No	2,585	3,693	No	3,693
	Age (≤ 50/ > 50)	1,094 £ (1,599)/1,660 £ (2,426)		1,094 £ (1,599)/1,660 £ (2,426)		1,957/2,968		1,957/2,968	2,796/4,240		2,796/4,240
	Severity (HAQ ≤ 1,2-HAQ > 2,6 (mild-severe)	548-4,832 £ (801-7,061)		548-4,832 £ (801-7,061)		980/8,640		980/8,640	1,400/10,997		1,400/10,997

Abbreviations: Anti-TNF, anti-tumor necrosis factor alfa agents; BA, biologic agents; HC, human capital; HICP, harmonized index of consumer prices; FC, friction costs; ND, no data; PPP, purchasing power parity; PsA, psoriatic arthritis

^a In the human capital method, indirect costs are quantified according to reduction in future gross earnings of the patients. In the friction costs method, quantification of lost productivity due to illness depends on the time needed to replace the worker on sick leave.

^b Cost estimate in euros with the reference exchange rate published by the Central European Bank in 2007 (according to publication) Available from: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=120.EXR.A.GBR.EUR.SP00.A&periodSortOrder=ASC

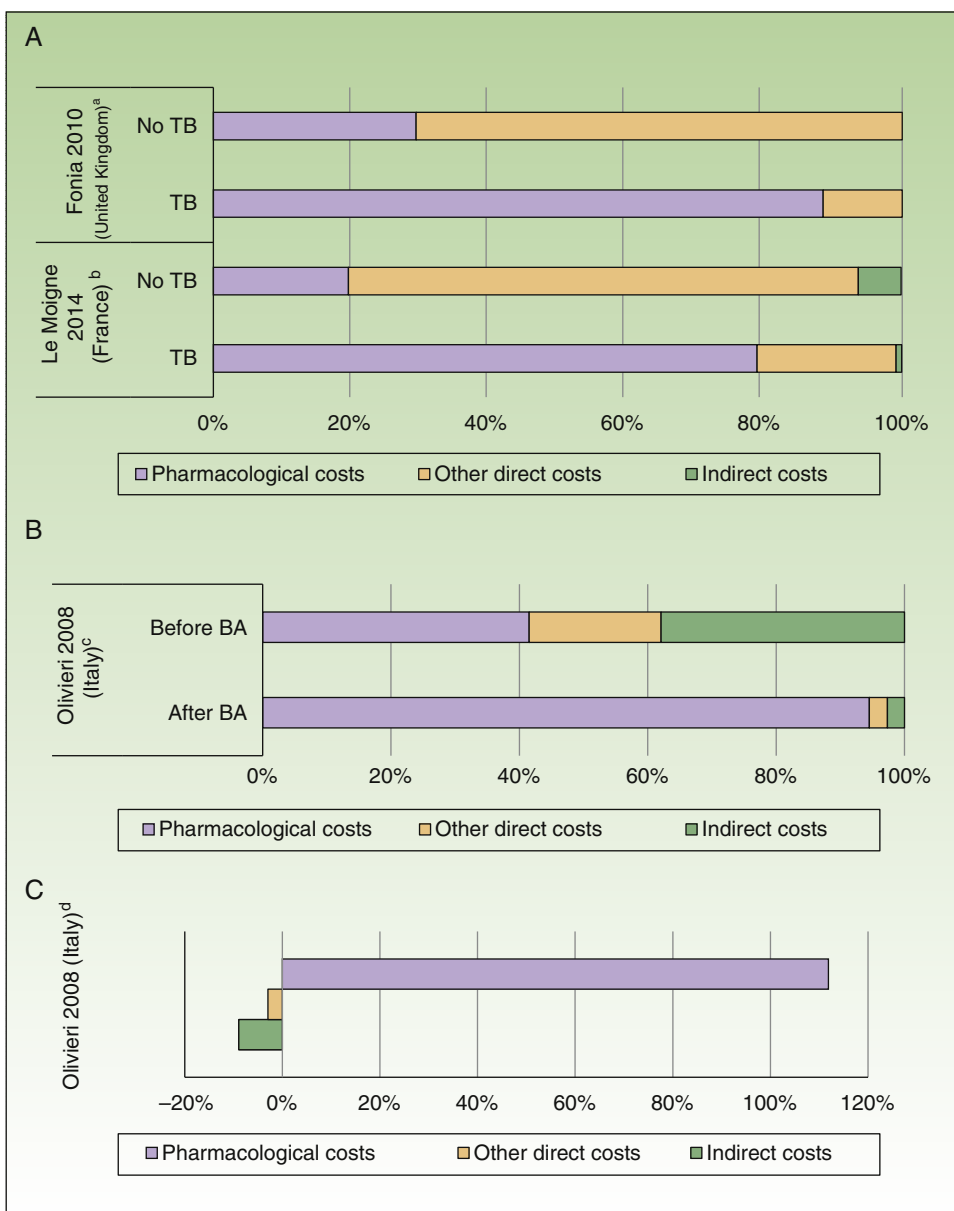


Figure 3 Impact of introduction of biologic agents (BA). A, Percentage of costs before and after exposure to BA in psoriasis. B, Percentage of costs before and after exposure to BA in psoriatic arthritis. C, Variation (in percent) of costs before and after exposure to BA in psoriatic arthritis.

^aPercentage of costs associated with patients with plaque psoriasis. The patients received treatment with systemic nonbiologic agents and topical agents before and after treatment with biologic agents.

^bPatients with moderate to severe psoriasis. The pharmacological cost of patients treated with BA also includes other systemic drugs.

^cPatients with psoriatic arthritis with failure or intolerance of conventional therapy. The percentage of costs after starting BA-based treatment was calculated from the increment in cost and cost before starting with BA.

^dExpresses the incremental cost in patients treated with BA compared to an earlier period.

and US \$12,192 (human capital method) PPP patient-year (Table 5). Among the studies that used the societal perspective, the item that accounted for the biggest share of the total cost varied from study to study, with higher direct costs reported in the study conducted in Spain,³² whereas the study conducted in Germany had higher indirect costs (Fig. 2B).³⁴

An increase in costs was seen in those studies that analyzed patients with severe disease (direct, indirect, and total cost of US \$8,808, \$48,834, and \$57,642 PPP patient-year, respectively).³⁴ Likewise, on analyzing the cost in patients with psoriatic arthritis who were treated for 6 months with or without a biologic agent, a greater than 5-fold increase was observed in direct costs (US \$7,768 PPP

patient-year), essentially because of the increased pharmacological cost (US \$7,101 PPP patient-year), as well as a reduction of US \$635 PPP in indirect costs in patients treated with biologic agents (Figs. 3B and C).³³

Discussion

The results of this study suggest that, in Europe, psoriasis and psoriatic arthritis are associated with a substantial economic impact. The annual cost of managing a patient with psoriasis is variable and in line with previously published reviews,^{2,35} except for the annual cost in Sweden, which was greater (11,928 €—in euros 2009—equivalent to US \$14,820 PPP).²

Except for 2 German studies,^{26,34} the direct costs account for the greatest part of the total cost from the societal perspective, both in psoriasis (6 studies) and psoriatic arthritis (2 studies). Spain was the country with the lowest annual direct costs per patient in psoriasis and the highest costs in psoriatic arthritis.

According to the present study, a directly proportional relationship between the severity of disease and the associated cost can be established, driven mainly by an increase in direct costs. In one of the reviews mentioned above,³⁵ an increase (of up to 2.5-fold) in the cost of management of severe psoriasis compared with moderate psoriasis was detected, driven mainly by the greater resource consumption and associated loss of productivity.

Although the introduction of biologic agents seems to have led to a reduction in hospital costs for the management of psoriasis, with a decrease of 2,357 € vs 564 € patient-year (euros 2013, equivalent to US \$2,902 to \$695 PPP patient-year),³⁵ the increase in direct and total cost identified in the studies of psoriasis and psoriatic arthritis^{23,25,33} showed the huge economic impact of their incorporation into the therapeutic arsenal. The effect of introducing biologic agents in Europe has been evaluated previously.^{36–38} The usage of the different biologic agents available for treatment of moderate to severe psoriasis in Spain was associated with a total cost between 12,120 and 18,370 € patient-year (euros 2010, equivalent to US \$19,385 and \$29,381 PPP patient-year).³⁶ In the Netherlands, the inclusion of biologic agents increased the cost of management of psoriasis to 17,712 € from 10,146 € (euros 2010, equivalent to US \$23,791 and \$13,628 PPP patient-year, respectively).³⁷

In Italy, the cost of treating patients with psoriatic arthritis refractory to nonbiologic systemic disease modifying antirheumatic drugs and those treated with anti-TNF agents for 5 years was assessed, showing a significant increase in direct costs due to pharmacological expenditure on anti-TNF agents. This increase was slightly offset by a decrease in indirect costs.³⁸

One of the possible limitations of this review is the variability in the methodology used in the studies (study population, sample size, follow-up duration, perspective used, year of costs assessed) and this might hinder comparison of results and thus extrapolation of conclusions.

Assessment of the methodological quality of the studies included with the CHEERS criteria²¹ identified considerable differences among studies. Some publications were presented in the form of congress abstracts,^{29,31,32} without

any corresponding full-text article in a scientific journal. This limits the amount of information available and may explain the high rate of noncompliance found in the CHEERS assessment. Another critical item missing in some publications was the date of costs.^{23,24,29,31} This shortcoming was addressed using the year of data collection,^{23,24} or the date of publication.^{29,31} Thus, the presentation of costs with different dates and currencies could be a serious limitation for comparability of the results. However, adjustment for increased harmonized index of consumer prices¹⁹ and the subsequent conversion to the currency of current international Dollars (US\$ PPP 2015)²⁰ has eliminated differences in the prices between countries and, therefore, balances the purchasing power of different currencies, making the comparison more feasible.³⁹

Another difference to consider is the use of different methods for the calculation of indirect costs. On the one hand, the friction costs method assesses the loss due to absence from work by estimating the cost required to replace the worker.⁴⁰ By contrast, the human capital method measures future monetary productivity of individuals who benefit from a health activity, for example, pensions that do not need to be paid to prevent occupational diseases or the work days that are not lost.⁴¹ The use of one or other method may have an impact on total cost, as observed in a publication on psoriatic arthritis that showed a substantial increase in indirect costs when the human capital method was used to calculate indirect costs.³⁴

Another possible limitation of the present study is the small number of publications identified, as although the PRISMA criteria were applied¹⁷ and the PubMed and EMBASE databases were used, other sources of grey literature were not assessed (see Annex 1).

Furthermore, it may be supposed that clinical management of psoriasis and psoriatic arthritis has changed considerably in recent decades, mainly as a result of the introduction of biologic agents in everyday clinical practice. Given that the most recent study reviewed here collected data in 2011,²³ the current costs of the diseases may actually be higher.

The low number of analyses focused on estimating the cost of psoriasis or psoriatic arthritis points to the need for and importance of future studies of the cost of the disease. These studies should reflect clinical practice and provide useful and up-to-date information for decision making in health care, in light particularly of the arrival of biosimilar biologic agents for the management of these 2 diseases.

In conclusion, despite the limitations mentioned above, a review of the studies included shows the high economic impact of treatment and management of psoriasis and psoriatic arthritis. Costs increase with increasing severity and in particular with the use of biologic agents.

Ethical Responsibilities

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this investigation.

Confidentiality of data. The authors declare that patient data do not appear in this article.

Right to privacy and informed consent. The authors declare that patient data do not appear in this article.

Funding

Celgene S.L. provided unconditional funding for conducting this project.

Conflicts of Interest

MTC is an employee of Celgene. RBP, IE, and MAC are employees of Pharmacoconomics & Outcomes Research Iberia (PORIB), which received unconditional financial support for writing the present manuscript. JMMS has received fees from PORIB for collaboration and consultation in this project. JMVC declares no conflict of interest and has received no fees for participation in or contribution to the present study.

Acknowledgments

The authors would like to thank Itziar Oyagüez and Nuria Ortega for their comments during the review of the manuscript.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.adengl.2016.04.001](https://doi.org/10.1016/j.adengl.2016.04.001).

References

- Papoutsaki M, Costanzo A. Treatment of psoriasis and psoriatic arthritis. *BioDrugs*. 2013;27 Suppl 1:3–12.
- Feldman SR, Burudpakdee C, Gala S, Nanavaty M, Mallya UG. The economic burden of psoriasis: A systematic literature review. *Expert Rev Pharmacoecon Outcomes Res*. 2014;14:685–705.
- Gonzalez-Álvaro I, Martínez-Fernández C, Dorantes-Calderon B, García-Vicuña R, Hernández-Cruz B, Herrero-Ambrosio A, et al. Spanish Rheumatology Society and Hospital Pharmacy Society Consensus on recommendations for biologics optimization in patients with rheumatoid arthritis, ankylosing spondylitis and psoriatic arthritis. *Rheumatology (Oxford)*. 2015;54:1200–9.
- Blasco AJ, Lázaro P, Ferrándiz C, García-Díez A, Liso J. Eficiencia de los agentes biológicos en el tratamiento de la psoriasis moderada-grave. *Actas Dermosifiliogr*. 2009;100:792–803.
- Gladman D, Antoni C, Mease P, Clegg D, Nash P. Psoriatic arthritis: Epidemiology, clinical features, course, and outcome. *Ann Rheum Dis*. 2005;64 Suppl 2:ii14–7.
- Poole CD, Lebmeier M, Ara R, Rafia R, Currie CJ. Estimation of health care costs as a function of disease severity in people with psoriatic arthritis in the UK. *Rheumatology (Oxford)*. 2010;49:1949–56.
- National Institute of Clinical Excellence. Psoriasis: assessment and management [Internet]. London: National Clinical Guideline Center (NCGC); 2012. [accessed 1 Sep 2015]. Available from: <https://www.nice.org.uk/guidance/cg153>
- López-Esteban JL, Zarco-Montejo P, Escalas-Taberner J, García-Rodríguez M, García-Llorente JF, García-Calvo C. Manejo clínico de la artritis psoriásica en España: estudio Calipso. *Actas Dermosifiliogr*. 2010;101:629–36.
- Gladman DD. Psoriatic arthritis. *Baillieres Clin Rheumatol*. 1995;9:319–29.
- Gratacos J, Dauden E, Gomez-Reino J, Moreno JC, Casado MA, Rodríguez-Valverde V. Health-related quality of life in psoriatic arthritis patients in Spain. *Reumatol Clin*. 2014;10:25–31.
- Helliwell PS, Taylor WJ. Classification and diagnostic criteria for psoriatic arthritis. *Ann Rheum Dis*. 2005;64 Suppl 2:ii3–8.
- Fernandez-Sueiro JL, Pinto JA, Pertega-Diaz S, Acasuso M, de Padura IH. Prevalence of psoriasis and psoriatic arthritis in a northern population of Spain. *Arthritis Rheum*. 2012;64 Suppl 10:247.
- Ferrándiz C, Carrascosa JM, Toro M. Prevalencia de la psoriasis en España en la era de los biológicos. *Actas Dermosifiliogr*. 2014;105:504–9.
- Ibrahim G, Waxman R, Helliwell PS. The prevalence of psoriatic arthritis in people with psoriasis. *Arthritis Rheum*. 2009;61:1373–8.
- Gossec L, Smolen JS, Gaujoux-Viala C, Ash Z, Marzo-Ortega H, Van der Heijde D, et al. European League Against Rheumatism recommendations for the management of psoriatic arthritis with pharmacological therapies. *Ann Rheum Dis*. 2012;71:4–12.
- Sociedad Española de Reumatología. ESPOGUIA: Guía de práctica clínica sobre el manejo de los pacientes con espondiloartritis [Internet]. Sociedad Española de Reumatología. Madrid: SER; 2009 [accessed 22 Sep 2015]. Available from: <http://www.ser.es/wp-content/uploads/2015/09/EspoguiaESP.pdf>
- Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med*. 2009;6:e1000097.
- Banco Central Europeo. Statistical Data Warehouse-Quick view. [Base de datos en Internet] [Accessed 8 Ene 2015]. Available from: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=120.EXR.A.GBP.EUR.SP00.A&periodSortOrder=ASC
- Organisation for economic co-operation and development. Consumer Price Indices (CPIs). OECD.STAT [Internet]. The Organization [consultado 21 Mar 2016]. Available from: http://stats.oecd.org/index.aspx?DatasetCode=MEI_PRICES
- Organisation for Economic Co-operation and development. PPP and exchange rates. OECD.STAT [Internet]. The Organization [accessed 21 Mar 2016]. Available from <http://stats.oecd.org/>
- Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, et al. ISPOR Health Economic Evaluation Publication Guidelines-CHEERS Good Reporting Practices Task Force. Consolidated Health Economic Evaluation Reporting Standards (CHEERS)-explanation and elaboration: A report of the ISPOR Health Economic Evaluation Publication Guidelines Good Reporting Practices Task Force. *Value Health*. 2013;16:231–50.
- Steinke SI, Peitsch WK, Ludwig A, Goebeler M. Cost-of-illness in psoriasis: Comparing inpatient and outpatient therapy. *PLoS One*. 2013;8:e78152.
- Le Moigne M, Sommet A, Lapeyre-Mestre M, Bourrel R, Molinier L, Paul C, et al. Healthcare cost impact of biological drugs compared with traditional systemic treatments in psoriasis: a cohort analysis in the French insurance database. *J Eur Acad Dermatol Venereol*. 2014;28:1235–44.
- Finzi AF, Mantovani LG, Belisari A. Italian Association for Studies on Psoriasis. The cost of hospital-related care of patients with psoriasis in Italy based on the AISP study. *J Eur Acad Dermatol Venereol*. 2001;15:320–4.
- Fonia A, Jackson K, Lereun C, Grant DM, Barker JN, Smith CH. A retrospective cohort study of the impact of biologic therapy initiation on medical resource use and costs in patients with moderate to severe psoriasis. *Br J Dermatol*. 2010;163:807–16.
- Berger K, Ehlken B, Kugland B, Augustin M. Cost-of-illness in patients with moderate and severe chronic psoriasis vulgaris in Germany. *J Dtsch Dermatol Ges*. 2005;3:511–8.

27. Colombo G, Altomare G, Peris K, Martini P, Quarta G, Congedo M, et al. Moderate and severe plaque psoriasis: cost-of-illness study in Italy. *Ther Clin Risk Manag.* 2008;4:559–68.
28. Schöffski O, Augustin M, Prinz J, Rauner K, Schubert E, Sohn S, et al. Costs and quality of life in patients with moderate to severe plaque-type psoriasis in Germany: A multi-center study. *J Dtsch Dermatol Ges.* 2007;5:209–18.
29. Lang S, Peitsch WK, Ludwig A, Goerdts S, Goebeler M. Cost-of-illness in psoriasis: comparing inpatient and outpatient therapy from an economic point of view. *J Eur Acad Dermatol Venereol.* 2010;24 Suppl 4:13.
30. Carrascosa JM, Pujol R, Dauden E, Hernanz-Hermosa JM, Bordas X, Smandia JA, et al. A prospective evaluation of the cost of psoriasis in Spain (EPIDERMA project: phase II). *J Eur Acad Dermatol Venereol.* 2006;20:840–5.
31. Sanchez-Carazo JL, Daudén E, Vanacllocha F, Toribio J, Pujol R, Puig L, et al. Cost of moderate to severe psoriasis patients in Spain. *Value Health.* 2009;12:A454.
32. Moreno JC, Dauden E, Rodríguez-Valverde V, Gómez-Reino J, Gratacos J, Sabater FJ, et al. A cost-of-illness study of psoriatic arthritis in Spain. *Value Health.* 2009;12:A437.
33. Olivieri I, de Portu S, Salvarani C, Cauli A, Lubrano E, Spadaro A, et al. The psoriatic arthritis cost evaluation study: A cost-of-illness study on tumour necrosis factor inhibitors in psoriatic arthritis patients with inadequate response to conventional therapy. *Rheumatology (Oxford).* 2008;47:1664–70.
34. Huscher D, Merkesdal S, Thiele K, Zeidler H, Schneider M, Zink A. Cost of illness in rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis and systemic lupus erythematosus in Germany. *Ann Rheum Dis.* 2006;65:1175–83.
35. Obradors M, Figueras M, Paz S, Cornellàs M, Lizan L. Costs of psoriasis in Europe. A systematic review of the literature. *Value Health.* 2014;17:A606.
36. Dominguez-Gil A, Moreno D, Garcia D, Campo C. Annual cost of biological therapies for the treatment of moderate to severe plaque psoriasis in Spain. *Value Health.* 2013;14:A504.
37. Driessen RJ, Bisschops LA, Adang EM, Evers AW, Van De Kerkhof PC, De Jong EM. The economic impact of high-need psoriasis in daily clinical practice before and after the introduction of biologics. *Br J Dermatol.* 2010;162:1324–9.
38. Cortesi PA, de Portu S, Salvarani C, Cauli A, Lubrano E, Spadaro A, et al. Long term costs and outcomes in psoriatic arthritis patients not responding to conventional therapy treated with tumor necrosis factor inhibitors: The extension of Psoriatic Arthritis Cost Evaluation (PACE) Study. *Value Health.* 2013;16:A566.
39. Organisation for Economic Co-operation and development. *Methodological Manual on Purchasing Power Parities*, OECD Publishing [Internet]. OECD/Eurostat 2012 [accessed 21 Mar 2016]. Available from: <http://www.oecd.org/std/prices-ppp/PPP%20manual%20revised%202012.pdf>
40. Koopmanschap MA, Rutten FF, van Ineveld BM, van Roijen L. The friction cost method for measuring indirect costs of disease. *J Health Econ.* 1995;14:171–89.
41. Revenga F. Métodos de análisis económico de las decisiones diagnósticas y terapéuticas. *Actas Dermosifiliogr.* 2004;95:1–13.