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Real-world treatment patterns, healthcare resource utilisation and costs in patients with systemic lupus erythematosus treated with belimumab: a retrospective analysis of claims data in the USA

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ABSTRACT

Objective To examine the effects of belimumab initiation on healthcare resource utilisation (HCRU) and costs in SLE.

Methods This retrospective observational cohort study used healthcare administrative claims data from the IBM MarketScan Commercial Claims and Encounters Database to identify patients with SLE billing codes who received ≥1 intravenous belimumab infusion between March 2011 and December 2015. The first belimumab administration was the 'index date'. During the 6-month postindex period, nine belimumab infusions were recommended: three during the initiation period and six during the maintenance period. HCRU and cost data for inpatient admissions, emergency department visits, physician office visits, hospital-based outpatient visits, laboratory services, other outpatient services and outpatient pharmacy prescriptions were compared in the 6-month pre/postindex periods.

Results Of the 1879 patients with SLE included, 43% received ≥3 intravenous initiation administrations. An average of 5.3 (SD: 2.4) of the nine recommended belimumab administrations were received within 6 months. In the 6-month preindex versus postindex periods, significant reductions were noted for inpatient hospitalisations (18% vs 9%, p<0.001; mean visits: 0.3 vs 0.14, p<0.001) and emergency department visits (40% vs 24%, p<0.001; mean visits; 3.53 vs 1.96, p<0.001). Mean total costs were higher in the 6-month postindex versus preindex period ($41 426 vs $29 270; p<0.001).

Conclusions In this study of real-world intravenous belimumab for SLE, adherence to recommended infusion schedules was low. Outpatient healthcare and associated costs were higher in the 6 months after belimumab was initiated, although inpatient costs were lower. Reasons for non-adherence with belimumab and implications should be investigated.

INTRODUCTION

SLE is a heterogeneous autoimmune disease with a wide variety of clinical symptoms, potentially affecting multiple organ system domains.[1] Despite improvements in the SLE-associated mortality rate, patients with SLE have an unsatisfactory long-term prognosis and considerable unmet needs, including persistent disease activity[2–6] and poor health-related quality of life (HRQoL).[7 8] Average SLE flare rates range from 0.19 to 1.20 per patient per year,[2 4 5] and chronic tissue and organ damage is frequent and associated with substantial economic and patient burden.[8]

Costs associated with SLE management and treatment are significant; a recent study estimated the annual mean total cost as $47 542 among patients with moderate-to-severe SLE and $28 298 among patients with mild SLE flares.[9] Total medical costs in patients who experience flares are approximately double those of patients who do not, with inpatient care accounting for 70% of total direct costs.[10] Long-term organ damage and oral corticosteroid utilisation are also key cost drivers of SLE,[11–13] with annual total costs among patients receiving high and medium-dose oral corticosteroids being 3.2 and 1.7 times greater, respectively, than those of patients receiving low-dose oral corticosteroids.[12] Thus, SLE treatment goals include remission, control of disease activity, prevention of further organ damage and reduction in oral corticosteroid utilisation.[1]

SLE treatments include antimalarials, non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids and immunosuppressants.[14] Due to persistent disease activity, a high proportion of patients require long-term corticosteroid and/or immunosuppressive treatment, which clinical studies suggest contributes to progressive organ damage accrual.[15 16] On the

basis of four phase 3 randomised trials,[17–20] the safety and efficacy of intravenous and subcutaneous belimumab, a human IgG1λ monoclonal antibody against B-lymphocyte stimulator,[21] has been demonstrated. Belimumab (intravenous or subcutaneous) is approved for the treatment of adults with active, autoantibody positive SLE, plus standard of care.[22 23]

While the safety and efficacy of belimumab has been extensively investigated within a clinical framework, studies examining the use of belimumab in a real-world setting and the economic impact of belimumab initiation are limited. This study used administrative claims data to describe the characteristics of patients initiating intravenous belimumab for the treatment of SLE, evaluate belimumab treatment patterns and quantify healthcare resource utilisation (HCRU) and associated costs before and after belimumab initiation.

METHODS

Study design

A retrospective observational cohort study (GlaxoSmithKline study 206345) was conducted using healthcare administrative claims data to assess demographics, clinical characteristics, medication treatment patterns, and HCRU and associated costs in patients diagnosed with SLE and initiating intravenous belimumab treatment. Data from the IBM MarketScan Commercial Claims and Encounters Database were used for this analysis. The database contains integrated patient-level pharmacy and medical (inpatient and outpatient) commercial insurance claims of several million individuals in the USA annually, covered under a variety of fee-for-service, fully capitated and partially capitated schemes. The database encompasses employees, their spouses and their dependents covered by employer-sponsored private health insurance and represents >150 large employers and unique health plans throughout the USA. Claims contain International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM) and ICD-10-CM diagnosis and procedure codes, Current Procedural Terminology (CPT) codes, Healthcare Common Procedure Coding System (HCPCS) codes and National Drug Codes (NDC). In addition to claims, the database contains enrolment files that include demographic and insurance plan information and clinician specialties.

The study design comprised two periods either side of the 'index' date (first intravenous belimumab administration): a 6-month preindex period and a postindex period of ≥3 months (figure 1). The analysis described here includes patients with 6 months of follow-up postindex.

Patient and public involvement

Patient and public involvement was not directly used in this study, but the database used in the study was developed with patient and public involvement and is updated by a committee that includes patient representatives.

Sample selection

Selected patients were 18–64 years of age on the index date, with ≥1 inpatient claim or outpatient claim with a diagnosis of SLE (ICD-9-CM: 710.0; ICD-10-CM: M32) from 1 September 2010 to 31 December 2015, and evidence of intravenous belimumab treatment from 9 March 2011 to 31 December 2015 (belimumab received Food and Drug Administration approval in March 2011). Where possible, belimumab was identified using product-specific NDC and HCPCS codes. As belimumab was not issued product-specific HCPCS codes until 1 July 2011, this study also relied on an algorithm to identify belimumab administration from 9 March 2011 to 1 July 2011 (online supplementary table 1).

Evidence of belimumab treatment included an outpatient prescription claim with an NDC for belimumab (NDC 49401-101-01, 49401-102-01) from 9 March 2011 to 31 December 2015; an outpatient medical claim with an HCPCS code for belimumab (HCPCS Q2044, J0490) from 1 July 2011 to 31 December 2015; or an outpatient medical claim with a CPT code for monoclonal antibody/chemotherapy administration from 9 March 2011 to 1 July 2011. To ensure that the CPT code was for the administration of belimumab and not the administration of a different agent, the patient must also have had an inpatient or outpatient claim for a diagnosis of SLE

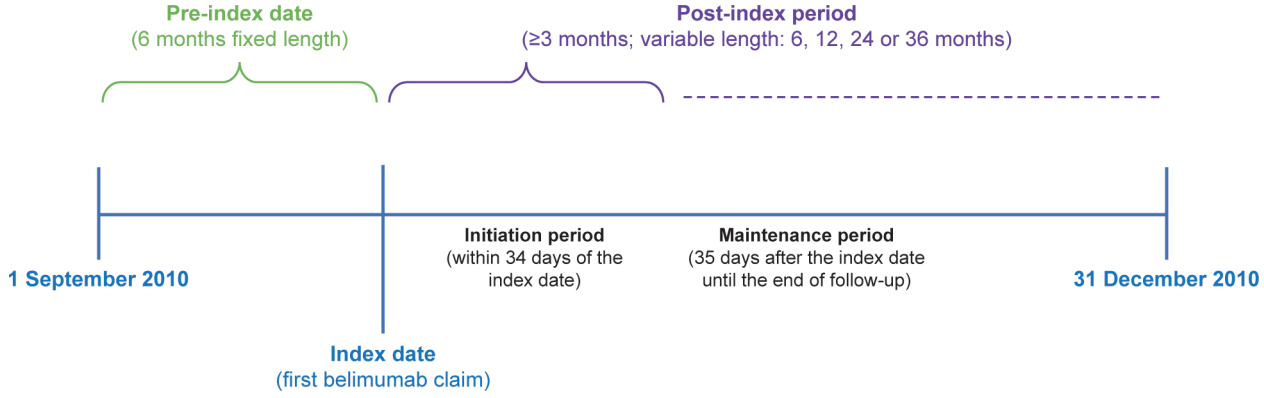

Figure 1 Study design (retrospective, observational cohort study (GlaxoSmithKline (GSK) study 206345) of patients with SLE identified via the IBM MarketScan Commercial Claims and Encounters Database (2010–2015) with ≥1 belimumab intravenous infusion between 2011 and 2015).

and no inpatient or outpatient claim for a diagnosis of cancer and no outpatient claim containing an HCPCS code for rituximab administration (HCPCS J9310) on the same date. Participants were required to have ≥6 months of continuous enrolment with medical and prescription drug coverage prior to the index date (preindex period) and ≥3 months of continuous enrolment with medical and prescription drug coverage following the index date.

As per US prescribing information,[23] belimumab has not been evaluated in patients with severe active lupus nephritis. Therefore, this analysis excluded patients with evidence of severe active lupus nephritis during the study period (online supplementary information: sample selection; and online supplementary tables 1 and 2) This was defined by a previously validated billing code algorithm.[24]

Study measures

Demographic and clinical characteristics

Demographic characteristics were evaluated on the index date. Clinical characteristics were evaluated in the 6-month preindex period and included Charlson Comorbidity Index,[25] Ward SLE Risk Adjustment Index[26] and comorbid conditions (based on ICD-9/ICD-10 diagnosis codes). Information on patient comorbidities during the baseline period was collected according to a prespecified list of conditions commonly associated with SLE.

Medication treatment patterns

Use of SLE-related medications (online supplementary table 3) was measured in the 6-month pre/postindex periods, defined as ≥1 claim (medical or pharmacy) for oral or intravenous corticosteroids, antimalarial agents (hydroxychloroquine and quinacrine), immunosuppressants (eg, azathioprine, cyclosporine, cyclophosphamide, methotrexate, mycophenolate mofetil), rituximab or NSAIDs, as either an outpatient prescription or outpatient medical claim with an NDC or HCPCS code for the medication. Oral corticosteroid utilisation was converted to average daily prednisone-equivalent dose and based on NDC codes only.

Intravenous belimumab use, including number of administrations and number of days between administrations, was measured during the 6-month postindex period, and was defined as per the study inclusion criteria. As per the belimumab package insert, the first three intravenous belimumab administrations are to be administered every 2 weeks (ie, days 0, 14 and 28), defined as the 'initiation period' (the first 34 days postindex), followed by administration every 4 weeks thereafter ('maintenance period').[23] Therefore, in a 6-month postindex period, patients could have received a total of nine infusions (three in the initiation period and six in the maintenance period). Discontinuation was defined as a gap of 84 days or longer following the previous belimumab administration. Participants with <84 days of continuous enrolment after the final belimumab administration, before a gap of 84 days or longer, were not eligible for the discontinuation measure.

HCRU and associated costs

All-cause HCRU and associated costs were measured in the 6-month pre/postindex periods and were recorded by setting and type of care (eg, inpatient admissions, emergency department (ED) visits, physician office visits, hospital-based outpatient visits, laboratory services, other outpatient services (any outpatient service not classed as ED visit, physician office visit, hospital-based outpatient visit or laboratory service) and outpatient pharmacy prescriptions).

Healthcare costs were based on paid amounts of adjudicated claims, including insurer and health plan payments as well as patient cost sharing in the form of copayment, deductible and coinsurance. All dollar estimates were inflated to 2015 $ using Medical Care Component of the Consumer Price Index.

SLE flares (number of patients experiencing flares, mean number of flares and flare severity) were evaluated in the 6-month preindex and 6-month postindex periods. A published administrative data SLE flare severity algorithm, based on the Lupus Foundation of America Flare Definition, was used (online supplementary table 4).[27]

Statistical analysis

Patient baseline characteristics were summarised with descriptive statistics using means, standard deviations (SD) and medians for continuous variables and frequency distributions for categorical variables.

The primary analysis was the comparison of HCRU and costs in the 6-month preindex versus postindex periods. Statistical tests for differences across the pre/postindex periods will include paired t-tests for continuous variables and McNemar's tests for categorical variables. For comparisons between preindex and postindex periods, paired tests were conducted. Statistical significance was evaluated at the α=0.05 level. All analyses were conducted using SAS V.9.4 statistical software (SAS Institute).

RESULTS

Demographic and clinical characteristics

The initial population with a claim for SLE from 1 September 2010 to 31 December 2015 comprised 229 737 patients; of these, 1879 met the inclusion criteria and had 6 months of postindex follow-up (figure 2). During the initiation period, 1068 (56.8%) received one to two belimumab administrations and 811 (43.2%) received ≥3 administrations. The study population was primarily female (94.8%) with a mean age of 44 years (table 1).

Medication treatment patterns

Overall, ~86% of patients received an SLE-related medication in the 6-month pre/postindex periods; corticosteroids were the most frequently used (preindex: 80.0%; postindex: 79.7%) (table 2). In the preindex versus postindex periods, significantly higher proportions of patients were receiving antimalarials (66.6% vs 62.5%; p=0.010), immunosuppressive agents (59.1% vs 51.2%; p<0.001) and oral corticosteroids (69.8% vs 63.9%; p<0.001),

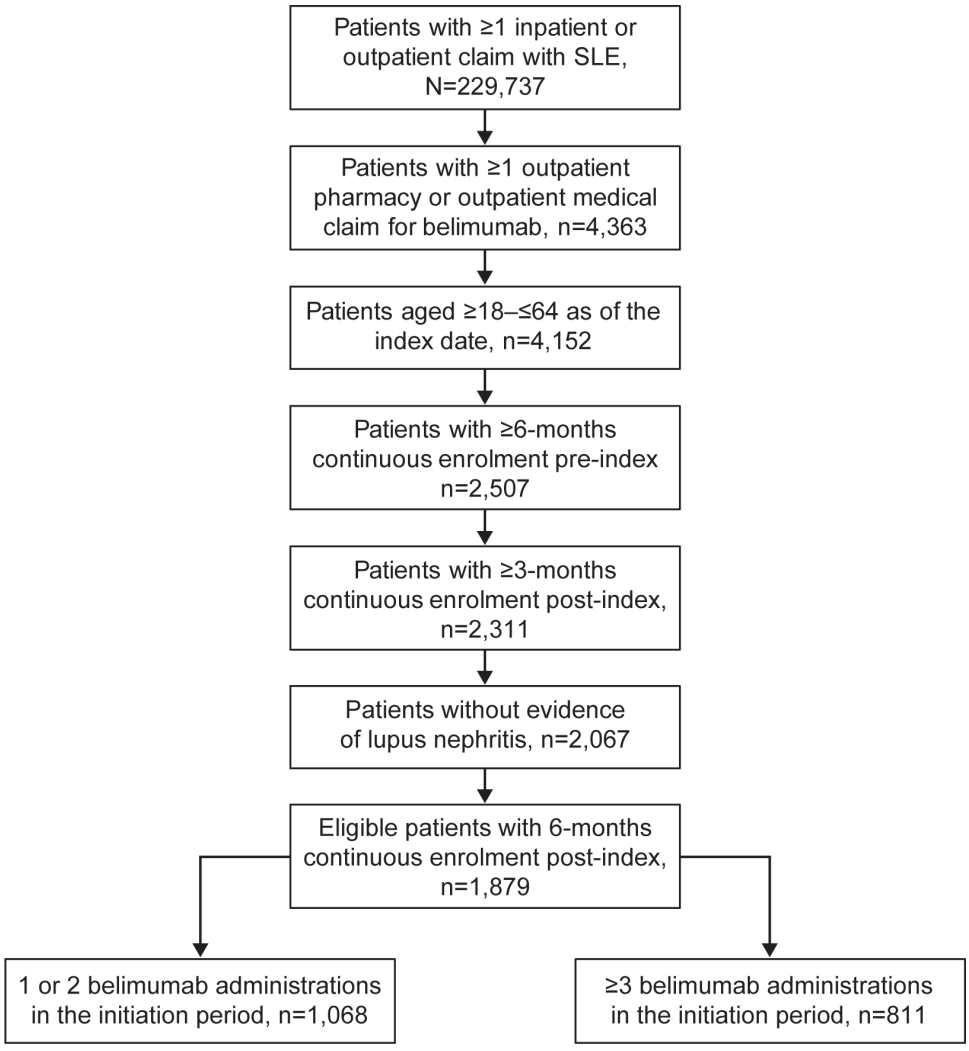

Figure 2 Identification of study sample (patients with SLE identified via the IBM MarketScan Commercial Claims and Encounters Database (2010–2015) with ≥1 belimumab intravenous infusion between 2011 and 2015).

while injectable/intravenous corticosteroids were taken by a significantly lower proportion of patients (36.2% vs 42.7%; p<0.001) (table 2).

The cumulative overall oral corticosteroid dose was significantly greater in the preindex versus the postindex period (mean (SD): preindex, 119.9 mg (259.4); postindex, 72.6 mg (167.8); p<0.001), whereas the mean oral prednisone-equivalent daily dose was similar (mean (SD): preindex, 27.0 mg (78.5); postindex, 23.8 mg (84.7); p=0.178). These relatively high doses are likely indicative of high disease activity and/or flares at baseline. However, when stratifying the study population by mean oral prednisone-equivalent daily dose categories (≤7.5 mg/day, >7.5 to ≤15 mg/day and >15 mg/day), a significantly higher proportion of patients were in the ≤7.5 mg/day dose category in the postindex period compared with the preindex period (p<0.001) (table 2).

In the 6-month postindex period, patients had a mean (SD) of 2.2 (0.8) belimumab administrations during the initiation period and 3.1 (2.0) administrations during the maintenance period for a total of 5.3 (2.4) administrations (table 3). The mean (SD) number of days between consecutive administrations was 15.9 (5.2) in the initiation period and 30.4 (10.0) in the maintenance period. In the total 6-month period, there was a mean (SD) of 46.3 (27.3) days to the third belimumab administration (table 3). Overall, 26.2% of patients discontinued belimumab in the 6-month postindex period.

Healthcare resource utilisation

Significant differences between the 6-month preindex and postindex periods were noted in the proportion of patients who had an inpatient admission (17.9% vs 9.3%; p<0.001), ED visit (39.5% vs 24.4%; p<0.001), hospital-based outpatient visit (82.5% vs 70.5%; p<0.001), laboratory service (92.6% vs 85.9%; p<0.001) and outpatient pharmacy use (97.4% vs 96.9%; p=0.03) (table 4). No statistically significant between-period differences were noted for all outpatient services, physician outpatient visits and other outpatient services. The mean number of times a service was used was significantly higher during the preindex versus postindex period for all HCRU types except other outpatient services (table 4).

Table 1 Demographic and clinical characteristics*

	Total population (n=1879)
Age†, mean (SD)	44.0 (11.0)
Female†, n (%)	1782 (94.8)
Index year†, n (%)	
2011	456 (24.3)
2012	512 (27.2)
2013	332 (17.7)
2014	367 (19.5)
2015	212 (11.3)
Geographic region†, n (%)	
Northeast	356 (18.9)
North Central	291 (15.5)
South	856 (45.6)
West	363 (19.3)
Unknown	13 (0.7)
Population density†, n (%)	
Urban	1656 (88.1)
Rural	210 (11.2)
Unknown	13 (0.7)
Charlson Comorbidity Index, mean (SD)	1.3 (0.9)
Ward SLE Risk Adjustment Index, mean (SD)	0.8 (1.7)
Comorbidities‡, n (%)	
Arthralgia	528 (28.6)
Hypertension	438 (23.3)
Myositis/myalgia	390 (20.8)
Haematologic disorders	384 (20.4)
Pulmonary disease	335 (17.8)
Rheumatoid arthritis	290 (15.4)
Depression	287 (15.3)
Cardiac disease	287 (15.3)
Ophthalmologic disorders	255 (13.6)

*Patients with SLE identified via the IBM MarketScan Commercial Claims and Encounters Database (2010–2015) with ≥1 belimumab intravenous infusion during 2011–2015.
†Characteristic recorded on the index date; all other characteristics were recorded during the 6-month preindex period.
‡Comorbidities with an incidence of ≥10% are presented; information on patient comorbidities was collected based on a prespecified list of conditions commonly associated with SLE (eg, other inflammatory polyarthropathies, autoimmune thyroid disorders, pericarditis, myositis/myalgia, hypertension, renal disease, depression, cardiac disease, cerebrovascular disease, liver disease, pulmonary disease, osteoporosis/osteopenia), as well as conditions that may be considered in the differential diagnosis of SLE (eg, rash, fever, mouth ulcers, haematologic disorders, Reynaud's phenomenon, ophthalmologic disorders, rheumatoid arthritis, arthralgia).

Most patients in the pre/postindex periods met the definition of a moderate SLE-related flare (91.1% and 87.2%, respectively), although the proportion of patients with a moderate SLE-related flare was significantly lower in the postindex period (p<0.001). The proportion of patients who met the definition of a mild SLE-related flare was similar between the preindex and postindex periods (44.7% vs 46.9%; p=0.104), while the proportion of patients with severe SLE-related flare was significantly reduced postindex (12.7% vs 10.2%; p=0.003) (table 4).

Costs

Total mean costs, including medications, were significantly higher in the postindex than the preindex period ($41 426 vs $29 270; p<0.001), as were mean costs for outpatient services ($32 095 vs $16 735; p<0.001), hospital-based outpatient services ($11 453 vs $7042; p<0.001) and other outpatient services ($18 587 vs $6124; p<0.001) (table 4). By contrast, mean costs in the preindex period were higher than in the postindex period for inpatient admissions ($6581 vs $3079; p<0.001), ED visits ($972 vs $704; p=0.027), physician office visits ($1810 vs $973; p<0.001) and laboratory services ($788 vs $377; p<0.001), while outpatient pharmacy prescription mean costs were similar ($5954 vs $6252; p=0.353) (table 4).

DISCUSSION

This large administrative data SLE cohort provides real-world information relating to medication treatment patterns, HCRU and associated costs in patients initiating intravenous belimumab for the treatment of SLE. Patients included in the study had active SLE; a large proportion of patients met the administrative definitions for mild or moderate SLE flare at baseline and during follow-up. During the initiation period (34 days after belimumab index), only 43.2% of patients received the recommended loading dose of three intravenous belimumab administrations. Similarly, 26.2% of patients discontinued belimumab during the 6-month postindex period, and overall patients received only an average of 5.3 out of the nine recommended belimumab administrations during the 6-month time period. Specific reasons for deviations from the recommended dosing schedule are not available in administrative claims data.

Medication adherence is an important determinant of patient outcomes and a challenge to chronic illnesses, in particular SLE. A literature review of medication utilisation in SLE found the percentage of non-adherent patients ranged from 43% to 75%, with studies consistently reporting that >50% of patients were non-adherent.[28] Studies of specific SLE treatments, many of which are considered the cornerstone of SLE treatment (hydroxychloroquine, azathioprine, mycophenolate mofetil and immunosuppressive medications), have also consistently shown adherence rates of <25% and medication possession ratios well below the accepted threshold of 80%.[29–32] Adherence may have been suboptimal due to hospitalisation as belimumab treatment may have been suspended.

A second finding from this study was the observed changes in HCRU and associated costs between the 6-month preindex and postindex periods. While four phase 3 randomised clinical trials[17–20] have established the safety and efficacy (reduced disease activity, reduction in flares, reduced oral corticosteroids and improved

Table 2 SLE-related medication utilisation*

	6-month preindex period (n=1879)	6-month postindex period (n=1879)	P value†
SLE-related medications, n (%)			
Any medication	1610 (85.7)	1612 (85.8)	0.926
Antimalarials	1251 (66.6)	1175 (62.5)	0.010
Immunosuppressive agents	1111 (59.1)	962 (51.2)	<0.001
Rituximab	21 (1.1)	23 (1.2)	0.762
NSAID	713 (37.9)	687 (36.6)	0.380
Corticosteroids	1504 (80.0)	1497 (79.7)	0.776
Injectable/intravenous	680 (36.2)	802 (42.7)	<0.001
Oral	1312 (69.8)	1200 (63.9)	<0.001
Oral corticosteroid			
Cumulative overall dose, mean (SD)	119.9 (259.4)	72.6 (167.8)	<0.001
Daily dose, mean (SD)	27.0 (78.5)	23.8 (84.7)	0.178
Categories (among patients receiving known dose of oral corticosteroids), n (%)			
≤7.5 mg/day	231 (15.5)	310 (25.9)	<0.001
>7.5 to ≤15 mg/day	486 (32.6)	389 (32.5)	
>15 mg/day	775 (51.9)	498 (41.6)	

*Patients with SLE identified via the IBM MarketScan Commercial Claims and Encounters Database (2010–2015) with ≥1 belimumab intravenous infusion during 2011–2015.
†P values represent a comparison between findings in the 6-month preindex period and those in the 6-month postindex period.
NSAID, non-steroidal anti-inflammatory drug.

fatigue) of belimumab (intravenous and subcutaneous administration), few studies have examined belimumab utilisation in usual care practice settings. In the current study, statistically significant reductions in the incidence of inpatient hospitalisations and ED visits, two highly burdensome and costly healthcare service types, were noted following belimumab initiation. From the cost perspective, mean total costs were higher in the 6-month period following belimumab initiation compared with prior to treatment ($41 426 vs $29 270). Reductions in costs were observed for inpatient hospitalisations, ED visits, physician office visits and laboratory services, but were offset by an increase in costs for hospital-based and other outpatient services, which were primarily attributable to intravenous belimumab administration.

Table 3 Intravenous belimumab utilisation*

	Intravenous belimumab utilisation (n=1879)
Initiation period	
Administrations, mean (SD)	2.2 (0.8)
Categories, n (%)	
1 administration	449 (23.9)
2 administrations	619 (32.9)
≥3 administrations	811 (43.2)
Days between administrations, mean (SD)	15.9 (5.2)
Maintenance period	
Administrations, mean (SD)	3.1 (2.0)
Days between administrations, mean (SD)	30.4 (10.0)
Total 6-month period	
Administrations, mean (SD)	5.3 (2.4)
≥3 administrations, n (%)	1547 (82.3)
Days to third administration, mean (SD)	46.3 (27.3)
Discontinuation, n (%)	492 (26.2)

*Patients with SLE identified via the IBM MarketScan Commercial Claims and Encounters Database (2010–2015) with ≥1 belimumab intravenous infusion during 2011–2015.

Results of the current analysis are congruent with prior real-world studies of belimumab treatment. First, in line with the findings of this study in which outpatient costs were higher and inpatient costs were lower following belimumab initiation, Ke *et al* found that inpatient hospital admissions decreased slightly in the 6-month period following initiation of belimumab treatment, as did total costs when the cost of belimumab treatment was excluded.[33] Furthermore, consistent with our results demonstrating reduced HCRU following belimumab initiation, several studies have reported reduced HCRU[34] and/or reduced SLE disease activity in the postbelimumab versus the prebelimumab periods.[34–37] This was demonstrated by reduced SLE Disease Activity Index (SLEDAI) score,[35 37–42] improved overall clinical response,[34 39 43] a reduced proportion of patients with moderate to severe disease,[34] reduced flare rate[38 40] and

Table 4 HCRU, SLE-related flares and all-cause costs*

	6-month preindex period (n=1879)	6-month postindex period (n=1879)	P value†
HCRU, n (%)			
Inpatient admissions	337 (17.9)	174 (9.3)	<0.001
Outpatient services	1876 (99.8)	1877 (99.9)	0.655
ED visits	743 (39.5)	458 (24.4)	<0.001
Physician office visits	1872 (99.6)	1868 (99.4)	0.248
Hospital-based outpatient visits	1550 (82.5)	1324 (70.5)	<0.001
Laboratory services	1740 (92.6)	1614 (85.9)	<0.001
Other outpatient services	1839 (97.9)	1830 (97.4)	0.286
Outpatient pharmacy prescriptions	1831 (97.4)	1820 (96.9)	0.034
HCRU, mean (SD)			
Inpatient admissions	0.30 (0.84)	0.14 (0.54)	<0.001
Length of stay (days)	0.74 (2.24)	0.42 (2.07)	<0.001
Outpatient services	115.25 (82.82)	83.30 (51.32)	<0.001
Emergency room visits	3.53 (9.43)	1.96 (6.19)	<0.001
Physician office visits	15.87 (10.59)	8.95 (6.01)	<0.001
Hospital-based outpatient visits	30.74 (43.19)	21.32 (31.65)	<0.001
Laboratory services	34.23 (30.07)	19.87 (20.01)	<0.001
Other outpatient services	30.88 (37.35)	31.20 (26.19)	0.669
Outpatient pharmacy prescriptions	51.63 (37.37)	28.73 (20.61)	<0.001
SLE-related flares, n (%)			
Mild	840 (44.7)	881 (46.9)	0.104
Moderate	1711 (91.1)	1639 (87.2)	<0.001
Severe	238 (12.7)	191 (10.2)	0.003
SLE-related flares, mean (SD)			
Mild	1.3 (0.5)	1.4 (0.6)	<0.001
Moderate	1.8 (0.7)	1.9 (0.9)	0.097
Severe	1.2 (0.4)	1.2 (0.4)	0.009
All-cause costs, mean (SD)			
Total costs	$29 270 (48 032)	$41 426 (38 483)	<0.001
Inpatient admissions	$6581 (28 777)	$3079 (18 788)	<0.001
Outpatient services	$16 735 (29 473)	$32 095 (31 516)	<0.001
ED visits	$972 (2737)	$704 (5023)	0.027
Physician office visits	$1810 (1362)	$973 (749)	<0.001
Hospital-based outpatient visits	$7042 (15 990)	$11 453 (24 310)	<0.001
Laboratory services	$788 (1060)	$377 (697)	<0.001
Other outpatient services	$6124 (22 955)	$18 587 (26 226)	<0.001
Outpatient pharmacy prescriptions	$5954 (14 167)	$6252 (13 777)	0.353

*Patients with SLE identified via the IBM MarketScan Commercial Claims and Encounters Database (2010–2015) with ≥1 belimumab intravenous infusion during 2011–2015.
†P values represent a comparison between findings in the 6-month preindex period and those in the 6-month postindex period.
ED, emergency department; HCRU, healthcare resource utilisation.

reductions in common SLE manifestations.[37] Furthermore, a range of studies showed decreased oral corticosteroid use following belimumab initiation.[34 37–40 42 43]

Administrative data provide valuable real-world information; however, there are challenges when conducting this type of analysis. Certain aspects of healthcare patterns can be measured using administrative claims, such as inpatient admissions, ED visits, oral corticosteroid reduction and SLE flares using a proxy algorithm; however, the claims databases lack information on many of the

patient-centric outcomes that are critical for the full evaluation of SLE, such as disease activity (eg, SLEDAI score,[44] SLE Flare Index[45]), symptoms (eg, SLE severity, flares, fatigue), long-term organ damage (eg, the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index[15 46]) and the humanistic impact of the disease, including effects on HRQoL, productivity and functional status, and the impact on caregivers. As such, the results of this study must be interpreted within the context of the missing patient-centric outcomes data. Importantly, many of these outcomes have been measured in randomised controlled trials and real-world observational studies, which have demonstrated the overall benefits of belimumab for the treatment of SLE.[7 17 18 20 47–49]

Data within a claims database are also subject to coding limitations and data entry error, which may lead to inaccuracies in the medication patterns and HCRU and associated costs reported. Indeed, SLE diagnosis was determined using ICD-9-CM and ICD-10-CM diagnosis codes rather than laboratory-confirmed tests or validated clinician-reported outcome measures. There were also inconsistencies in how belimumab was identified before it was assigned a code. Inclusion in this study was limited to patients with commercial health insurance who were receiving belimumab; thus, study results may not be generalisable to a broader population. The study did not consider the duration of SLE or time since initial diagnosis, factors which are likely to be associated with disease severity and increased HCRU and costs. In addition, the study observation period of 6 months pre and postindex period was relatively short, given that disease activity and subsequent HCRU and costs are likely to increase with time.

CONCLUSIONS

This study in a large sample of US patients with SLE provides valuable real-world information about treatment patterns of intravenous belimumab as well as HCRU and costs before and after treatment initiation. Outpatient-based HCRU and associated costs were significantly higher in the 6 months following belimumab initiation, likely reflecting increased use of outpatient resources for belimumab administrations. Conversely, inpatient admission and ED visit rates were significantly lower following belimumab treatment and costs for these resources were significantly reduced. Oral corticosteroid utilisation and the number of patients experiencing a moderate or severe flare were significantly lower in the 6-month postindex versus preindex period, suggesting improved disease activity following belimumab initiation. A longer evaluation period may provide increased visibility as to HCRU and costs following belimumab initiation. For instance, over a longer period of time, further organ damage may be prevented, or disease progression may be reduced and thus offset the increased drug costs associated with belimumab treatment. Further studies are required to fully examine the impact of belimumab on HCRU and costs for patients with SLE, and reasons for non-adherence with recommended infusion schedules, with a focus on patient-centric outcome measures and the effect of belimumab treatment beyond a 6-month follow-up period.

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