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Comparative-Effectiveness Research/HTA

Healthcare Costs and Utilization for Patients With Systemic Lupus Erythematosus in China: A National Claims Database Study

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ABSTRACT

Objectives: This study aimed to describe the healthcare resource utilization (HCRU) and healthcare costs associated with systemic lupus erythematosus (SLE) management in China from the patient's and the payer's perspective.

Methods: HCRU and medical costs (2017 US dollar [USD]) between January 1 and December 31, 2017, were extracted from the national medical insurance claims database, China Health Insurance Research Association (consisting of claims from all public health insurance schemes in China), for adults with ≥ 1 SLE-related claim. The main analysis group comprised all adults with an SLE diagnosis and claim during 2017 (overall group); the annual subgroup (SLE diagnosis and claim in January 2017) informed annual HCRU and costs.

Results: The overall group consisted of 3645 adults with ≥ 1 SLE-related claim. Outpatient visits constituted 86.9% of healthcare visits. SLE-related healthcare outpatient costs were USD 433 per outpatient, and inpatient costs were USD 2072 per inpatient. Medication costs accounted for 75.0% (USD 42/56) of total costs for outpatient visits and 44.3% (USD 456/1030) for inpatient hospitalizations. Notably, 35.4% of patients had a severe SLE flare; mean SLE-related cost per severe flare was USD 1616. HCRU and costs were similar in the annual subgroup. Female sex, SLE flares, tertiary hospitals, renal involvement, and utilization of anti-infective drugs were associated with higher SLE-related patient costs.

Conclusions: SLE in China is associated with considerable HCRU and medical costs, especially for patients experiencing severe SLE flares. Preventing organ involvement, infections, flares, and associated hospitalizations may reduce the burden on patients and healthcare providers in China.

Keywords: China Health Insurance Research Association, Chinese population, cost of illness, claims analysis, observational study, systemic lupus erythematosus.

VALUE HEALTH REG ISSUES. 2023; 37:88–96

Introduction

Systemic lupus erythematosus (SLE) is a chronic inflammatory autoimmune disease that affects multiple organs, with periodic worsening presenting as flare episodes.[1,2] Symptoms of SLE range from general malaise, arthralgia, and fever to more severe manifestations including fatigue, nephritis, cognitive impairment, and cardiovascular diseases.[3-5] Irreversible organ damage accumulates over time as a consequence of both disease activity and medication toxicities.[4,6] Patients with SLE experience substantial impairment in their health-related quality of life, both physically and mentally.[7,8]

The incidence and prevalence of SLE vary with sex, age, ethnicity, and geographical differences. The estimated 1-year period prevalence of SLE in China is estimated to be 47.53 per 100 000 persons,[9] and prevalence is particularly high among women, with a female-to-male ratio of approximately 10:1.[10-12] Comparatively, prevalence of up to 241 per 100 000 persons is estimated for North America, although there is a lower incidence and prevalence among people of White ethnicity than Asian ethnicity across studies in the United States and Europe, with the highest prevalence seen among people of Black ethnicity.[13] SLE is known to develop more frequently and have more severe manifestations in Asian populations than in White populations.[14-16] In a multicenter study from China, the mean age at adult-onset SLE diagnosis was reported to be 30 years.[17] These findings are in line with data about patients worldwide; approximately 90% of patients with SLE are female, with symptoms and diagnosis of SLE typically occurring between the ages of 15 and 45 years.[13,15,18]

Standard therapy for Chinese patients with SLE at the time of this analysis included glucocorticoids, hydroxychloroquine, and immunosuppressive agents.[19,20] Nevertheless, prolonged use of these therapies is not always sufficient to control disease activity; and continued glucocorticoid use may be associated with

*At the time of study.

detrimental effects such as irreversible organ damage,[21] high morbidity, and mortality,[22] ultimately leading to high healthcare demands.

Management of SLE activity and comorbidities poses a great humanistic and economic burden in terms of health-related quality of life and costs.[23] Impaired physical or mental health, young age, and high disease activity in patients with SLE have been found to associate with high direct and indirect costs.[23,24] Despite the profound impact of SLE on patients and healthcare system, claims database studies of the economic burden of SLE in relation to clinical characteristics in the Chinese population are currently unavailable. The few studies that have examined the economic burden of SLE in China have been single-center studies with small sample sizes, but no findings based on large sample sizes or claims databases were reported in China.[25,26] Studies assessing healthcare resource utilization (HCRU) and clinical characteristics have focused on other Asian-Pacific countries, including Japan[27] and South Korea.[28] Furthermore, to date, there have been no studies that have attempted to estimate the cost of disease flares in patients with SLE in China.

The higher prevalence of SLE in the Chinese population versus White population[14,19,29] and the emergence of therapies that reduce disease activity and healthcare costs[20,30,31] prompt the need for a better understanding of the economic burden among Chinese patients with SLE.

Methods

Study Objectives

The primary objectives of this study were to describe HCRU and healthcare costs associated with SLE management and treatment in China. Medical costs were measured in 2017 Chinese yuan renminbi (CNY) and converted to 2017 US dollars (USD) at the average 2017 exchange rate of 1 CNY to 0.148 USD.[32] As secondary objectives, the study sought to identify factors associated with healthcare costs (eg, hospital tier [primary, secondary, tertiary], glucocorticoid use, and frequency and severity of SLE flares) of SLE management/treatment. An exploratory objective of this study was to explore the definition of SLE flares in medical claims in China and quantify the SLE-related medical costs of SLE flares in China.

Study Design

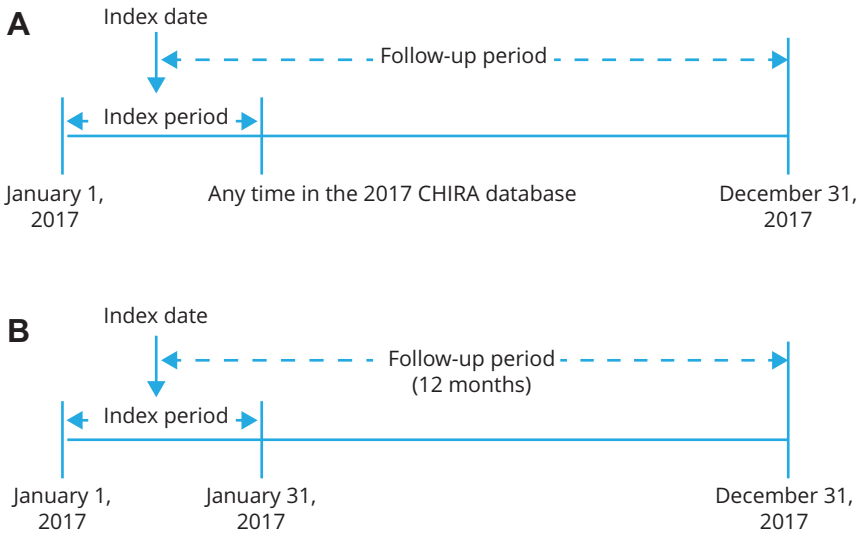
This was a retrospective analysis (GSK Study 213597) of nationwide inpatient and outpatient insurance claims (made in 2017) extracted from the China Health Insurance Research Association (CHIRA) database. The index date for the overall group was the date of the first medical claim with a diagnosis of SLE at any time within the 2017 CHIRA database (quarter 1, January 1 to March 31; quarter 2, April 1 to June 30; quarter 3, July 1 to September 30; quarter 4, October 1 to December 31). For the annual subgroup, the index date was within the index period of January 1 to 31, 2017, to facilitate a follow-up period of up to 12 months, until death or the end of study (December 31, 2017) (Fig. 1).

Data Source

CHIRA is a comprehensive claims data source in China. It includes nationwide data from all 3 types of public health insurance schemes: Urban Employee Basic Medical Insurance, Urban Resident Basic Medical Insurance, and New Rural Cooperative Medical Insurance. These insurance schemes cover > 95% of individuals in China, and this proportion is increasing[33,34]; the small proportion of people in China who are not under these public health insurance schemes were not represented in this analysis.

Only data from 2017 were used in the current analysis. In the 2017 database, a total of 68 sampling cities were covered. Cities were classified into tiers[1-4] according to the economic development level, with tier-1 cities (including Beijing, Shanghai, and Guangzhou) having the highest economic development levels. Available data included patient demographics, type of healthcare service (inpatient, outpatient), hospital information (primary [community], secondary, or tertiary), and patients' medical

Figure 1. Study design for the (A) overall group and (B) annual subgroup.



For the overall group, the index date was the first medical claim with a diagnosis of SLE at any time within the 2017 CHIRA database. For the annual subgroup, the index period was January 2017. The follow-up period for both groups was from the index date to the end of the study period (December 31, 2017) or death. CHIRA indicates China Health Insurance Research Association; SLE, systemic lupus erythematosus.

history, including diagnosis, medication, and HCRU. In China, primary or community hospitals are generally small (< 100 beds) and provide mainly preventive care. Secondary level hospitals are responsible for providing comprehensive health services and medical education and conducting research on a regional basis. Tertiary level hospitals are responsible for providing specialist health services, perform a bigger role regarding medical education and scientific research, and serve as medical hubs providing care to multiple regions.

Statement of Ethics Compliance

This study used previously collected anonymized patient data, extracted from a nationwide public health insurance database of medical information, and does not contain any new data from human participants or animals. Thus, patient consent was not required, and the study did not require an ethics committee approval. The study conformed with the Declaration of Helsinki 1964.

Study Population

All adults with a diagnosis code or keywords for SLE during the calendar year 2017 were eligible for inclusion. Patients were required to be ≥ 18 years of age and have ≥ 1 claim with an International Classification of Diseases, 10th Revision (ICD-10) code for SLE (M32, M32.0, M32.1, M32.8, M32.9) or the keywords "systemic lupus erythematosus" or "lupus" in the patient's primary or secondary diagnosis. Patients with ICD-10 codes of L93 (ie, lupus erythematosus [LE]), L93.0 (ie, discoid LE), L93.1 (ie, subacute cutaneous LE), and/or L93.2 (ie, other localized LE) were excluded from the study.

The main analysis focused on adult patients with an SLE diagnosis who had a healthcare claim any time within 2017 (overall group). Data were also analyzed for patients who had their first SLE-related visit in January 2017 and therefore had up to 1 year of follow-up data collected (annual subgroup).

Study Outcomes and Variables

This study was conducted from the perspective of the patient and the payer (public health insurance). Study outcomes related to HCRU included number of SLE-related hospitalizations, length of stay per SLE-related hospitalization, SLE-related hospital admissions per patient, and the number of SLE-related outpatient visits per patient.

Healthcare costs covered inpatient and outpatient care and included SLE-related medication costs for medications available in 2017 (antimalarials, glucocorticoids, immunosuppressants [including methotrexate, cyclosporin, leflunomide, azathioprine, mycophenolate mofetil, and tacrolimus], cyclophosphamide [oral and intravenous], non-steroidal anti-inflammatory drugs, rituximab, and other SLE-related drugs [eg, traditional Chinese medicine]), and other (non–SLE-related) medication costs and non-medication costs (laboratory tests, imaging, surgery, bed, nursing, medical consumables, dialysis, or other treatments).

Algorithm for Identification of an SLE Flare

Given that there is no ICD-10 code for SLE flares within CHIRA, as with other claims analyses, an algorithm was used to identify patients with such events. The algorithm was adapted from that developed by Garris et al[35] to identify flares and categorize their severity from claims data. The validated Garris et al[35] algorithm, used in a US claim-based study, was developed using the Lupus Foundation second International Lupus Flare Conference definition categorizing the severity of flares[36]; consensus of expert, clinical opinion; and additional criteria of outpatient visits, hospitalizations, and emergency room visits with an SLE diagnosis.[35] Since no existing algorithm is available in China, this algorithm was adapted in the present study to exclude steroid usage criteria, which is not captured by CHIRA. The algorithm was validated by Chinese clinical experts as the most feasible method for this claims analysis. SLE flares were categorized as either severe or non-severe (mild/moderate) (Appendix Table 1 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007).

Criteria for duration of flares are defined in Appendix Table 1 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007. If a subsequent flare was captured during the 30 days after the index flare, the episode was counted as a single flare. If a severe flare occurred during the 30 days after an index mild/moderate flare, the length of the mild/moderate flare was considered as the time from its start to the start of the severe flare. For severe flares, if a patient had an outpatient admission the day before the hospitalization, the start date of the severe flare was considered to be the date of the outpatient consultation before hospitalization rather than the first day of the patient's admission.

Statistical Analyses

Descriptive statistics are presented for the demographic and clinical characteristics of the study population. Means and SDs were calculated for continuous variables, such as cost, length of hospital stays, number of hospital visits, and age. Categorical variables included demographic characteristics, insurance type, city level, hospital tier, SLE flare status (yes/no) and severity (severe or mild/moderate), and SLE-related medication prescriptions and were summarized using count (frequency) and percentage.

Factors associated with healthcare costs per patient with SLE were determined by stepwise multivariable regression. Initially, potential factors that might affect the medical costs of SLE were identified based on existing literature and clinical experience, and univariate analysis was used to determine the association between medical costs per patient with SLE and each potential factor (SLE flare, sex, insurance type, tier of cities, hospital tier, date of first SLE claim, anti-infective drugs, renal involvement, dialysis, and comorbidities [using Charlson comorbidity index score (CCI)]; Appendix Table 2 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007). The CCI score, originally developed in 1987[37] and adapted to ICD-10 codes,[38] weights a patient's comorbidities to provide a score that indicates the likelihood of mortality and the severity of comorbidities.

Variables were considered to be significant at a $P < .1$ (Wilcoxon test and general linear model) and were considered as potential predictors for the multivariate regression analysis. A threshold of $P < .1$ was used to determine statistical significance to ensure that no potentially useful variable from the analysis was missed. Factors associated with healthcare costs per patient with SLE in the univariate analyses were tested for type of distribution and estimated using high-performance generalized linear models. The best fitted model was selected based on the minimization of the Akaike information criterion. Stepwise regression with fitted negative binomial distribution and a logarithm link function was selected. Covariates identified as potential predictors using univariate analysis were qualified as risk factors when P values using multivariate analysis of tested associations were < .05.

Table 1. Baseline characteristics of patients with SLE in the overall group (N = 3645).

Variable	Overall group (N = 3645)
Age (years), Mean (SD)	45.5 (14.8)
Sex, n (%)	
Male	670 (18.4)
Female	2975 (81.6)
Insurance type, n (%)	
Employees	2485 (68.2)
Residents	1160 (31.8)
Tier of cities, n (%)	
Tier 1	452 (12.4)
Tier 2	820 (22.5)
Tier 3	983 (27.0)
Others	1390 (38.1)
Hospital tier, n (%)	
Tertiary	2598 (71.3)
Other*	1418 (38.9)
Date of first SLE-related claim, n (%)	
First quarter (January 1 to March 31)	1681 (46.1)
Second quarter (April 1 to June 30)	634 (17.4)
Third quarter (July 1 to September 30)	690 (18.9)
Fourth quarter (October 1 to December 31)	640 (17.6)
CCI score,† mean (SD)	0.5 (1.2)
SLE-related medications, n (%)	
Glucocorticoids	1983 (54.4)
Antimalarials	1642 (45.0)
Immunosuppressants‡	933 (25.6)
Cyclophosphamide	335 (9.2)
NSAIDs	322 (8.8)
Rituximab	2 (0.1)
Others	116 (3.2)
Other medications, n (%)	
Anti-infective	795 (21.8)
Antibiotics	739 (20.3)

CCI indicates Charlson comorbidity index; NSAIDs, non-steroidal anti-inflammatory drugs; SD, standard deviation; SLE, systemic lupus erythematosus.
*These data include all hospital tier visits per patient.
†CCI scoring as per Quan et al,[38] with a score of 0 indicating no comorbidities and the maximum score of 24 indicating a greater risk of mortality and severity of comorbidities according to the updated scoring method.
‡Immunosuppressants included cyclosporin, methotrexate, leflunomide, azathioprine, mycophenolate mofetil, and tacrolimus.

Table 2. HCRU among patients with SLE in the overall group (N = 3645).

Variable	Overall group (N = 3645)
Number of healthcare visits	23 576
Outpatient visits	20 496
Inpatient visits	3080
Healthcare visits per patient, mean (SD)	6.5 (11.6)
Outpatient visits, mean (SD)	5.6 (11.1)
Inpatient visits, mean (SD)	0.9 (2.1)
≥ 1 SLE-related hospitalization, n (%)	1532 (42.0)
SLE-related hospitalization admissions, mean (SD)	2.0 (2.8)
Length of stay per inpatient (days), mean (SD)	17.2 (30.2)
Length of stay per hospitalization (days),* mean (SD)	8.6 (17.6)
≥ 1 SLE-related outpatient visit, n (%)	2654 (72.8)
SLE-related outpatient visits, mean (SD)	7.7 (12.3)

HCRU indicates healthcare resource utilization; SD, standard deviation; SLE, systemic lupus erythematosus.
*Based on number of inpatient visits (n = 3080).

All statistical analyses were performed using the SAS 9.4 statistical software (SAS Institute Inc, Cary, NC).

Results

Overall Group

Patient characteristics and treatment patterns

A total of 3645 adult patients from the 2017 CHIRA database were included in the overall group. Patients were mostly female (2975 of 3645, 81.6%), mean (SD) age was 45.5 (14.8) years, and the mean (SD) CCI score was 0.5 (1.2) (of maximum 24). Most patients (2485 of 3645, 68.2%) were covered by Urban Employee Basic Medical Insurance (employee insurance). Patients most frequently received glucocorticoids (1983 of 3645, 54.4%), antimalarials (1642 of 3645, 45.0%), and immunosuppressants (933 of 3645, 25.6%) to manage their SLE. Anti-infectives (795 of 3645, 21.8%) and antibiotics (739 of 3645, 20.3%) were also frequently prescribed (Table 1).

HCRU

In this overall group, there were a total of 23 576 healthcare visits reported in 2017, of which 20 496 (86.9%) were outpatient visits (Table 2). In total, 1532 of 3645 patients (42.0%) had ≥ 1 SLE-related hospitalization, with a mean (SD) number of 2.0 (2.8) hospitalizations per inpatient and a mean (SD) length of stay of 8.6 (17.6) days per admission (Table 2). Additionally, 2654 of 3645 patients (72.8%) had ≥ 1 SLE-related outpatient visit, with a mean of 7.7 (12.3) SLE-related outpatient visits per outpatient (Table 2).

SLE-related healthcare costs

For the overall group, per healthcare visit, the mean (SD) inpatient hospitalization and outpatient visit costs were USD 1030 (1770) and USD 56 (102), respectively (Fig. 2A). Medication costs contributed to 44.3% (USD 456/1030) of inpatient hospitalization costs and 75.0% (USD 42/56) of outpatient costs (Fig. 2A). The costs of SLE-related medications were generally lower than costs of other medications.

Per patient with SLE, the mean (SD) SLE-related medical costs were USD 1186 (2677); inpatient medical costs were USD 2072 (3503) per inpatient, which is > 4 times greater than outpatient costs (USD 433 [856] per outpatient; Fig. 2B). Inpatients' medication costs (mean [SD] USD 918 [1777]) were approximately 3 times greater than those of outpatients (USD 321 [627]), but mean SLE-related medication costs made up a greater proportion of total costs for outpatients (USD 119/433, 27.5%) than inpatients (USD 125/2072, 6.0%) (Fig. 2B).

Medical costs associated with SLE flares

Overall, in 2017, 1980 of 3645 patients (54.3%) had ≥ 1 SLE flare (any severity) during follow-up (Fig. 3), with a mean (SD) of 1.7 (1.3) SLE flare events per patient. Severe flares were experienced by 1291 of 3645 patients (35.4%), with a mean (SD) of 1.4 (0.9) severe flares per patient (Fig. 3).

The mean (SD) total cost was USD 1616 (2398) per severe flare event, which was > 5 times greater than per non-severe flare event (USD 302 [336]) (Fig. 3). Medication costs contributed to 71.2% (USD 215/302) and 41.9% (USD 677/1616) of total costs for non-severe and severe events, respectively (Fig. 3).

Factors associated with SLE-related medical costs per patient

The univariate analyses identified SLE flare, sex, tier of cities, tier of hospitals, date of first SLE claim, use of anti-infective drugs, renal involvement, dialysis, and comorbidities as possible predictors of SLE-related medical costs in the overall group (Appendix Table 2 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007). In the multivariate regression analysis of this overall group, SLE flares (effect estimate 1.62), female sex (effect estimate 0.28), tertiary hospitals (effect estimate 0.58), utilization of anti-infective drugs (effect estimate 0.84), and renal involvement (effect estimate 0.84) were associated with higher SLE-related costs per patient (all $P < .0001$) (Appendix Table 3 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007).

Annual Subgroup

In total, 930 adults had an index date within the index period of January 1 to 31, 2017, and comprised the annual subgroup. Patient demographics are presented in Appendix Table 4 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007. In brief, the mean (SD) age was 44.7 (14.5) years, and most patients were female (803 of 930, 86.3%).

In total, 339 of 930 patients (36.5%) had ≥ 1 SLE-related hospitalization, with a mean (SD) length of stay of 6.8 (24.3) days, and 834 of 930 patients (89.7%) had ≥ 1 SLE-related outpatient visit (Appendix Table 4 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.03.007). There were 13 997 healthcare visits in total, of which the majority (12 820, 91.6%) were outpatient visits.

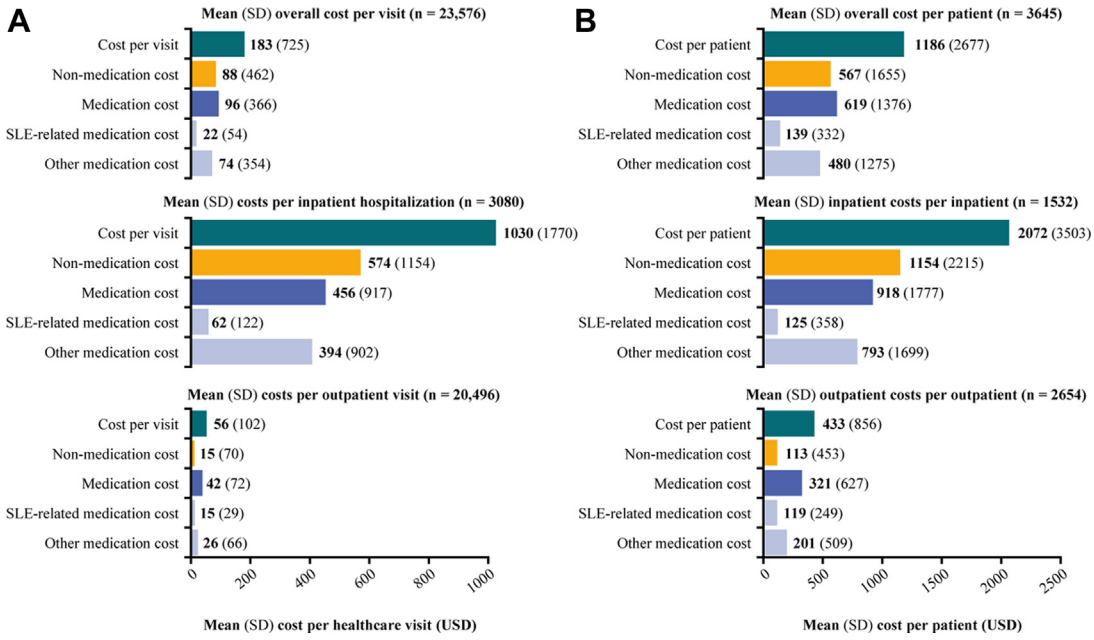
Mean (SD) costs per healthcare visit were USD 794 (1843) per inpatient hospitalization and USD 53 (78) for outpatient visits (Table 3). The mean (SD) total costs per patient were USD 1735 (3522), with inpatient medical costs of USD 2758 (4810) per inpatient and outpatient medical costs of USD 813 (1249) per outpatient (Table 3). In total, 575 of 930 patients (61.8%) had ≥ 1 SLE flare (any severity) with 244 of 930 patients (26.2%) having ≥ 1 severe flare. Mean (SD) cost per non-severe flare event was USD 336 (358) and mean (SD) cost per severe flare event was USD 1895 (3275) (Table 3).

Discussion

This retrospective analysis of 3645 adults with SLE is the first study to analyze a national claims database in China and provide insight about HCRU, economic burden, flare occurrence, and associated medical costs in patients with SLE. We found that SLE has a considerable economic impact, with mean per patient costs of approximately USD 1186 in the overall group and USD 1735 in the annual group. In the overall group, this represents 30.9% (USD 1186/3844) of the 2017 disposable capital income per capita in China,[39] highlighting the considerable economic burden of SLE for individual patients. Patients who experienced flares, renal involvement, or infections, were female, or visited a tertiary hospital were positively associated with per patient costs as determined by multivariate regression analysis.

Annual direct costs per patient have been reported previously for Shanghai and for the Anhui province.[25,26] These studies reported costs per patient that were considerably higher (CNY 33 899 [converted to 2017 USD: 5017] and CNY 16 732 [converted to 2017 USD: 2476], respectively) than those reported in the current study for patients within 2017 (USD

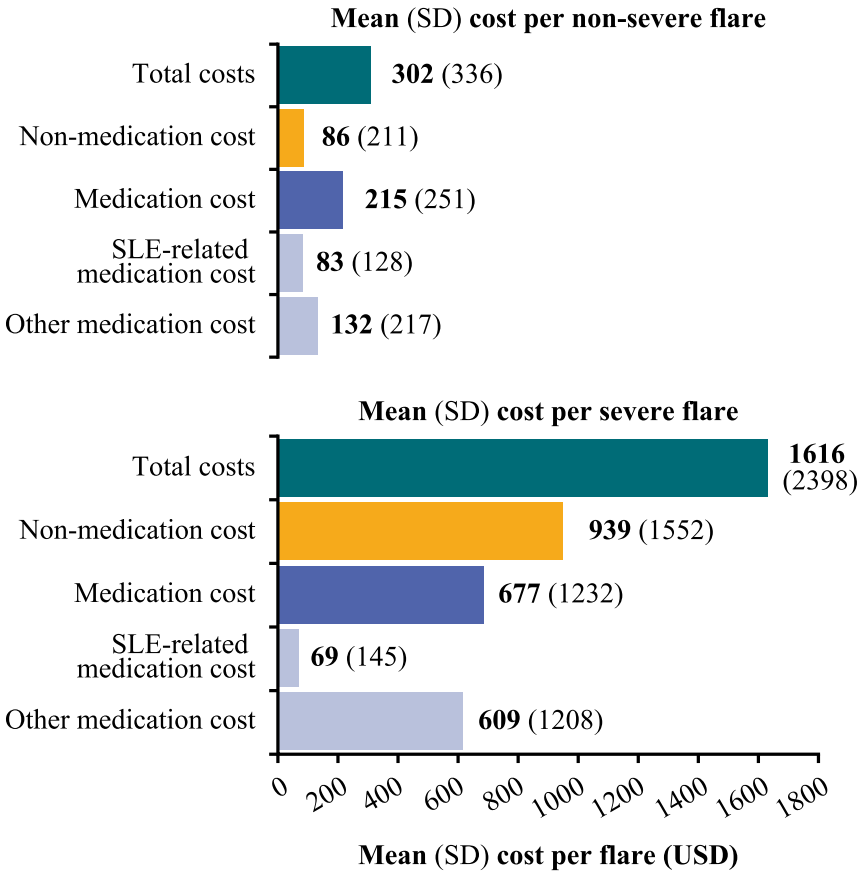
Figure 2. Mean (SD) healthcare costs per (A) SLE-related healthcare visit and per (B) patient with SLE, in the overall group (N = 3645).



Non-medication costs include laboratory tests, imaging, operation/surgery, bed, nursing, medical consumables, dialysis, and other treatments. Inpatients are patients with ≥1 SLE-related hospitalization; outpatients are patients with ≥1 SLE-related outpatient visit. SD indicates standard deviation; SLE, systemic lupus erythematosus; USD, US dollars.

Figure 3. SLE flares and mean (SD) costs per flare among patients with flares in the overall group (N = 3645).

	Severe flares	Non-severe flares	Any severity flares
Number of patients*, n (%)	1291 (35.4)	910 (25.0)	1980 (54.3)
Mean (SD) number of flares per patient	1.4 (0.9)	1.8 (1.4)	1.7 (1.3)



*Percentage are of total overall group. Non-medication costs include laboratory tests, imaging, operation/surgery, bed, nursing, medical consumables, dialysis, and other treatments. SD indicates standard deviation; SLE, systemic lupus erythematosus; USD, US dollars.

1186), including when compared only with patients with data collected across 1 year (annual subgroup, USD 1735). Nevertheless, both of these previous studies derived data from small samples (~100 patients) cared for in a small number of tertiary hospitals based on a questionnaire survey. In comparison, the current study used data from a nationwide claims database, with a large sample size across different tiers of hospital and cities, which should be more representative of broader SLE populations than previous studies.

The HCRU reported here is generally similar to that reported in other countries, including Japan[27] and the United States,[35] though with notable differences in some findings. For example, the length of hospitalization (mean [SD] 8.6 [17.6] days) was higher than the average inpatient hospital stay of 3.5 days reported in the USA, but lower than the inpatient stay reported in Japan (mean [SD] 19.9 [32.4] days). Opposing results in HCRU among studies may be because of differences in the national healthcare coverage systems, regional differences related to clinical practice, mode of health service, the level of economic development, and methodologies used.

The data presented here indicate that SLE flares, particularly severe flares, are common and costly; for severe flares, costs were approximately 5 times greater (USD 1616) than for non-severe flares (USD 302). Indeed, in the multivariate analysis, SLE flares were associated with higher SLE-related costs per patient (effect estimate 1.62).

In this study, glucocorticoids were the most frequently prescribed SLE-related medications, although this study did not calculate the average dose used by patients given that no data were available on the number of days that the patients were on glucocorticoids or the dose change. Other commonly received medications were antimalarials and immunosuppressants. These results are consistent with the those of the US claims data analysis[35] and single-center medical record analysis in China.[40] Anti-

Table 3. Mean (SD) healthcare costs per SLE-related healthcare visit, per patient with SLE, and per SLE flare event in the annual subgroup (N = 930).

Healthcare costs per SLE-related healthcare visit	
Number of overall SLE healthcare visits	13 997
Total cost per visit (USD), mean (SD)	115 (577)
Non-medication cost (USD),* mean (SD)	49 (444)
Medication cost (USD), mean (SD)	66 (206)
Number of SLE inpatient visits	1177
Cost per hospitalization (USD), mean (SD)	794 (1843)
Non-medication cost (USD),* mean (SD)	453 (1465)
Medication cost (USD), mean (SD)	341 (621)
Number of SLE outpatient visits	12 820
Cost per outpatient visit (USD), mean (SD)	53 (78)
Non-medication cost (USD),* mean (SD)	12 (48)
Medication cost (USD), mean (SD)	41 (58)
Healthcare costs per patient with SLE	
Total patients with SLE, n	930
Total cost per patient with SLE (USD), mean (SD)	1735 (3522)
Non-medication cost (USD),* mean (SD)	738 (2489)
Medication cost (USD), mean (SD)	997 (1574)
Inpatients, n	339
Inpatient cost per SLE inpatient (USD), mean (SD)	2758 (4810)
Non-medication cost (USD),* mean (SD)	1574 (3619)
Medication cost (USD), mean (SD)	1184 (1839)
Outpatients, n	834
Outpatient cost per SLE outpatient (USD), mean (SD)	813 (1249)
Non-medication cost (USD),* mean (SD)	184 (680)
Medication cost (USD), mean (SD)	630 (918)
Healthcare costs per flare	
Patients with any flare event, n	575
Number of flares per patient, mean (SD)	2.3 (1.8)
Total cost per any flare (USD), mean (SD)	808 (1960)
Non-medication cost (USD),* mean (SD)	429 (1503)
Medication cost (USD), mean (SD)	378 (694)
Patients with non-severe flare event, n	433
Number of flares per patient, mean (SD)	2.1 (1.7)
Total cost per non-severe flare (USD), mean (SD)	336 (358)
Non-medication cost (USD),* mean (SD)	97 (239)
Medication cost (USD), mean (SD)	240 (259)
Patients with severe flare event, n	244
Number of flares per patient, mean (SD)	1.6 (1.2)
Total cost per severe flare (USD), mean (SD)	1895 (3275)
Non-medication cost (USD),* mean (SD)	1196 (2549)
Medication cost (USD), mean (SD)	699 (1138)

SD indicates standard deviation; SLE, systemic lupus erythematosus; USD, US dollars.
*Non-medication costs include laboratory tests, imaging, operation/surgery, bed, nursing, medical consumables, dialysis, other treatments.

infectives and antibiotics were also commonly prescribed, in line with reports of infections being one of the primary causes (37.3%) of death among patients with SLE.[41]

Our results show disparities for medical costs between the annual subgroup and overall group. For example, mean inpatient costs per patient were almost USD 700 greater for patients in the annual subgroup (USD 2758) than in the overall group (USD 2072). Nevertheless, this result is not surprising because the yearly medical costs of the annual subgroup will better reflect the annual economic burden in real world settings. For the annual subgroup, only patients whose first claim occurred in Q1 2017 were included. For the overall group, some patients had their first medical claim in Q2, Q3, or Q4 2017. Thus, the follow-up period of the 2 groups differed.

There are some limitations to this study. The overall group assessed here may not be an accurate reflection of the annual costs of SLE. Although the annual subgroup is a better reflection of the annual costs of the SLE population with a maximum 12-month treatment, the number of patients in this subgroup was low, and it is unknown whether all patients were eligible to submit claims for the entire study duration because they could have been lost to follow-up. In addition, the number of SLE-related visits could be under- or over-reported given that data within a claims database are derived from the diagnosis codes input by physicians and are subject to coding limitations and data entry error. The study population included patients from different city tiers at varying sampling rates, so caution is advised when generalizing to the total population of patients with SLE in China. Similarly, only patients with public medical insurance were included, and the medical costs covered by private medical insurance companies are not considered.

Patients were identified based on ICD-10 diagnostic codes used in the CHIRA database; nevertheless, the presence of diagnosis or examination procedure codes on a medical claim does not necessarily confirm the presence of SLE because these may include misdiagnosis. Furthermore, the CHIRA claims database may not capture all organ damages of SLE, which may have led to an underestimation of SLE-related costs.

It was not possible to follow individual patients retrospectively within the CHIRA database for previous years because the data are collected annually from local medical insurance offices, de-identifying patients in the database each year. The algorithm for the identification of flares was adapted from a US claims database analysis, in which changes in glucocorticoid dose also were considered, unlike in the CHIRA database. Although the algorithm used in this study has been developed alongside clinical experts in China as the most feasible for this data source, reliance on an algorithm to identify patients is not 100% accurate and will potentially lead to missing counts of flares and patients with flares. In addition, given that no new medicines for SLE were approved in China until 2019,[42] subsequent changes in clinical practice may have occurred since the study's completion. Despite these limitations, this study provides a valuable insight into the clinical characteristics of Chinese patients with SLE and the impact of SLE on HCRU and economic burden in China.

Conclusions

In China, SLE is associated with considerable HCRU and healthcare costs, especially in patients experiencing hospitalization/inpatient visits or severe SLE flares. These findings suggest that preventing organ involvement, infections, flares, and

associated hospitalizations may lower the burden for patients and healthcare providers in China.

Supplemental Material

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.vhri.2023.03.007.

Article and Author Information

Accepted for Publication: March 29, 2023

Published Online: June 26, 2023

doi: https://doi.org/10.1016/j.vhri.2023.03.007

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Conflict of Interest Disclosures: Dr He is an employee of GlaxoSmithKline (GSK). Drs Llyod, Chauhan, Juliao, and Quasny are employees of GSK and reported receiving stocks and shares in the company. Dr Cooper was an employee of GSK at the time of the study. Dr Li is an employee of Beijing Brainpower Pharma Consulting Co Ltd, Beijing, China, and reported receiving funding from GSK. No other disclosures were reported.

Funding/Support: This study (GSK Study 213597) was funded by GSK, US.

Role of the Funder/Sponsor: GSK was involved in designing the study, contributed to the analysis and interpretation of the data, supported the authors in the development of the article, and funded the medical writing assistance provided by Fishawack Indicia Ltd, part of Fishawack Health. All authors, including those employed by GSK, approved the content of the submitted article and were involved in the decision to submit the article for publication. China Health Insurance Research Association database is owned by China Health Insurance Research Association, and GSK had no access to the database.

Medical Writing, Editorial, and Other Assistance: Medical writing support was provided by Nicholas Thomas, PhD of Fishawack Indicia Ltd, UK, part of Fishawack Health, and was funded by GSK.

Compliance With Ethics Guidelines: This study used previously collected anonymized patient data, extracted from a nationwide public health insurance database of medical information, and does not contain any new data from human participants or animals performed by any of the authors. Thus, patient consent was not required and the study did not require an ethics committee approval. The study conformed with the Declaration of Helsinki 1964.

Data Availability: The data sets generated during and/or analyzed during the current study are not publicly available due the ownership and confidentiality of China Health Insurance Research Association database.

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