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Update on Prevalence of Diagnosed Systemic Lupus Erythematosus (SLE) by Major Health Insurance Types in the US

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Abstract

Objective

To provide current estimates of the number of patients with prevalent systemic lupus erythematosus (SLE) by major health insurance types in the US and describe patient characteristics. Four large US health insurance claims databases were analyzed to represent different types of insurance coverage, including private insurance, Medicaid, and Medicare Supplemental.

Results

Overall unadjusted SLE prevalence per 100,000 persons in the US ranged from 150.1 (private insurance) to 252.9 (Medicare Supplemental insurance). Extrapolating to the US civilian population in 2016, we estimated roughly 345,000 to 404,000 prevalent SLE patients with private/Medicare insurance, and 99,000 prevalent SLE patients with Medicaid insurance.

Comorbidities, including renal failure/dialysis were commonly observed across multiple organ systems in SLE patients (8.4-21.1%).

We estimated a larger number of prevalent SLE cases in the US civilian population than previous reports and observed extensive disease burden based on a 1-year cross-sectional analysis.

Introduction

Systemic lupus erythematosus (SLE) is a complex autoimmune disease that can affect multiple body organs and systems, with prevalence previously reported in a broad range of populations from 6.5 to 178.0 per 100,000 worldwide, [1] and from 24 to 150 per 100,000 among adults in the US. [2] There are no current estimates of how many people in the US have SLE, although a commonly quoted estimate suggests a prevalence of 161,000 with definite SLE and 322,000 with definite or probable SLE. [3] This estimate was derived by projecting the SLE prevalence among persons aged 15 to 64 years in San Francisco Kaiser Foundation Health Plan in 1965-1973, [4] to the corresponding 2005 US population Census data. It is not known if the prevalence estimates from 50 years ago still hold today with increasing epidemiological surveillance and research, including the development of SLE classification criteria over time. [1] Having a current estimate of the number of prevalent SLE patients helps with understanding the disease burden and health care planning. In the US, private, Medicare and Medicaid insurance make up the major civilian health insurance sectors. [5] A recent study estimated that there were 97,590 people with prevalent SLE among the total Medicare population in 2016. [6] Other than a poster abstract that estimated a total of 313,436 prevalent SLE patients in the US in 2009 using private, Medicare and Medicaid insurance claims databases, [7] no current estimates of the number of prevalent SLE patients by insurance coverage was available in the public domain.

In this report, we provide current estimates for SLE prevalence proportions and prevalent number of SLE patients in the US by major health insurance types. In addition, we describe 1-year cross-sectional SLE health care utilization and encounters across different insurance types.

Main Text

Data sources

We used four large US health insurance claims databases converted to the OMOP Common Data Model: [8] IBM MarketScan® Commercial (CCAE), IBM MarketScan® Medicare Supplemental (MDCR), Optum De-identified Clinformatics® Data Mart Databases (Optum), and IBM MarketScan® Multi-state Medicaid (MDCD). CCAE represents data from individuals enrolled in US employer sponsored insurance health plans. The data includes health insurance claims (e.g., inpatient, outpatient, and outpatient pharmacy) as well as enrollment data from large employers and health plans who provide private health care coverage to employees, their spouses, and dependents. MDCR is an administrative health claims database for Medicare-eligible active and retired employees and their Medicare-eligible dependents from employer-sponsored supplemental plans. Persons under age 65 in MDCR had Medicare coverage due to disability (including from SLE), therefore were not considered as representative of the general US population, and were excluded from the analysis when projecting the number of prevalent SLE cases in the US below. Optum is an adjudicated administrative health claims database for members with private health insurance. The population is primarily representative of US commercial claims patients (0-65 years old) with some Medicare patients (65+ years old). MDCD is an administrative health claims database that contains the pooled healthcare experience of Medicaid enrollees, covered under fee-for-service and managed care plans from multiple states.

The use of Optum and MarketScan® databases was reviewed by the New England Institution Review Board (IRB) and was determined to be exempt from broad IRB approval, as this research project did not involve human subject research.

Patients

In each database, prevalent SLE cases were identified for calendar year 2016 based on having ≥1 SLE diagnosis codes or ≥1 belimumab prescription in 2016; and meeting at least one of the following conditions [9-13] before or during 2016: (1) ≥3 SLE diagnoses spanning across ≥60 days; or (2) ≥1 belimumab infusion/injection and ≥2 SLE diagnoses; or (3) ≥1 inpatient SLE diagnosis and ≥1 dispensed prescription for systemic corticosteroids, antimalarials, or immunomodulators commonly used in SLE treatment. At least one year of continuous enrollment in the health plan was required of all individuals. The study sample creation flowchart and detailed descriptions of the claims database algorithms for defining SLE from the published literature are provided in the Supplemental Materials.

Analysis

In each database, age- and sex-specific SLE prevalence proportion was estimated for calendar year 2016. The numerator included diagnosed SLE cases and denominator included individuals enrolled for the entire year of 2016. Projection of prevalent SLE cases (rounded down to the nearest thousands) in the US was based on the age- and sex-specific prevalence proportions from each database multiplied by the corresponding US census population counts by age, sex, and insurance type, and taken the sum. [5] Given that CCAE (mostly people age<65) and MDCR (mostly people age ≥65) cover complementary age groups, we combined the estimated SLE prevalence proportions from MDCR age ≥65 and CCAE age <65 to project to US civilian population with private insurance coverage of all ages. The estimated SLE prevalence proportions from Optum were used as a second source to project to US civilian population with private/Medicare insurance coverage across all ages. These two estimates (i.e., CCAE age<65 combined with MDCR age≥65, Optum) for people with private/Medicare insurance coverage were separately combined with the third projection, from MDCD to persons with Medicaid coverage, to estimate overall SLE prevalence in the US civilian population. To enable comparison with age-standardized SLE prevalence published previously from population-based SLE surveillance programs, we provided age-standardized SLE prevalence from these insurance databases (see Supplemental Table 2).

To provide a 1-year cross-sectional profile of disease burden in 2016, we also described the health care utilization and encounters for various conditions and comorbidities for SLE patients using prescription drug, procedure, and diagnosis codes from the insurance claims. All codes are provided in the Supplemental Materials.

Results

In 2016, a total of 28,848 (CCAE), 3,922 (MDCR age ≥65), 23,877 (Optum) and 15,096 (MDCD) prevalent cases of SLE were identified. The unadjusted SLE prevalence per 100,000 persons was 150.1 (25.6 in males and 266.0 in females), 236.4 (66.1 in males and 372.7 in females), 195.4 (39.2 in males and 341.1 in females) and 158.7 (27.1 in males and 258.9 in females) in CCAE, MDCR age≥65, Optum, and MDCD, respectively. Age-standardized SLE prevalence per 100,000 persons was 134.9, 146.7, 143.3, and 244.3 in CCAE, MDCR age≥65, Optum, and MDCD, respectively (see Supplemental Materials for details).

The age and sex-specific prevalence proportions of each database were plotted in Figure 1. SLE prevalence in females was consistently higher than in males across all age groups in all four databases. Female to male ratio of SLE prevalence by age was provided in the Supplemental Figure 2. The projected numbers of prevalent SLE cases with private (including Medicare) or Medicaid insurance ranged from 444,000 (i.e., 345,000 with private/Medicare plus 99,000 with Medicaid insurance) to 503,000 (404,000 with private/Medicare plus 99,000 with Medicaid insurance) (Table 1).

Across the four databases, 15% to 33% of patients had at least one hospitalization in 2016 (Table 2). Healthcare utilization including hospitalizations for infections appeared highest, despite lowest mean age

in MDCD. Comorbidities and SLE disease manifestations were common across multiple organ systems in SLE patients, including renal failure/dialysis that ranged from 8.4% (in CCAE) to 21.1% (MDCR). Across the four databases, SLE medications dispensed the most frequently were systemic corticosteroids (61-65%) and anti-malarial drugs (35-63%); anti-inflammatory biologic agents were infrequently prescribed (<5%) in any of the database cohorts.

Discussion

Our study characterized patient cohorts from four large US insurance claims databases to provide updated estimates for SLE prevalence proportions and the number of SLE cases in the US civilian populations. The cross-sectional design of health care utilization and encounters during calendar year 2016 demonstrated considerable burden across all insurance types.

We estimated more prevalent SLE cases in the US than previous reports, including that based on prevalence proportions from 50 years ago applied to US population in 2005, [3] and an abstract using the same databases in 2009 [7]. This likely reflects both increased SLE prevalence proportions (compared with the 1970s, and with previous population-based surveillance studies shown in Supplemental Table 2) and overall increased US population size (compared with 2005, 2009). Rigorous algorithms were used to identify SLE cases [9-13], with an estimated sensitivity and specificity both > 90% and positive predictive value 80%-90% (Supplemental Table 1, 3). Although chart validation was not feasible, the SLE algorithms reflected real-world health care experience and utilization for presumed SLE patients in routine clinical practice. For example, 98% to 99% of the cases across the four databases had ≥3 SLE diagnoses spanning at least 60 days apart.

The strength of the study includes using data from large and differing representative U.S. healthcare claims databases standardized to a common data model [8] to provide updated estimates of SLE prevalence.

Conclusion

Overall, our research provides an update on the estimates of prevalent cases of SLE from a variety of US insurance types, each indicating a significant utilization burden. Future research is needed to understand the health care and societal costs for the management of persons diagnosed with SLE, including causes of health disparities, resulting disability and premature mortality among patients younger than 65.

Limitations

First, the four databases do not cover persons without health insurance or all persons with health insurance in the US. Although about 50% of the US population covered by Medicare insurance have some supplemental private insurance, the MDCR database in our study includes persons covered by both Medicare and employer supplemental insurance, and may not be representative of the entire Medicare

population at risk for SLE. For example, a recent study using a 20% random sample from US Medicare insurance estimated 54,490 persons aged ≥65 had prevalent SLE in 2016. [6] The corresponding projection using the MDCR database in our study was 60,000. Our estimate was only slightly higher, which may be explained by differences in the study populations as well as in the definitions of prevalent SLE between the two studies. Li and colleagues [6] defined prevalent SLE by requiring all the SLE criteria to be met in the cohort year 2016, whereas our study defined prevalent SLE by requiring all the SLE criteria to be met during or before 2016. Because of the flare/remission disease patterns of SLE, [14] our more sensitive definition could have captured prevalent SLE cases who happened to be inactive or in remission in 2016 and therefore may not have met the inclusion criteria applied by Li and colleagues. [6]

Another limitation of our study is that we could not identify persons overlapping with multiple insurance types from the four databases. Adding the projected SLE cases across different insurance types may overestimate the total number of SLE cases in the US. For example, Li and colleagues reported about 13% of SLE patients had dual Medicare and Medicaid coverage. [6] However, we expect the overlap between Medicare and Medicaid in CCAE and Optum to be lower given Medicare supplemental coverage. Finally, our study showed extensive health care utilization by SLE cases across the individual insurance types in calendar year 2016, especially for Medicaid.

List Of Abbreviations

SLE, systemic lupus erythematosus; US, United States; CCAE, IBM MarketScan® Commercial database; MDCR, IBM MarketScan® Medicare Supplemental database; Optum, Optum De-identified Clinformatics® Data Mart Databases; MDCD, IBM MarketScan® Multi-state Medicaid database.

Declarations

Ethics approval (include appropriate approvals or waivers)

This study used IBM® Marketscan® and Optum® retrospective administrative claims data. Data were de-identified and comply with the Health Insurance Portability and Accountability Act and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The use of the IBM® Marketscan® and Optum® databases was reviewed by the New England Institution Review Board (IRB) and was determined to be exempt from broad IRB approval, as this research project did not involve human subject research. Informed consent was not obtained as this research project did not involve human subject.

Consent to participate

Not applicable.

Availability of data and material

The data underlying this article were made available to the authors by third-party license from IBM MarketScan®, and Optum®, commercial data providers in the US. Under the licensing agreement, the authors cannot provide the raw data themselves. Other researchers could access the data by purchase through IBM MarketScan® and Optum®; and the inclusion criteria specified in the Methods section would allow them to identify the same cohort of patients we used for these analyses.

Code availability (software application or custom code)

The common data model (CDM) methods are openly available from https://www.ohdsi.org/data-standardization/the-common-data-model/. Specific diagnosis and drug codes in the study are provided in the Supplemental Materials.

Competing interests

YW, LLH, CSK, DMK, MB, KD and KS are all current employees of Janssen Pharmaceutical companies; all authors were employees of Janssen Pharmaceutical companies at the time of this study, which was conducted as part of their employment.

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Authors' contributions

YW, JL, SR and KS contributed to the conception of the study; all authors contributed to the design of the study; LLH, DMK, MB contributed to the acquisition of data and analysis; all authors contributed to the interpretation of data, drafting and revising the manuscript critically for important intellectual content; all authors approved of the version submitted.

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Consent for publication

Not applicable.

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Tables

Table 1. Estimated total number of prevalent SLE patients in the US, by major civilian health insurance, 2016

	Projection to Private insurance population		**Projection to Medicaid population**
Age categories	CCAE (age<65) and MDCR (age≥ 65) [1]	Optum (all ages) [2]	MDCD[3]
<18			
Female	2,465	2,214	2,148
Male	357	329	426
18-64			
Female	259,502	311,904	80,425
Male	23,067	29,975	6,367
≥65			
Female	52,784	53,125	8,994
Male	7,501	6,799	524
Total (rounding)	345,000	404,000	99,000

[1] based on estimated age, sex-specific prevalence proportion from CCAE (age<65) and MDCR (age≥65) multiplied by US census age and sex-specific counts of persons with private insurance in 2016; age

categories were <18, 18-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64 in CCAE and 65-74, ≥75 in MDCR.

[2] based on estimated age, sex-specific prevalence proportion from Optum multiplied by US census age and sex-specific counts of persons with private insurance in 2016; age categories were <18, 18-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-74, ≥75 in Optum (separately done in those age<65 and age≥65).

[3] based on estimated age, sex-specific prevalence proportion from MDCD multiplied by US census age and sex-specific counts of persons with Medicaid insurance in 2016; age categories were <18, 18-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-74, ≥75 in MDCD.

Table 2. Characterization of prevalent SLE patients and their healthcare utilization across 4 US databases, 2016

	CCAE	MDCR	OPTUM	MDCD
Total N	**28,846**	**4,281**	**23,877**	**15,096**
Women, n (%)	26,476 (91.8)	3,759 (87.8)	21,568 (90.3)	13,979 (92.6)
Mean age (SD), years	47 (12)	72 (7)	56 (15)	45 (15)
Number of visits, median (interquartile range)				
for any healthcare encounter	17 (10-30)	25 (15-41)	20 (11-35)	25 (13-49)
with an SLE diagnosis	4 (2-7)	3 (2-5)	4 (2-7)	4 (2-8)
Number of patients with ≥1 hospitalization, n (%)	4,374 (15.2)	1,185 (27.7)	4,510 (18.9)	5,044 (33.4)
Median (interquartile range) length of hospital-stay, days	3 (2-6)	4 (2-8)	4 (2-6)	4 (2-6)
Co-morbidities*, n (%)				
Renal diseases	5,018 (17.4)	1,177 (27.5)	6,089 (25.5)	4,328 (28.7)
Renal dialysis/failure	2,429 (8.4)	902 (21.1)	3,970 (16.6)	2,781 (18.4)
Cardiovascular diseases				
Hypertension	10,191 (35.3)	2,999 (70.1)	11,457 (48.0)	5,218 (34.6)
Ischemic heart disease	1,031 (3.6)	545 (12.7)	2,186 (9.2)	1,433 (9.5)
Heart failure	903 (3.1)	638 (14.9)	2,275 (9.5)	2,047 (13.6)
Rheumatic heart disease	483 (1.7)	236 (5.5)	799 (3.4)	537 (3.6)
Cerebral vascular diseases	1,052 (3.7)	484 (11.3)	1,747 (7.3)	1,409 (9.3)
Neuropsychiatric conditions				
Headache (recorded on claims)	4,043 (14.0)	512 (12.0)	3,804 (15.9)	3,897 (25.8)
Psychosis	444 (1.5)	272 (6.4)	990 (4.2)	1,004 (6.7)
Epilepsy/Seizure	1,050 (3.6)	144 (3.4)	1,336 (5.6)	1,800 (11.9)
Depression	4,112 (14.3)	698 (16.3)	4,782 (20.0)	3,284 (21.8)

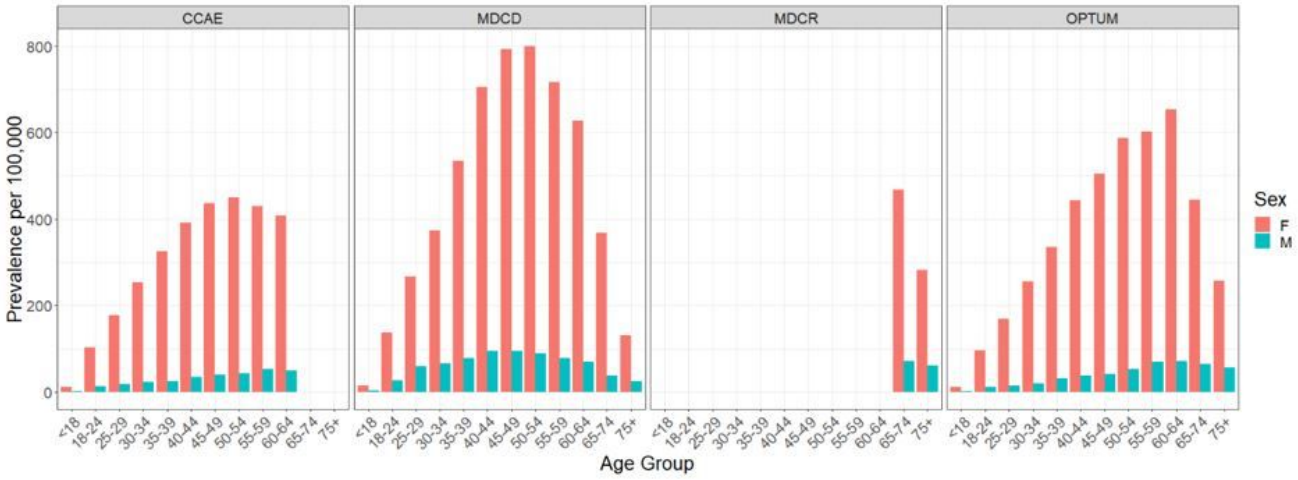
	CCAE	MDCR	OPTUM	MDCD
Total N	**28,846**	**4,281**	**23,877**	**15,096**
Cutaneous manifestations				
Cutaneous lupus	4,452 (15.4)	683 (16.0)	4,133 (17.3)	3,136 (20.8)
Dermatosis and dermatitis	3,977 (13.8)	683 (16.0)	3,412 (14.3)	2,184 (14.5)
Infections	8,778 (30.4)	1,450 (33.9)	7,955 (33.3)	6,405 (42.4)
Hospitalized infections	1,543 (5.4)	472 (11.0)	1,847 (7.7)	2,168 (14.4)
Musculoskeletal comorbidities				
Inflammatory Polyarthropathies	6,711 (23.3)	1,238 (28.9)	7,403 (31.0)	3,688 (24.4)
Spondylopathies	3,050 (10.6)	874 (20.4)	3,999 (16.8)	2,337 (15.5)
Osteoarthritis	7,257 (25.2)	2,251 (52.6)	9,360 (39.2)	5,145 (34.1)
Osteoporosis	2,351 (8.2)	1,056 (24.7)	4,051 (17.0)	1,257 (8.3)
Medication** use (any), n (%)				
Anti-malarials	18,129 (62.8)	2,275 (53.1)	12,411 (52.0)	5,324 (35.3)
Systemic corticosteroids	18,518 (64.2)	2,768 (64.7)	14,619 (61.2)	9,255 (61.3)
Non-biologic disease modifying drugs	5,906 (20.5)	660 (15.4)	3,904 (16.4)	2,423 (16.1)
Biologics	1,286 (4.5)	139 (3.2)	818 (3.4)	480 (3.2)
Any of the above	25,037 (86.8)	3,620 (84.6)	19,268 (80.7)	10,746 (71.2)

† Physician specialty is incompletely captured or unspecified in insurance claims databases, especially MDCD.

* Based on diagnosis codes, except for depression which includes anti-depressant prescriptions (codes provided in the online supplemental materials).

** Anti-malarials included artemether, lumefantrine, atovaquone, proguanil, chloroquine, halofantrine, hydroxychloroquine, mefloquine, primaquine, pyrimethamine, quinacrine, quinine, sulfadoxine, pyrimethamine, chloroquine; Non-biologic disease modifying drugs included azathioprine, chlorambucil, cyclophosphamide, cyclosporine, methotrexate, mycophenolate mofetil, mycophenolic acid; Biologics included abatacept, rituximab, tocilizumab, adalimumab, etanercept, infliximab, golimumab, certolizumab pegol, ustekinumab, secukinumab, ixekizumab, vedolizumab, belimumab

Figures



Note, see Supplemental Digital Content Supplemental Figure 1 for prevalence proportions under age 65 for MDCR.

Figure 1

Age-, and sex-specific prevalence of SLE in the 4 study databases, 2016

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SuppMaterialBMCReserachNotesSLEPrevalence.docx