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Real-world burden of systemic lupus erythematosus in the USA: a comparative cohort study from the Medical Expenditure Panel Survey (MEPS) 2016–2018

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ABSTRACT

Objective SLE is a chronic, multiorgan, autoimmune disease; however, current prevalence estimates are dated and often from non-generalisable patient populations, and quality of life and patient-reported outcomes in the real-world SLE population are not well-published. The present study used the Medical Expenditure Panel Survey (MEPS), a generalisable US data source encompassing a representative sample of regions/payers, to estimate SLE prevalence and characterise disease burden compared with non-SLE respondents.

Methods Retrospective population-based survey data weighted to the full US population from MEPS for the calendar years 2016–2018, pooled over the full study period, was used. The primary inclusion criteria included adults with self-reported SLE and either a record of SLE-related medication and/or rheumatologist visit in the calendar year. A matched-control cohort was created and the general non-SLE MEPS population was matched to MEPS SLE respondents by gender, age, region and MEPS reporting year using a 1:5 ratio.

Results From 2016 to 2018, 96 996 adults reported annual data in MEPS, of whom 154 respondents met the primary SLE definition, equivalent to 490 385 weighted number of adults with SLE. The prevalence of SLE was 195 (95% CI 149 to 242) per 100000, with greater prevalence observed in the US South, African-American/black and publicly insured people and females. SLE respondents reported limitations in physical function at 3 times greater rate (45% vs 15%; p<0.0001), higher rates of pain-limiting work (67% vs 39%; p<0.001) and feeling depressed 'nearly every day' (7% vs 2%; p<0.001) compared with non-SLE respondents. All-cause healthcare and prescription expenses were significantly higher in SLE respondents (US$17 270 vs US$8350 (p<0.0001) and US$4512 vs US$1952 (p<0.001), respectively, in 2018 US dollars).

Conclusion Wide variation of SLE prevalence exists among patients of different regional, demographic and payer groups; SLE is associated with adverse quality of life, productivity and economic outcomes compared with non-SLE respondents.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ SLE is a chronic, multiorgan autoimmune disease that carries a considerable clinical, humanistic and economic burden.

WHAT THIS STUDY ADDS

⇒ The present study provides recent data from 2016 to 2018 on SLE prevalence, demographics and clinical characteristics across a generalisable spectrum of respondents within the US population, which includes commercially and publicly insured individuals, as well as those who are uninsured.

⇒ In addition to supporting previous findings, the present study contributes further by establishing a matched non-SLE population as a reference to ascertain the relative burden of SLE in comparison to a general non-SLE population.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE AND/OR POLICY

⇒ The increased SLE prevalence in recent years and the continuing burden of disease suggests a need to better understand these patient characteristics so that management approaches can be personalised, including the use of more effective therapeutics, as well as patient support for those demonstrating higher risks and unmet needs.

INTRODUCTION

SLE is a chronic, multiorgan, autoimmune disease estimated to affect 73 to 178 people per 100 000 in the USA, largely based on data from the early 2000s.[1] The aetiology is multifactorial and may include genetic, hormonal and environmental factors.[2–4] A twofold risk of premature mortality exists for individuals with SLE compared with healthy controls.[5]

SLE carries a considerable humanistic burden; the quality of life of individuals with SLE is consistently lower than that of matched healthy controls, or those with other chronic

diseases such as rheumatoid arthritis or chronic obstructive pulmonary disease.[6] Previous findings have also established an increased economic burden for adults with SLE compared with controls. However, much of what is currently known about SLE healthcare resource utilisation (HCRU) patterns and costs is based on analyses conducted before 2011 or is conducted largely within a commercially insured administrative claims environment, which may under-represent certain patient groups within the USA, such as the underserved or underinsured population, who may be more prone to adverse clinical outcomes.[7–9]

In addition to the existing body of evidence being >10 years old and non-generalisable to all patient types, socioeconomic data, quality of life and patient-reported outcomes affecting access to care, indirect costs and day-to-day life in the real-world SLE population are not well-published. A recent meta-analysis generated an estimate of SLE prevalence by applying sex-stratified/race-stratified estimates to the 2018 US Census population but used a random-effects model based on various US state-specific registry case findings from either 2002 to 2004 or 2007 to 2009.[10] Importantly, no SLE study to date has been generalisable to the full US population, including the public, private and uninsured population. Thus, the present study aimed to use Medical Expenditure Panel Survey (MEPS) data, a generalisable US data source encompassing a representative sample of geographic regions and payers, to estimate SLE prevalence, as well as evaluate demographics, comorbidities, patient-reported outcomes, medication use, HCRU and costs compared with the general population without SLE. To the authors' knowledge, no recent study has quantified the SLE population in a real-world representative US population that fully measures the disease burden in an SLE cohort to a matched-control cohort.

PATIENTS AND METHODS

Study design

This analysis used retrospective population-based survey data weighted to the full US population. Data from MEPS from the calendar years 2016–2018 were used (https://www.meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp).[11] Sponsored by the Agency of Healthcare Research and Quality, MEPS, is a nationally representative survey of the US civilian non-institutionalised population that collects person-level and household-level information on respondents' sociodemographic characteristics, health status, access to care, clinical diagnosis and related charges and payments. MEPS survey includes stratification, clustering, multiple stages of selection and disproportionate sampling. Furthermore, the MEPS sampling weights reflect adjustments for survey non-response and adjustments to population control totals from the Current Population Survey. The survey design and estimation include variables to obtain weighted estimates and implement a Taylor-series approach to estimate SEs for weighted survey estimates. Each year of data was treated independently and then pooled by using weighted averages per MEPS methodology over the full study period (2016–2018).

Population

The primary inclusion criteria consisted of adults aged 18 years or older, with both self-reported SLE and either a record of SLE-related medication and/or rheumatologist visit in the calendar year. SLE-related medications were composed of the standard treatment classes for SLE, including antimalarials, oral corticosteroids, intravenous/injectable corticosteroids and immunosuppressive agents. Patients with SLE were initially identified from MEPS based on the three-digit code (M32) in the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). Following initial SLE ICD-10-CM criteria, the presence of a rheumatologist visit or SLE-related medication was assessed. Additional definitions for SLE were used to assess prevalence: (1) any SLE self-reported diagnosis and (2) self-reported SLE diagnosis along with a record of SLE-related medication.

A recent published abstract compares the sensitivity across multiple definitions for SLE in MEPS, including any SLE self-reported diagnosis, and a self-reported SLE diagnosis along with a record of SLE-related medication.[12]

Study end points

The primary end points of the study included prevalence of SLE, demographic and socioeconomic variables (age, gender, geographic region, race/ethnicity, household income, insurance status, disability, employment status, poverty status); patient-reported quality of life, access to care and work productivity (perceived health, perceived mental health, health limitation to activity, difficulty performing tasks, pain that limits work, feeling depressed, annual disability days); comorbid conditions and use of prescribed medications and HCRU and cost by setting (inpatient, outpatient, emergency room). Costs were adjusted using the gross domestic product price index to 2018 US dollars.

Comorbid conditions in the MEPS Medical Conditions file were assessed based on: (a) "Has a physician ever diagnosed you with X condition?" and (b) "Do you currently have X condition?" The conditions in the Medical Conditions file were coded based on the three-digit ICD-10-CM code as part of the deidentification process; therefore, the ability to look at fourth or fifth digit-specific codes was not possible. The condition categories in MEPS are defined using Clinical Classification Software (CCS) and Clinical Classification Software, which is a tool developed by the Agency for Healthcare Research and Quality for clustering diagnoses into a manageable number of clinically meaningful, policy-relevant categories. CCS codes were also used to evaluate specific condition categories. Comorbid conditions of interest for this study were identified based on clinician input.

Medications in the MEPS Prescribed Medications files were coded as text name and National Drug Code and rolled up into predefined therapeutic classes. Medications and classes of interest for this study were identified based on clinician input.

HCRU and healthcare cost data were found in the MEPS Full Year Consolidated Data file.[11] Costs were defined as total medical expenditures and total prescription expenditures. HCRU variables included the number of office-based, inpatient, outpatient and emergency room visits, and the number of prescriptions. Cost variables were reported in 2020 US dollars and adjusted for the Consumer Price Index.

All variables are included in the supplementary table of operational definitions (online supplemental table 3).

Statistical methods

A matched-control cohort was created using annual survey participants; the general non-SLE MEPS population was matched to MEPS SLE respondents by gender, age (birth year), geographic region and year of reporting within MEPS (ie, 2016, 2017 or 2018) using a 1:5 ratio. The MEPS population sample is taken from a complex national probability sample survey of the US civilian non-institutionalised population. All analyses were inclusive of MEPS sampling weights, which adjusted for survey non-response with poststratification adjustments for age, race/ethnicity and gender using the Census Bureau's population control totals.[11] Variance (SEs) estimates were based on the Taylor-series linearisation method. For the Taylor-series method for continuous variables, the means were calculated using the df for the t-test as the number of clusters minus the number of strata. If there were no clusters, then the df equaled the number of observations minus the number of strata. If the design was not stratified, then the df equaled the number of primary sampling units minus one. For categorical variables, a weighted second-order Rao-Scott χ^2 test was applied, which uses the design effects of the marginal proportion estimates. In short, the complex weighting established and recommended by the Agency for Healthcare Research and Quality uses the marginal probabilities of the patient characteristics within the sample to determine the full US population estimate.

Statistical analyses were conducted in all cohorts for each outcome, with pooled data representing the average annual estimate across the 3 years of data. Descriptive statistics (per cent, means, medians, SD) were used to describe patient demographic characteristics (age, gender, region, etc), clinical characteristics (treatments, comorbidities, etc) and outcomes both overall and across comparator groups; χ^2 tests were used to evaluate differences in categorical variables and t-tests or Wilcoxon rank-sum test was used for continuous variables depending on the distributional properties of the measures. Prevalence estimates were calculated annually using the weighted number of patients with SLE divided by the total adult population and displayed as per 100 000 adults. The annual estimates were averaged across all years of data using MEPS-cited methods.[11] All analyses were conducted in SAS V.9.2 (Cary, North Carolina, USA).

RESULTS

Study population

From 2016 to 2018, a total of 96 996 adults reported annual data in MEPS, of whom 154 (0.16%) respondents self-reported SLE with either a filled SLE-related medication and/or rheumatologist visit within the calendar year. All results below are weighted to the general US population using the MEPS sampling weights derived by the Agency of Healthcare Research and Quality described above. Weighted estimates represent the average annual estimated US population over the 3 years of study (2016–2018). The weighted total annual US adults were estimated to be 250 935 390 over the 2016–2018 period. After weighting, the 154 respondents self-reporting SLE equated to 490 385 adults in the USA. A total of 770 matched non-SLE controls (weighted to 2 625 426) were compared with the SLE cohort.

Epidemiology and demographic/socioeconomic trends

The pooled annual prevalence of SLE using the predetermined primary SLE definition was 195 (95% CI 149 to 242) per 100 000 adults. For other definitions of SLE, the prevalence ranged from 168 per 100 000 adults to 261 per 100 000 adults (table 1). From 2016 to 2018, the prevalence of SLE (using the primary definition) appeared to increase slightly, from 188 per 100 000 adults in 2016 to 208 per 100 000 adults in 2018. This trend of increasing prevalence over time was also observed when using self-reported SLE alone as a definition, but not self-reported SLE combined with SLE-related medication (online supplemental table 1).

Geographically, respondents in the Southern region of the USA had a slightly higher prevalence of SLE compared with other regions (North, West or East). The prevalence of SLE was about 9 times higher in females compared with males (343 vs 37 per 100 000 adults). Individuals who reported black or multiple races appeared to have a higher prevalence of SLE compared with white individuals. In particular, the prevalence of SLE was higher in black adults 287 (95% CI 162 to 412) per 100 000 compared with white adults 187 (95% CI 133 to 241) per 100 000 (online supplemental table 1). Respondents with public insurance (Medicare or Medicaid) were twice as likely to have SLE than those with private insurance (prevalence was 311 for those reporting only public insurance vs 168 per 100 000 adults for those reporting any private insurance).

Several demographic and socioeconomic differences were observed between SLE respondents and non-SLE respondents (table 1). In total, 60% of SLE respondents reported private insurance at some point within the MEPS reporting year, 28% Medicaid, 32% Medicare,

Table 1 Weighted prevalence by SLE definition and overview of demographics and socioeconomic characteristics for US population with SLE versus controls without SLE

	MEPS 2016–2018 pooled data		
Prevalence			
Definition	**Prevalence per 100 000 adults (95% CI)**	**Estimated average annual no. of adults with SLE**	
Self-reported SLE and SLE-related medication or rheumatologist visit (primary definition)	195 (149 to 242)	490 385	
Self-reported SLE and SLE-related medication	168 (130 to 206)	422 604	
SLE self-reported diagnosis only	261 (203 to 319)	655 547	
Demographics			
	SLE	**Non-SLE**	**P value**
Total weighted, N	490 385	2 625 426	
Age (years)			
Mean (SD)	49 (1.4)	50 (0.7)	NS†
Median	48.8	51.7	
Gender, %			NS†
Male	9.2	5.6	
Female	90.8	94.4	
Geographic region, %			NS†
Northeast	16.0	16.3	
Midwest	21.7	22.1	
South	46.6	41.6	
West	15.7	19.9	
Insurance, %			
Private	59.6	72.1	*
TRICARE/Civilian Health and Medical Programme of the Department of Veterans Affairs	3.5	4.1	NS
Medicare	31.6	19.4	**
Medicaid/State's Children's Health Insurance Programme	28.3	15.0	**
Both Medicare and Medicaid	9.0	3.1	**
Uninsured	4.8	6.2	NS
Health insurance coverage indicator, %			***
Any private	60.0	75.6	
Public only	35.2	18.3	
Uninsured	4.8	6.2	
Race, %			NS
White—no other race reported	74.3	76.8	
Black—no other race reported	18.2	13.3	
Other race (only single-race answers were reported)	2.9	6.5	
Multiple races reported	4.6	3.3	
Physician visits, %			
Rheumatologist was seen during the calendar year	68.8	2.6	***
General practitioner was seen during the calendar year	40.7	33.5	NS

Continued

Table 1 Continued

	MEPS 2016–2018 pooled data		
Other type of physician was seen during the calendar year	89.5	66.6	***
Socioeconomic status			
Education level completed, %			NS
≤Grade 12	33.3	35.0	
1–2 years college	19.8	24.1	
3–4 years college	28.2	25.9	
5+ years college	18.7	14.5	
Unknown	0.0	0.5	
Family income, US$			*
Mean (SD)	US$71 507 (US$7643)	US$88 270 (US$2715)	
Median	US$46 925	US$70 624	
Employment, %			**
Employed at interview date	47.4	65.8	
Job to return to at interview date	2.6	0.5	
Not employed at interview date	49.9	33.6	
Unknown	0.0	0.1	
Unemployed reason, %			N/A
Retired	9.1	9.0	
Unable to work ill/disabled	17.2	5.9	
Taking care of home/family	3.2	3.8	
Other	1.5	2.0	
Unknown	69.0	79.4	
Food stamps, %			***
Yes	20.5	8.6	
No	78.3	89.3	
Unknown	1.2	2.1	
Problem paying bills, %			**
Yes	23.6	12.0	
No	75.6	87.5	
Unknown	0.8	0.5	
Poverty status, %			**
Negative or poor	22.2	9.2	
Near-poor	3.3	3.8	
Low income	10.6	10.3	
Middle income	25.9	25.8	
High income	38.1	50.9	

*p<0.05; **p<0.01; ***p<0.001.
†Non-SLE respondents were matched to SLE respondents based on age, gender and geographic region.
MEPS, Medical Expenditure Panel Survey; N/A, not available; NS, not significant.

5% uninsured and 4% TRICARE/Civilian Health and Medical Programme of the Department of Veterans Affairs. Overall, 9% of SLE respondents reported both Medicare and Medicaid coverage. In contrast, a higher percentage of non-SLE respondents reported private insurance (72%), and a lower percentage reported public insurance (19% and 15% for Medicare and Medicaid, respectively). SLE respondents on public insurance were also observed to be more likely female and of lower education status. SLE respondents were more likely to be only publicly insured compared with non-SLE respondents (35% vs 18%; p<0.001), have lower median family income

(US$46 925 vs US$70 624; p<0.05) and higher unemployment (50% vs 34%; p<0.001); however, education level did not differ compared with the non-SLE respondents (p>0.05).

Quality of life, work productivity and access to care

In general, SLE respondents reported worse quality of life and physical/health status than non-SLE respondents (table 2). Greater proportions of SLE respondents reported 'poor' or 'fair' perceived health, compared with non-SLE respondents (p<0.0001). SLE respondents reported notable physical limitations; 45% of SLE respondents compared with 15% of non-SLE respondents reported a limitation in physical function (p<0.0001). Among respondents reporting a physical limitation, SLE respondents were more than twice as likely to report being unable to stand for 20 min, and unable to walk three blocks or walk a mile compared with non-SLE respondents (p<0.05 for both). SLE respondents were also significantly more likely to report poorer perceived mental health (p<0.0001) and feeling depressed (p<0.001).

SLE respondents responded that 'pain limits work' ('a little bit', 'moderately', 'quite a bit' or 'extremely') at a significantly higher rate compared with non-SLE respondents (67% vs 39%; p<0.001) (table 2). Additionally, SLE respondents reported a numerically higher average of 9 days (SD 2.3) of work missed due to illness/injury, whereas non-SLE respondents reported 5 days (SD 0.4) (p=0.13) (table 2).

The variables from the MEPS database that assessed access to care were not available in the 2018 data; therefore, only pooled data from 2016 to 2017, addressing access to medical and pharmacy services were analysed (online supplemental table 2). More SLE respondents reported 'delaying getting necessary care' (14% vs 5% (p=0.0001)), 'unable to pay family medical bills' (16% vs 5% (p=0.001)) and 'delayed prescription' (8% vs 4% (p=0.0465)), compared with the non-SLE cohort. In the adults with SLE, the most common reason cited for delaying care was 'could not afford care' (5%).

Comorbidities and SLE manifestations

Comorbidities and SLE disease manifestations where a statistically significant difference was observed between SLE versus non-SLE adults included joint pain in the last 12 months (63% vs 33%; p<0.0001), arthritis (ever diagnosed) (61% vs 29%; p<0.0001), hypertension (39% vs 26%; p<0.01), asthma (ever diagnosed) (27% vs 13%; p<0.01) and heart disease (ever diagnosed) (24% vs 8%; p<0.0001) (figure 1).

HCRU and costs

SLE adults had a higher number of office-based, inpatient, outpatient and emergency room visits compared with non-SLE respondents (table 3). All-cause healthcare and prescription expenses were twice as high in SLE adults compared with non-SLE adults (US$17 270 vs US$8350 (p<0.0001) and US$4512 vs US$1952 (p<0.001), respectively, in 2018 US dollars).

DISCUSSION

To the authors' knowledge, this is the first study in >10 years to characterise the burden of an SLE cohort versus a matched non-SLE cohort based on a representative sample of the US population, which proportionally included respondents across insurance types, races and geographical areas, including the traditionally underserved and underinsured populations. In the present study, data from this cohort were analysed for prevalence and demographic patterns, and quality of life, access to care, work productivity, comorbidities and economic burden.

The present study found that SLE prevalence (based on the primary definition) was 195 per 100 000 adults, and was highest in females compared with males, in public insurance compared with private or uninsured and in black respondents compared with white respondents. The prevalence found in the present study demonstrated a slightly higher burden than prior estimates of between 0.05% and 0.1% of the population from national survey data,[13] and found a similar prevalence in the Medicare population (260 per 100 000 adults) compared with a 0.3% prior estimate from a Medicare-only population.[14] Additionally, the SLE prevalence was substantially higher than the 72.8 per 100 000 found in a meta-analysis based on data from the calendar years 2002 to 2009.[10] The findings from the present study, specifically the prevalence of 311 per 100 000 for public insurance vs 168 per 100 000 adults for private insurance, were also consistent with previous reports that found a higher prevalence of SLE in Medicaid and low-income populations.[15] Regarding the prevalence of SLE among subsets of various demographic groups, other studies have similarly reported the SLE burden to be highest in females, racial minorities and lower socioeconomic status.[10 15–17] Unlike recently published estimates, MEPS is more representative of the US racial and payer composition. This representativeness could lead to higher than previously published prevalence estimates from less diverse or single-payer analyses. It should be noted that SLE is self-reported in MEPS; therefore, it is possible that patients could over-report or under-report their diagnosis due to recall bias. The prevalence of SLE, as well as flare severity, has also been previously found to be higher in black respondents versus white respondents.[1 18]

While many real-world studies include only administrative claims from commercial payer populations, the present study, which uses data from a generalisable US population, confirms a wide variation of SLE prevalence by different regional, demographic and payer groups uncaptured in other publications. The higher overall prevalence (261 per 100 000) found using the alternative definition of self-reported SLE alone in the present study suggests that while commonly used in market-centric or

Table 2 Weighted patient-reported quality of life metrics for SLE versus non-SLE respondents

	MEPS 2016–2018 pooled data		
	SLE	**Controls**	**P value**
Perceived health			
Total weighted, N	490 385	2 625 426	
Perceived health, n (%)			***
Excellent	7.7%	23.3%	
Very good	16.9%	35.9%	
Good	28.3%	27.8%	
Fair	22.5%	10.6%	
Poor	24.6%	2.3%	
Perceived mental health, n (%)			***
Excellent	20.8%	34.3%	
Very good	28.4%	32.6%	
Good	30.3%	28.2%	
Fair	17.9%	4.3%	
Poor	2.6%	0.6%	
Felt depressed in the last 2 weeks			***
Not at all	52.9%	69.6%	
Several days	24.9%	14.1%	
More than half the days	6.5%	4.4%	
Nearly every day	6.7%	1.6%	
DK/Refused/Inapplicable	9.0%	10.2%	
Pain limits work, n (%)			***
Not at all	26.3%	52.3%	
A little bit	16.6%	23.0%	
Moderately	15.1%	7.4%	
Quite a bit	22.7%	6.1%	
Extremely	12.2%	2.5%	
DK/Refused/Inapplicable	7.1%	8.6%	
Days missed work due to illness/injury, mean (SD)			NS
Mean	9 (2.3)	5 (0.4)	
Median	2.1	0.2	
Limitations in physical functioning			
Limitation in physical functioning, n (%)			
Yes	45.1%	15.3%	***
No	54.4%	84.6%	
DK/Refused/Inapplicable	0.5%	0.1%	
Among respondents reporting limitations in physical functioning			
Unable to walk 1 mile	56.6%	33.3%	**
Unable to walk three blocks	41.0%	21.7%	*
Unable to stand 20 min	35.3%	11.6%	**
Unable to walk up 10 steps	8.2%	5.9%	NS
Unable to reach overhead	5.1%	2.4%	NS

*p<0.05; **p<0.01; ***p<0.001.
DK, do not know; MEPS, medical expenditure panel survey; NS, not significant.

patient-centric research, it may be too general or sensitive a definition in capturing true SLE cases. On the other hand, electronic medical records/site-based studies tend to capture only treated patients, excluding undertreated, underserved populations. Thus, a key takeaway is that for ill-defined or poorly understood conditions such as

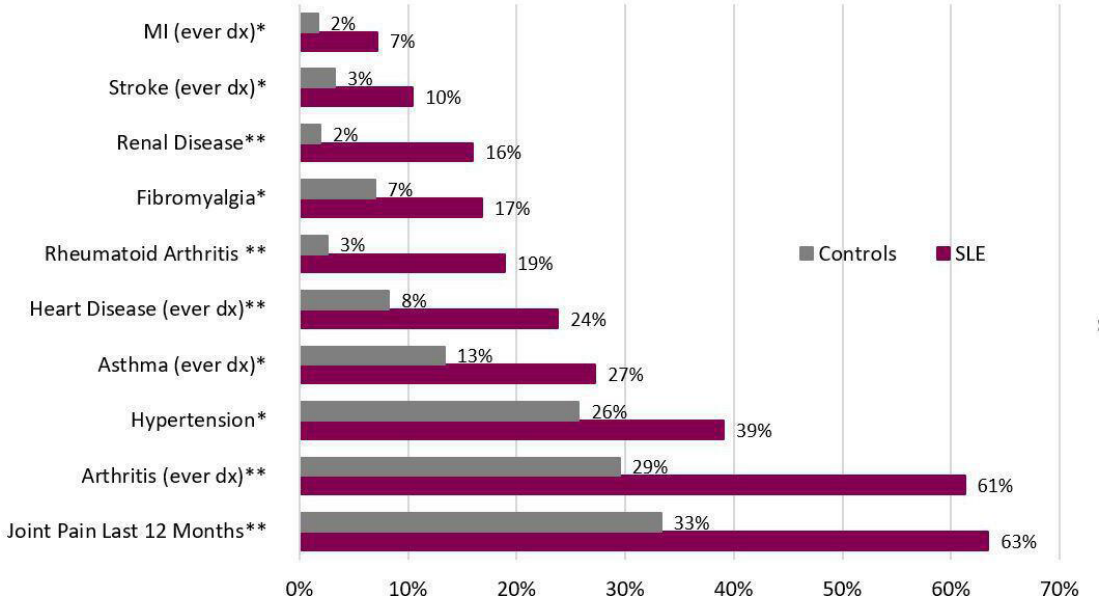

Figure 1 Weighted significant comorbidities and SLE manifestations† in SLE versus non-SLE respondents. dx, diagnosis; MI, myocardial infarction. †Comorbidities in the year of patient-reported SLE, unless ever diagnosed is noted with 'dx', which implies it could be at any point prior to the study year. *p<0.01; **p<0.001.

SLE, where wide demographic and regional variation exists, it is important to understand the range of possible

Table 3 Weighted-unadjusted annualised all-cause costs and HCRU in SLE versus non-SLE respondents

MEPS 2016–2018 pooled data			
Measures	**SLE**	**Controls**	**P value**
Total weighted, N	490 385	2 625 426	
Unadjusted costs (2018 US dollars)			
Total healthcare expenses			
Annual mean (SE)	17 270 (1762)	8350 (868)	**
Total prescription expenses			
Annual mean (SE)	4512 (510)	1952 (547)	**
HCRU			
Office-based provider visits, %†	97.7%	82.1%	
Annual mean (SE)	18.3 (1.7)	10.4 (0.5)	**
Outpatient department visits, %‡	44.6%	21.8%	
Annual mean (SE)	5.6 (1.2)	2.2 (0.1)	*
Emergency room visits, %	31.2%	15.9%	
Annual mean (SE)	2.5 (0.1)	1.4 (0.0)	**
Inpatient visits, %	16.7%	11.4%	
Annual mean (SE)	1.7 (0.1)	1.3 (0.0)	**
Number of medications, including refills			
Annual mean (SE)	38.4 (3.5)	14.2 (0.7)	**

*p<0.01; **p<0.001.
†An office-based provider visit was defined as any visit made to a physician or group practice office, medical clinic, managed care plan or health maintenance organisation centre, neighbourhood/family/community health centre, surgical centre, rural health clinic, company clinic, school clinic, walk-in urgent centres, veterans affairs facility or laboratory/X-ray facilities. They are not necessarily mutually exclusive with outpatient department visits (defined below).
‡An outpatient visit/use/event is any visit made during the person's reference period to a hospital outpatient department, such as a unit of a hospital or a facility connected with a hospital, providing health and medical services to individuals who receive services from the hospital but do not require hospitalisation overnight.
HCRU, healthcare resource utilisation; MEPS, Medical Expenditure Panel Survey; NS, not significant.

prevalence values and how patient-level characteristics or disparities can influence these results.

In the present study, respondents with SLE reported poorer perceived mental and physical health. They reported more physical limitations than non-SLE respondents, as well as a higher prevalence of unemployment and decreased access to care. This is consistent with prior published reports; in a systematic review of 12 studies (including participants from the USA and Europe) on employment and disability in SLE, the prevalence of inability to work or cessation of work ranged from 15% to 51% across studies and 20% to 32% of adults with SLE received disability benefits.[19] A further systematic review found that patient-reported outcomes of activities of daily living, fatigue, physical health, emotional health, pain, work disability and employment were adversely affected.[6 20] In a separate analysis of the Georgia Lupus Registry from 2014, 49% experienced work loss, with black individuals affected twice as often as white individuals.[21]

Many comorbidities or SLE manifestations—including joint pain in the last 12 months (63%), arthritis (ever diagnosed) (61%), hypertension (39%), asthma (ever diagnosed) (27%) and heart disease (ever diagnosed) (24%)—were statistically higher in SLE respondents compared with non-SLE respondents. The findings of joint pain and arthritis in the present study were somewhat low relative to previous reports of up to 95% in adults with SLE,[22] potentially a function of differences in data collection between studies. Meanwhile, there was some overlap with comorbidity findings from other international retrospective studies of SLE populations: a Greek registry of adults with SLE found that the main comorbidities were thyroid (46%), hypertension (25%), depression (27%), cardiovascular (21%)[23]; while a UK registry demonstrated an increased risk of cardiovascular disease, stroke, end-stage renal failure, osteoporosis and infection.[24]

The odds of having an outpatient or emergency room visit in the SLE cohort versus non-SLE cohort were significantly higher in the present study. These findings were similar to those from a 2013 Medicare retrospective study, which found 2.2 times more outpatient visits and 2.1 times more emergency room visits for adults with SLE compared with non-SLE adults.[7] The proportion of adults with SLE with any office-based provider visit was 98% in the present study, which was similar to the proportions of between 86% and 100% reported in other US-based population studies.[25–27] The proportion of adults with SLE with reported emergency room visits in the present study was 31%, which fit within the reported range of 22%–58% for other US studies.[25–27]

In the present study, the annual mean per-person medical cost in adults with SLE was approximately US$17 000 (vs US$5000 in non-SLE respondents), and prescription costs were US$5000 (vs US$2000 in non-SLE respondents); both significantly higher than non-SLE respondents. The findings are similar to those from a 2013 retrospective study, which compared adults with SLE with non-SLE adults in a Medicare cohort, and found a total mean annual medical cost of US$16 881 (crude difference of US$10 229 (2008 US dollars)) in annual medical costs, similar to the US$12 000 difference observed in the present study.[12] Other studies in the literature have compared HCRU and cost differences within SLE severity levels, but have not compared SLE as a cohort against a non-SLE cohort.[7 27 28] Unsurprisingly, higher annual costs have been observed for severe SLE compared with moderate and mild forms of the condition.

Inherent limitations similar to those of any retrospective study apply to this study as well, and the accuracy of conclusions is dependent on data quality and scope. For example, it is important to note that data from MEPS may potentially under-report costs due to a lack of inclusion of a nursing home component for the years of data (2016–2018) used. MEPS is based on patient-reported disease and patient characteristics, including comorbidities and medications. Therefore, SLE and other key variables could be over (or under) reported, although it is worth noting that the Agency of Healthcare Research and Quality performs validation of random samples to ensure results are accurate by matching with provider data. Additionally, other publications have addressed the sensitivity and specificity of disease diagnoses in MEPS and have found that self-reported diagnosis is relatively accurate.[29 30] While weighted analyses represent the full US population, the target crude SLE numbers are relatively small, and as such, statistical tests should be interpreted with caution. While it is possible for type 1 error for multiple comparisons, it was implied that the study was descriptive in nature, focusing on patterns and not statistical significance. The small numbers involved precluded multivariate analyses of data; however, the SLE and non-SLE groups were well-matched by age, gender and region, and future research would ideally involve larger crude SLE numbers.

CONCLUSION

This study, based on MEPS data across a broad, generalisable spectrum of respondents (both commercially and publicly insured, as well as uninsured), established that the prevalence of SLE may be higher than reported elsewhere and has increased over recent years. Furthermore, SLE carries a more significant burden compared with controls in certain demographic groups and is associated with adverse clinical (comorbidity), quality of life, productivity and economic outcomes. Opportunities for further research include further evaluation of racial disparities and additional studies considering payer-related SLE characteristics. In addition, the continuing unmet burden of disease suggests a need for better treatment approaches, potentially including more effective therapeutics.

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Competing interests SG and EF are employees of Xcenda, which was contracted by AstraZeneca to conduct this study. Both authors received compensation from Xcenda for study-related activities (study development, analysis) and reviewing the manuscript; however, neither author received payments directly from AstraZeneca. Neither author has any other competing or financial interests to declare. MP is an employee of AstraZeneca, which contracted Xcenda to conduct this study. He is a former employee of Xcenda. He received stock awards from AstraZeneca and his former employer, Anthem. SS-jW is an employee of AstraZeneca. She received a stock award as an employee of AstraZeneca. RO was an employee of AstraZeneca at the time of manuscript development; he is now an employee of Horizon Pharma.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Although this study involved patient-reported data from the Medical Expenditure Panel Survey, these data are publicly available and deidentified by the Agency of Healthcare Research and Quality; thus, no institutional review board approval was required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. Data from the Medical Expenditure Panel Survey: Data for Social, Economic and Health Research. Download data files, documentation and codebooks at the link below. Accessed 29 November 2021 (https://www.meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp).

Author note RO is a former employee of Astra Zeneca.

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