The Impact of Psychiatric Comorbidity on Health Care Utilization for Youth with Newly Diagnosed Systemic Lupus Erythematosus

Alaina Davis[1] 0000-0003-2716-2491
Jennifer Faerber[2]
Kaveh Ardalan[3] 0000-0002-5552-4501
Hannah Katcoff[4]
Marisa Klein-Gitelman[5] 0000-0001-7118-3439
Tamar B. Rubinstein[6] 0000-0001-8170-9377
Zuleyha Cidav[7] 0000-0003-4323-0175
David S. Mandell[8]
Andrea Knight[9] 0000-0003-4278-9049

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[1] A Davis, MD, MPH; Department of Pediatrics, Division of Pediatric Rheumatology, Monroe Carell Junior Children's Hospital at Vanderbilt, Nashville, TN, USA
[2] J Faerber, PhD; Data Science and Biostatistics Unit, Department of Biomedical and Health Informatics, Children's Hospital of Philadelphia, Philadelphia, PA, USA
[3] K Ardalan, MD, MS; Department of Pediatrics (Division of Pediatric Rheumatology), Duke University School of Medicine, Durham, NC, USA; Departments of Pediatrics and Medical Social Sciences, Ann & Robert H. Lurie Children's Hospital of Chicago, Northwestern University Feinberg School of Medicine, Chicago, IL, USA
[4] H Katcoff, MPH; Data Science and Biostatistics Unit, Department of Biomedical and Health Informatics, Children's Hospital of Philadelphia, Philadelphia, PA, USA
[5] M Klein-Gitelman, MD, MPH; Department of Pediatrics, Ann & Robert H. Lurie Children's Hospital of Chicago, Northwestern University Feinberg School of Medicine, Chicago, IL, USA
[6] TB Rubinstein, MD; Department of Pediatrics, Division of Pediatric Rheumatology, Children's Hospital at Montefiore/Albert Einstein College of Medicine, Bronx, NY, USA
[7] Z Cidav, PhD; Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, PA; Center for Mental Health, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA
[8] DS Mandell, ScD; Center for Mental Health, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA
[9] A Knight, MD, MSCE; Department of Pediatrics, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA; PolicyLab, Children's Hospital of Philadelphia Research Institute, Philadelphia, PA, USA; Division of Rheumatology, Hospital for Sick Children, Toronto, ON, CA

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Corresponding Author:
Alaina Davis
2141 Blakemore Avenue, Office 162
Nashville, TN 37232
alaina.m.davis@vumc.org

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Abstract

Objective: To examine the impact of psychiatric diagnoses on health care use in youth with systemic lupus erythematosus (SLE) during their first year of SLE care.

Methods: We conducted a retrospective cohort study using claims for 2000 to 2013 from Clinformatics™ DataMart (OptumInsight, Eden Prairie, MN). Youth ages 10-24 years with an incident diagnosis of SLE (≥3 International Classification of Diseases, Ninth Revision codes for SLE 710.0, >30 days apart) were categorized as having: 1) a preceding psychiatric diagnosis in the year before SLE diagnosis, 2) an incident psychiatric diagnosis in the year after SLE diagnosis, or 3) no psychiatric diagnosis. We compared ambulatory, emergency, and inpatient visits in the year after SLE diagnosis, stratified by non-psychiatric and psychiatric visits. We examined the effect of childhood-onset versus adult-onset SLE by testing for an interaction between age and psychiatric exposure on outcome.

Results: We identified 650 youth with an incident diagnosis of SLE, of which 122 (19%) had a preceding psychiatric diagnosis and 105 (16%) had an incident psychiatric diagnosis. Compared with those without a psychiatric diagnosis, youth with SLE and a preceding or incident psychiatric diagnosis had more health care use across both ambulatory and emergency settings for both non-psychiatric and psychiatric-related care. These associations were minimally affected by age at time of SLE diagnosis.

Conclusion: Psychiatric comorbidity is common among youth with newly diagnosed SLE and associated with greater health care use. Interventions to address preceding and incident psychiatric comorbidity may decrease health care burden for youth with SLE.

Introduction

Systemic lupus erythematosus (SLE) is a chronic autoimmune condition with significant morbidity and mortality, particularly for patients with childhood-onset disease.[1,2] Health care use associated with SLE is high,[3,4] with greatest use occurring in the first year of care.[5] Youth with SLE have higher medical costs than adults with SLE and their healthy peers,[4,6] with over 7000 hospitalizations per year.[7]

Youth with SLE represent a vulnerable population at risk for health care disparities,[3,8] and those with psychiatric comorbidity may be at further risk. One third of youth with SLE have comorbid psychiatric disorders,[9,10] the cause of which can be multifactorial due to brain inflammation, stress of chronic illness and/or its treatment. Studies of adults with SLE and those with other chronic illness have shown that comorbid psychiatric disorders increase health care use,[11,12] but this association has not been fully studied in youth with SLE. While we found in a previous study that 18% of youth with SLE had a psychiatric diagnosis prior to their SLE diagnosis and this preceding psychiatric comorbidity was associated with increased health care use prior to SLE diagnosis,[13] it remains unknown how it affects care after SLE diagnosis.

This retrospective cohort study further examines the association between psychiatric disorders and health care use in youth with SLE. Specifically, we examined the association of psychiatric comorbidity with health care visits to ambulatory and acute care settings, during the first year of care. We hypothesized that youth with SLE and psychiatric comorbidity would have lower ambulatory visits, but higher emergency visits and hospitalizations than those without these disorders, as recent studies have shown increased acute care use in children with comorbid medical and psychiatric conditions.[14,15]

Methods

Study Design: We conducted a retrospective cohort study using a large insurance claims database. Given that the dataset is de-identified, an exemption was approved for this study by the Institutional Review Boards at The Children's Hospital of Philadelphia (15-012105), Hospital for Sick Children (1000062686), and Vanderbilt University Medical Center (171241), meaning written consent and approval by a research ethics board were not required.

Data sources and sample: Administrative health care claims were extracted from Clinformatics™ DataMart (OptumInsight, Eden Prairie, MN) from 2000 to 2013. OptumInsight data are derived from a large, nationwide database of commercial health insurance and Medicare Advantage (C and D) claims. The database contains de-identified patient-level demographics, medical diagnoses, prescription drug use, and health care use for approximately 15% of U.S. residents.

We included individuals ages 10-24 years with an incident diagnosis of SLE. Diagnosis of SLE was defined using previously validated methods as having at least 3 hospital discharge or physician visit claims with an International Classification of Diseases, Ninth Revision (ICD-9) primary diagnosis code for SLE of 710.0, each at least 30 days apart.[16–18] Incident cases were defined as having at least one year of continuous claims data with no SLE codes in any position preceding the index primary diagnosis of SLE. This method has been used for identifying incident SLE cases in medical records databases[19,20] and incident rheumatoid arthritis cases using claims data.[21,22] Healthy controls were identified for comparison of psychiatric disorder prevalence by random selection from age and sex-matched enrollees during the same eligibility

period, without ICD-9 codes specifying a chronic complex condition, per the algorithm developed by Feudtner et al.[23]

Date of diagnosis, defined as date of first physician visit or admission date of first hospitalization with a SLE claim, was used as the index date. Age was determined at the index date. The study population includes both youth with childhood-onset SLE (cSLE, age 10-17 years) and youth with adult-onset SLE (aSLE, age 18-24 years). The upper age limit was selected to include youth in the process of transitioning from pediatric to adult health systems, a population at risk for suboptimal health care utilization and outcomes.[24,25] The lower age limit was set to exclude monogenic causes of very early-onset SLE. All individuals were continuously enrolled for at least 24 months. Only youth with insufficient or discontinuous enrollment during the specified study period were excluded. There were no exclusions based on disease characteristics, demographics, or comorbidities.

Exposure Groups: We categorized mutually exclusive groups of youth with SLE as those with: 1) no psychiatric diagnosis, 2) a psychiatric diagnosis in the 12 months preceding SLE diagnosis, and 3) an incident psychiatric diagnosis in the 12 months after SLE diagnosis. Psychiatric diagnoses were identified by a primary or secondary ICD-9 code pertaining to categories of depression, anxiety, adjustment disorder/acute stress, and other psychiatric disorders (Supplemental Table 1).[10] We used a single diagnosis code to capture psychiatric diagnoses due to the low sensitivity of these codes in administrative data related to undercoding.[26] We included primary and secondary diagnoses to capture comorbid medical and psychiatric diagnoses, as well as comorbid depression and anxiety diagnoses.[27]

SLE health care utilization

Outcome Measures: The primary outcome measure was the number of health care visits in the 12-month period following the index date. Health care visits were categorized as ambulatory visits, emergency visits (including urgent care), and inpatient visits (i.e. hospitalizations). Ambulatory visits were further divided into primary care, rheumatology and nephrology visits by OptumInsight provider codes. Visit categories were stratified by non-psychiatric and psychiatric visits; psychiatric visits were defined as those with a primary ICD-9 code for a psychiatric disorder.

Covariates: We included the following demographic and disease-related covariates: age, sex, race/ethnicity, household education level, geographic region, presence of lupus nephritis at or after diagnosis, presence of seizure and/or stroke disorder (as indicators of central nervous system (CNS) manifestations of SLE) at or after diagnosis, and index year. OptumInsight derives race and ethnicity from a combination of sources including public records, self-report and proprietary ethnic code tables and household education level using U.S. Census data. Household income data in this database is incomplete, precluding its use as an estimate of socioeconomic status (SES) and emphasizing the importance of including highest household education level as a covariate. We categorized geographic region based on subject residence using U.S. Census Bureau Division state groupings of Northeast, Midwest, South and West (http://www2.census.gov/geo/docs/maps-data/maps/reg_div.txt). Specific zip codes or states of residence were not available due to the de-identified nature of the data set, but the sample does include representation from all 9 U.S. census divisions. Presence of lupus nephritis was identified using a previously validated administrative claims data algorithm requiring > 2 nephrologist visits and > 2 renal ICD-9 codes.[17,18] Presence of seizure or stroke disorder was

identified by using a validated algorithm requiring at least one ICD-9 code for these conditions.[28–30]

Statistical Analysis: Two-proportion Z-tests were used to compare prevalence of psychiatric diagnoses among youth with SLE and healthy controls. Pearson chi-square tests were used to estimate differences in demographic and disease characteristics between the three exposure groups. Mean and median numbers of ambulatory visits, emergency visits, and hospitalizations per patient in the year following the index date were calculated. Length of stay for hospitalizations was tabulated. Number of prescription fills for oral glucocorticoids, hydroxychloroquine, and immunosuppressants (mycophenolate mofetil, azathioprine, leflunomide, methotrexate, calcineurin inhibitors, and cyclophosphamide) was also tabulated. To compare the number of visits among exposure groups, unadjusted and adjusted incidence rate ratios (IRR) were estimated using Poisson regression models including all above outlined covariates. As health care utilization patterns may differ among children and young adults with SLE, we examined the effect of childhood-onset vs adult-onset SLE by testing for an interaction between age group and psychiatric exposure group. We also performed secondary analyses to compare between psychiatric exposure groups: i) non-psychiatric visits to ambulatory, emergency and inpatient settings, and; ii) subcategories of ambulatory visits (primary care, rheumatology, nephrology). Data preparation and analyses were performed using SAS statistical software, version 9.4.

Results

Demographic & Disease Characteristics

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We identified 650 youth with an incident diagnosis of SLE. Table 1 summarizes demographic and disease characteristics for this population. Individuals with a preceding psychiatric disorder were slightly older and individuals with an incident psychiatric disorder were slightly younger than those with no psychiatric disorder (19.1 vs 17.6 vs 18.4 years, $p = 0.01$, respectively). There were no differences among the three groups for race/ethnicity, geographic region, household education level, and medication prescription fills. A higher proportion of individuals with a preceding psychiatric disorder or an incident psychiatric disorder had seizure/stroke disorder, compared with those without a psychiatric disorder (10% vs 14% vs 6%, $p = 0.02$).

Prevalence and Incidence of Psychiatric Comorbidity in Youth with Newly Diagnosed SLE

Psychiatric diagnoses were present for 35% of youth with newly diagnosed SLE (Figure 1). Psychiatric diagnoses preceding SLE diagnosis were present in 122 (19%) individuals, and incident psychiatric diagnoses after SLE diagnosis were present in 105 (16%) individuals. Depression was diagnosed in 117 (18%) individuals, 65 (10%) with a preceding diagnosis and 52 (8%) with an incident diagnosis. Anxiety was diagnosed in 78 (12%) individuals, 46 (7%) had a preceding diagnosis and 32 (5%) had an incident diagnosis. Adjustment disorders were diagnosed in 65 (10%) individuals, 30 (5%) had a preceding diagnosis and 35 (5%) had an incident diagnosis. Other psychiatric disorders were diagnosed in 110 (17%) individuals including schizophrenic, bipolar, delusional, dissociative, attention deficit, conduct, learning, substance-related and eating disorders.

We identified 575 age- and sex-matched controls for comparison of psychiatric disorder prevalence. The prevalence for each psychiatric disorder was significantly lower among controls than among youth with SLE. Depression was diagnosed in 68 controls (11.8% vs 18%, $p < 0.01$),

anxiety in 43 controls (7.5% vs 12%, $p < 0.01$), adjustment disorder in 23 controls (4% vs 10%, $p < 0.001$), and other psychiatric disorders in 46 controls (8% vs 17%, $p < 0.001$).

Association of Psychiatric Comorbidity with Overall Health Care Use

Table 2 summarizes health care use for youth with SLE during the first year of care, including non-psychiatric and psychiatric visits to ambulatory, emergency, and inpatient settings. Table 3 shows results of multivariable regression models testing the association between psychiatric comorbidity and overall health care use. Compared with youth with no psychiatric disorder, youth with a preceding psychiatric diagnosis had more ambulatory visits (incident rate ratio (IRR)=1.4, 95% CI 1.2-1.6, $p < 0.001$) and more emergency visits (IRR=1.4, 95% CI 1.1-1.9, $p < 0.05$). Compared with youth with no psychiatric disorder, youth with incident psychiatric disorders had more ambulatory visits (IRR=1.6, 95% CI 1.4-1.9, $p < 0.001$) and more emergency visits (IRR=1.7, 95% CI 1.3-2.2, $p < 0.001$). The median number of hospitalizations was not significantly different between groups. Also, the length of stay per hospitalization was not significantly different between groups (no psychiatric diagnosis (mean 5.9, SD 6.5), preceding psychiatric diagnosis (mean 5.4, SD 6.4), and incident psychiatric diagnosis (mean 5.7, SD 7.0). Of the 227 individuals with a psychiatric diagnosis (preceding or incident), 23 (10.1%) had a single outpatient psychiatric visit during the first year after SLE diagnosis, 56 (24.7%) had more than one psychiatric visit, and 148 (65.2%) had no psychiatric visits.

Effect of Age Group on Association of Psychiatric Comorbidity with Overall Health Care Use

Table 4 summarizes results of the analysis to assess the effect of age at onset (cSLE vs aSLE) on the association of psychiatric comorbidity with overall health care use. For youth with a

preceding psychiatric diagnosis, ambulatory care differed by age group in comparison to those with no psychiatric diagnosis (cSLE IRR=1.2 (95% CI, 1.1-1.3, p < 0.01), aSLE IRR=1.5 (95% CI 1.4-1.6, p < 0.001)). Emergency visits also differed by age group for youth with a preceding psychiatric diagnosis, compared with those no psychiatric diagnosis (cSLE IRR=1.1 (95% CI 0.9-1.2, p-value > 0.05), aSLE IRR=1.8 (95% CI 1.6-2.0, p < 0.001). There was no significant interaction by age group for hospitalizations for those with a preceding psychiatric diagnosis.

For youth with a incident psychiatric diagnosis, there was no significant interaction by age group for ambulatory care visits. Emergency visits differed by age group for youth with an incident psychiatric diagnosis, compared to those with no psychiatric diagnosis (cSLE IRR=2.1 (95% CI 1.8-2.3, p < 0.001), aSLE IRR=1.6 (95% CI 1.5-1.9, p < 0.001). Hospitalizations also differed by age group for youth with an incident psychiatric diagnosis, compared to those with no psychiatric diagnosis (cSLE IRR=2.0 (95% CI 1.7-2.3, p < 0.001), aSLE IRR=1.0 (95% CI 0.8-1.3, p-value > 0.05).

Association of Psychiatric Comorbidity with Non-Psychiatric Health Care Use & Subcategories of Ambulatory Non-Psychiatric Care

Results from the secondary analysis examining non-psychiatric health care use showed differences by psychiatric comorbidity group (Figure 2). Youth with no psychiatric disorder did not differ from youth with preceding psychiatric diagnoses in non-psychiatric ambulatory visits (adjusted IRR 1.2 [95% CI 1.0, 1.4, p > 0.05]), but those with an incident psychiatric diagnosis had more ambulatory visits (adjusted IRR 1.5 [95% CI 1.3, 1.7, p < 0.0001]). Non-psychiatric emergency visits were also higher for both those with preceding (adjusted IRR 1.37 [95% CI 1.02, 1.85, p < 0.05]) and incident psychiatric diagnoses (adjusted IRR 1.7 [95% CI 1.3, 2.2, p <

0.001]) than for those without psychiatric diagnoses. There were no differences in non-psychiatric hospitalizations among psychiatric comorbidity groups.

Psychiatric comorbidity groups differed in use of subcategories of non-psychiatric ambulatory care (Table 3). Compared with youth with no psychiatric diagnoses, youth with preceding psychiatric diagnoses had more primary care visits (adjusted IRR 1.6 95% CI 1.3, 2.1, $p<0.001$), as did those with incident psychiatric diagnoses (adjusted IRR 1.8 (95% CI 1.4, 2.3, $p < 0.0001$). Youth with no psychiatric diagnoses did not differ from those with preceding and incident psychiatric diagnoses in frequency of rheumatology visits (adjusted IRR 0.9 [95% CI 0.7, 1.1] and adjusted IRR 1.2 [95% CI 1.0, 1.4]). Compared with youth with no psychiatric diagnoses, those with incident psychiatric diagnoses had fewer nephrology visits (adjusted IRR 0.6 [95% CI 0.4, 0.9, $p < 0.05$]); there was no difference for those with preceding psychiatric diagnoses.

Discussion

The prevalence of psychiatric disorders among youth with SLE is high, and their effect on health care use for this population is substantial. Psychiatric diagnoses were present in 35% of our study cohort, similar to previously reported prevalence estimates ranging from 20-54%,[31–33] with specific psychiatric diagnoses all higher in youth with SLE than in age- and sex-matched controls in our study. Psychiatric comorbidities in youth with SLE have been associated with poorer health-related quality of life and higher rates of medication non-adherence, a known risk factor for increased disease activity and damage, potentially requiring increased health care resources.[34–36] Direct adverse effects of comorbid psychiatric disorders on health care utilization has been shown in adults with SLE and those with other chronic illness.[11,12,37] While a recent

study showed that preceding psychiatric comorbidity was associated with increased health care use prior to SLE diagnosis,[13] our reports regarding the effects of psychiatric comorbidities on health care use subsequent to SLE diagnosis are a new contribution to the literature.

Only 35% of youth with SLE and psychiatric comorbidity in our cohort had any psychiatric visits. Though we cannot examine reasons for suboptimal psychiatric care, prior studies have reported limited resources, lack of insurance coverage, and patient time burden as primary barriers to mental health care.[38,39] Youth with a preceding psychiatric diagnosis and youth with an incident psychiatric diagnosis had much greater ambulatory and emergency health care use for psychiatric and non-psychiatric reasons during the first year from SLE diagnosis than those without a psychiatric diagnosis. Individuals with an incident psychiatric diagnosis had the highest non-psychiatric health care use across all settings, including ambulatory rheumatology visits. Those with either a preceding psychiatric diagnosis or an incident psychiatric diagnosis had more primary care provider visits than did those with no psychiatric comorbidity.

There were some notable differences in care patterns between youth with cSLE versus aSLE. Compared with those with no psychiatric diagnosis, youth with cSLE and an incident psychiatric diagnosis had more emergency visits and hospitalizations than their aSLE counterparts. Although the reasons for these findings are unclear, it is possible that newly diagnosed children with SLE may have more severe psychiatric presentation necessitating acute care, or that progressive psychiatric symptoms are not being identified well in ambulatory settings. This has implications for differential focus of mental health intervention according to age of onset, with possible emphasis on optimizing outpatient intervention for children with SLE to reduce psychiatric care in acute care settings.

SLE health care utilization

Our study suggests that addressing psychiatric comorbidities may decrease health care use, particularly during the first year of SLE care when health care use is the highest.[5] Mental health interventions that minimize the impact of frequent medical visits are likely to have positive downstream effects on school performance, peer relationships, and family dynamics.[40] Furthermore, mental health interventions that decrease health care use could decrease health care costs. Studies have shown that adolescents with mental health conditions incur significantly higher total health care costs,[41,42] and that adults with SLE who have poorer psychologic functioning incur higher indirect costs.[43] This may be particularly impactful for youth with SLE who have higher medical costs than adults with SLE and their healthy peers.[4,6] Lastly, decreased health care use can reduce indirect costs to patients and families, such as lost workdays and travel expenses.

Our study emphasizes the importance of early identification of mental health needs for youth with SLE. Routine depression screening can identify at-risk youth and promotes appropriate referral in primary care clinics for patients with other pediatric chronic diseases.[44,45] Pediatric rheumatologists are uniquely positioned to provide mental health screening for youth with SLE. In a large survey of pediatric rheumatologists, 77% of providers responded that routine screening for depression and anxiety in SLE patients should be conducted, but only 2% reported that standardized screening had been implemented at their center.[46]

Increasing the use of social workers and psychologists in pediatric rheumatology clinics could increase early mental health screening for youth with SLE and help ensure appropriate connection to and follow-up with mental health services. However, access to behavioral health providers within pediatric rheumatology clinics remains an unmet need with a recent Childhood Arthritis and Rheumatology Research Alliance (CARRA) study confirming that over one-third

of surveyed centers had no social worker or psychologist.[38] Collaborative relationships with primary care providers also could increase early mental health screening and treatment for youth with SLE. While a prior study showed lower rates of primary care use in patients with depression symptoms,[9] we are encouraged by our findings of higher primary care use among youth with SLE and psychiatric comorbidities, possibly reflecting improving mental health intervention by primary care providers. Regardless of the strategy used, increasing partnerships to improve integration of medical and mental health services was identified as a priority in a recent survey of patients with rheumatologic disease and their parents.[39]

Database limitations should be acknowledged. First, the cohort includes only privately insured patients and disproportionately low percentages of African American and Latino American youth. Underrepresentation of those with low SES and racial/ethnic minorities may bias interpretation of this data. Acute care use may be even greater in more representative populations, given increased SLE disease severity and mortality[47] compounded by worse access to outpatient medical[48,49] and psychiatric care[50] in these marginalized populations. Second, attempts to control for confounding related to disease severity were limited to validated ICD-9 algorithms for lupus nephritis and CNS involvement. However, use of this database enabled us to identify one of the largest national cohorts of youth with newly diagnosed SLE to assess health care use for this population across multiple health care settings and provider types.

Additional limitations include those inherent to the study design. While the coding algorithms used to identify SLE cases have been validated for claims data,[16–18] our definition of incident cases of SLE has not been formally validated. This could result in misclassification between comorbid psychiatric groups. In addition, we acknowledge that our efforts to minimize under-diagnosis of psychiatric comorbidities by using the presence of a single diagnosis code to

define psychiatric disorders may have inadvertently contributed to over-diagnosis in both the SLE and control cohorts. Lastly, we recognize that a causal relationship between psychiatric diagnoses and healthcare use cannot be confirmed with this retrospective cohort study design. Regardless of these limitations, however, our study shows that psychiatric diagnoses are prevalent among youth with newly diagnosed SLE and are associated with increased health care use.

In conclusion, our study confirms the high prevalence of comorbid psychiatric diagnosis in youth with SLE and that comorbid psychiatric diagnoses are associated with greater ambulatory and emergency care use for both non-psychiatric and psychiatric-related reasons in the first year after SLE diagnosis. Interventions to address comorbid psychiatric diagnosis in youth with newly diagnosed SLE may have the potential to decrease health care burden in this vulnerable population. Further work is needed to better characterize other potentially modifiable factors contributing to increased health care utilization, and longitudinal studies will be required to clarify causal relationships between such factors. Additionally, studies incorporating cost-analysis methodology to quantify the financial impact of mental health interventions are urgently needed. This work will help support advocacy efforts for adequate resources to improve outcomes for youth with SLE.

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SLE health care utilization

Figure Legends

Figure 1 Legend: Prevalence of preceding and incident psychiatric diagnoses in youth with newly diagnosed systemic lupus erythematosus (SLE)

Figure 2 Legend: Comparison of annual medical visits by psychiatric status (Preceding vs Incident vs No Psychiatric Diagnosis) for youth with newly diagnosed systemic lupus erythematosus (SLE)

Table 1. Demographics and Health Characteristics

Characteristic, n (%)	SLE Full Cohort (n = 650)	No Psychiatric Diagnosis (n=423)	Preceding Psychiatric Diagnosis (n=122)	Incident Psychiatric Diagnosis (n=105)	p-value*
Age, mean (SD)	18.4 (3.7)	18.4 (3.7)	19.1 (3.6)	17.6 (3.8)	0.01
Female	571 (88)	364 (86)	109 (89)	98 (93)	0.25
Race/Ethnicity					
White	367 (56)	223 (53)	84 (69)	60 (57)	0.11
Black	110 (17)	78 (18)	12 (10)	20 (19)	
Hispanic	91 (14)	62 (15)	15 (12)	14 (13)	
Asian	41 (6)	33 (8)	3 (2)	5 (5)	
Unknown	41 (6)	27 (6)	8 (7)	6 (6)	
Region					
Midwest	171 (26)	107 (25)	36 (30)	28 (27)	0.52
Northeast	73 (11)	44 (10)	15 (12)	14 (13)	
South	313 (48)	203 (48)	60 (49)	50 (48)	
West	93 (14)	69 (16)	11 (12)	13 (12)	
Household education level					
Less than 12th grade	7 (1)	5 (1)	2 (2)	0 (0)	0.23
High school diploma	167 (26)	120 (28)	26 (21)	21 (20)	
Less than bachelor degree	331 (51)	198 (47)	69 (57)	64 (61)	
Bachelor degree or higher	119 (18)	79 (19)	22 (18)	18 (17)	
Unknown	26 (4)	21 (5)	3 (3)	2 (2)	
Disease Characteristics					
Nephritis§	159 (25)	98 (23)	28 (23)	33 (31)	0.20
Seizure/stroke disorder§	52 (8)	25 (6)	12 (10)	15 (14)	0.02
Medication prescriptions filled†					

Glucocorticoids	483 (74)	309 (73)	91 (75)	83 (79)	0.89
Hydroxychloroquine	506 (78)	327 (77)	93 (76)	86 (82)	0.93
Immunosuppressants	292 (45)	179 (42)	56 (46)	57 (54)	0.41

*p-values correspond to Pearson chi-square tests used to estimate differences between the three exposure groups.
§ Indicates disease manifestation at or after SLE diagnosis
†Indicates medication prescriptions filled during the first year after SLE diagnosis. Immunosuppressants include mycophenolate mofetil, azathioprine, leflunomide, methotrexate, calcineurin inhibitors, and oral cyclophosphamide.

Table 2: Health Care Utilization in Youth with SLE during the First Year of Care

Utilization in year after SLE diagnosis	No Psychiatric Diagnosis (n=423)	Preceding Psychiatric Diagnosis (n=122)	Incident Psychiatric Diagnosis (n=105)	
Annual health visits per patient, number	Mean (SD) Median (IQR)	Mean (SD) Median (IQR)	Mean (SD) Median (IQR)	**p-value**
Overall Visits				
Ambulatory	11.6 (10.0) 11 (5, 17)	17.0 (14.8) 15 (8, 24)	19.7 (15.0) 17 (9, 27)	<0.0001
Emergency	5.1 (8.6) 2 (0, 6)	7.0 (13.2) 3 (0, 9)	9.7 (11.0) 5 (1, 15)	<0.0001
Inpatient§	2.7 (7.8) 0 (0, 0)	3.8 (9.0) 0 (0, 3)	5.3 (11.8) 0 (0, 4)	0.021
Non-psychiatric visits				
Ambulatory	11.6 (10.0) 11 (5, 17)	14.4 (11.7) 13 (6, 21)	18.1 (14.6) 15 (8, 25)	<0.0001
Emergency	5.1 (8.6) 2 (0, 6)	6.9 (13.1) 3 (0, 9)	9.5 (10.9) 5 (1, 15)	<0.0001
Inpatient§	2.7 (7.8) 0 (0, 0)	3.5 (8.2) 0 (0, 2)	4.9 (10.7) 0 (0, 4)	0.021
Psychiatric Visits†				
Ambulatory	-	2.7 (7.2) 0 (0, 1)	1.6 (3.3) 0 (0, 2)	0.15
Emergency	-	0.2 (0.9) 0 (0, 0)	0.2 (0.8) 0 (0, 0)	1
Inpatient	-	0.3 (2.0) 0 (0, 0)	0.4 (1.7) 0 (0, 0)	0.69

*p-values correspond to type 3 Wald Chi-square tests from unadjusted Poisson regression models. NS denotes p-values >= 0.05.
§ Inpatient visit measures include individuals with at least one hospitalization during the observation period
†151 individuals without psychiatric diagnosis had hospitalizations (all non-psychiatric); 64 individuals with a preceding psychiatric diagnosis had hospitalizations (60 non-psychiatric and 4 psychiatric); and 53 individuals with a new psychiatric diagnosis had hospitalizations (49 non-psychiatric and 4 psychiatric).

Table 3: Association of Psychiatric Comorbidity with Health Care Utilization in Youth with SLE

Utilization in year after SLE diagnosis	Preceding Psychiatric Diagnosis (n=122)	Incident Psychiatric Diagnosis (n=105)
	Adjusted IRR (95% CI)	Adjusted IRR (95% CI)
All health visits		
Ambulatory	1.4 (1.2, 1.6)***	1.6 (1.4, 1.9)***
Emergency	1.4 (1.1, 1.9)*	1.7 (1.3, 2.2)***
Inpatient§	1.4 (0.9, 2.1)	1.4 (0.9, 2.2)
Non-psychiatric visits		
Ambulatory	1.2 (1.0 1.4)	1.5 (1.3, 1.7)***
Rheumatology	0.9 (0.7, 1.1)	1.2 (1.0, 1.4)
Primary care	1.6 (1.3, 2.1)***	1.8 (1.4, 2.3)***
Nephrology	0.7 (0.5, 1.2)	0.6 (0.4, 0.9)*
Emergency	1.37 (1.02, 1.85)*	1.7 (1.3, 2.2)***
Inpatient§	1.3 (0.8, 2.0)	1.3 (0.9, 2.0)

Results are shown from multivariable Poisson regression models comparing annual health care visits among youth with new-onset SLE (n=650) by psychiatric comorbidity status. The reference group is individuals with no psychiatric diagnosis (n=423). Separate models were used for ambulatory, emergency, and inpatient visits, adjusting for age, sex, race/ethnicity, household education level, geographic region, presence of lupus nephritis, presence of seizure/stroke, and year of diagnosis.
* = p <0.05; ** = p < 0.01; *** = p < 0.001

Table 4: Stratification by Childhood-onset vs Adult-onset Age Group - Association of Psychiatric Comorbidity with Overall Health Care Utilization in Youth with SLE

Utilization in year after SLE diagnosis	Preceding Psychiatric Diagnosis (n=122)		Incident Psychiatric Diagnosis (n=105)	
	Adjusted IRR (95% CI)		Adjusted IRR (95% CI)	
	Childhood-onset	Adult-onset	Childhood-onset	Adult-onset
Ambulatory	1.2 (1.1, 1.3)**	1.5 (1.4, 1.6)***	1.6 (1.5, 1.6)*** (no significant interaction by age group)	
Emergency	1.1 (0.9, 1.2)	1.8 (1.6, 2.0)***	2.1 (1.8, 2.3)***	1.6 (1.5, 1.9)***
Inpatient	1.3 (1.1, 1.4)*** (no significant interaction by age group)		2.0 (1.7, 2.3)***	1.0 (0.8, 1.3)

Results are shown from multivariable Poisson regression models comparing annual health care visits among youth with new-onset SLE (n=650), including an interaction term for psychiatric comorbidity status and age group. The reference group is individuals with no psychiatric diagnosis (n=423). Separate models were used for ambulatory, emergency, and inpatient visits, adjusting for age, sex, race/ethnicity, household education level, geographic region, presence of lupus nephritis, presence of seizure/stroke, and year of diagnosis.
* = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$

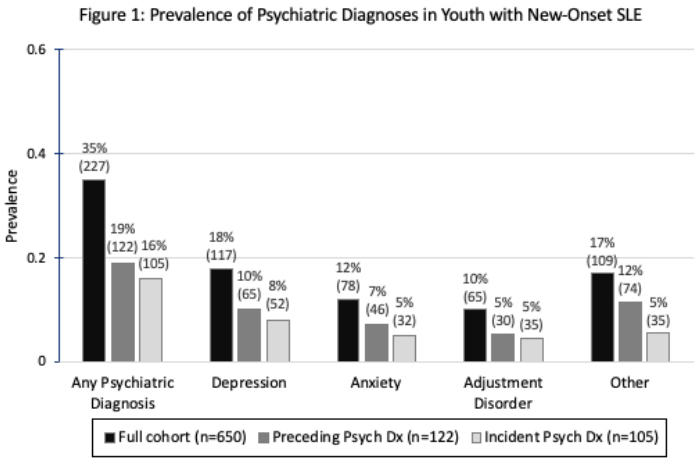

Figure 1 Legend: Prevalence of preceding and incident psychiatric diagnoses in youth with newly diagnosed systemic lupus erythematosus (SLE)

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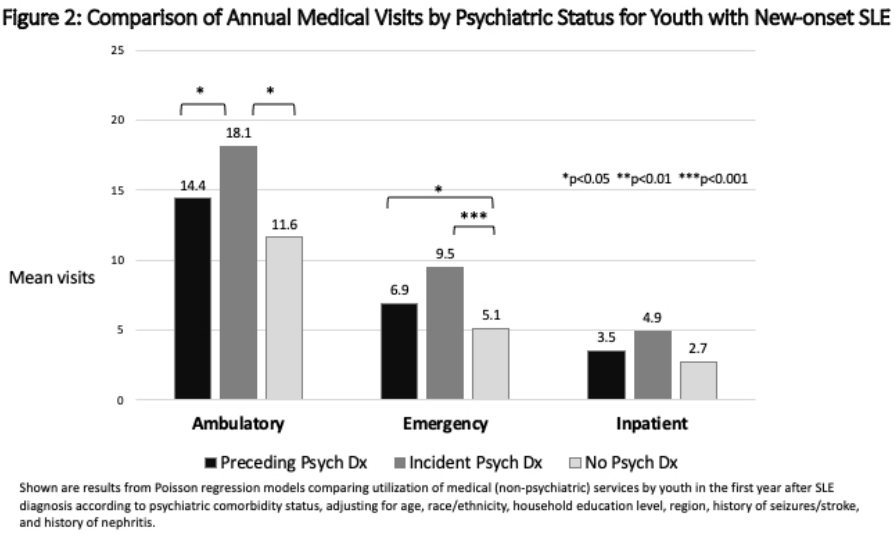

Figure 2 Legend: Comparison of annual medical visits by psychiatric status (Preceding vs Incident vs No Psychiatric Diagnosis) for youth with newly diagnosed systemic lupus erythematosus (SLE)

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